

**An Examination of Dog Ownership in the Promotion of Walking as a Form of
Physical Activity and its Effects on Physical and Psychological Health**

by

Nikolina Antonacopoulos

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Abstract

The low percentage of Canadian adults who are sufficiently active is of concern in light of the detrimental health consequences associated with insufficient physical activity. Two studies were conducted in order to explore dog walking as a means of obtaining physical activity and the possible health benefits from dog walking. In Study 1, dog walking was examined from three perspectives through a week-long study of 61 regular dog walkers. First, summary statistics revealed that slightly more than half of the time spent dog walking was at a moderate- to vigorous-intensity physical activity (*MVPAI*) level and approximately 2 in 5 dog owners met the Canadian physical activity guideline through dog walking alone. Second, analyses revealed that an important factor affecting time spent dog walking at a *MVPAI* level is the size of the dog, as it is a factor that individuals who are acquiring a dog can take into consideration. Another key finding was that all of the dog walkers reported that they walk their dog for its well-being, which indicates that dog walking is a purposeful physical activity. This suggests that dog walking should be promoted in terms of its benefits for the dog. Third, analyses comparing dog walkers' psychological health before and after their dog walks revealed an improvement on six out of seven psychological health measures. In Study 2, results from an 8-month longitudinal study revealed that, as hypothesized, participants who acquired a dog ($n = 17$) increased their *MVPAI* from baseline to 8 months, while there was no change in the control group ($n = 28$). Contrary to expectations, although individuals in the acquired-dog group became more active over time, they did not experience any improvements in their physical or psychological health over the course of the study relative to the control group. Taken together, these findings suggest that promoting dog

walking may be one way of increasing physical activity. The short-term health benefits that occur after dog walking need to be explored further, while the possible long-term health benefits need to be examined using a larger sample over a longer time frame.

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Table of Contents

Abstract	ii
Acknowledgements.....	iv
List of Tables	viii
List of Figures	xiii
List of Appendices	xiv
Introduction.....	1
Health Consequences of Insufficient Physical Activity	3
Physical Activity Guidelines	6
Assessing Physical Activity Levels.....	9
Dog Walking as a Form of Physical Activity.....	17
Factors Affecting Time Spent Dog Walking.....	24
Health Benefits Associated With Dog Walking.....	30
Limitations of Studies Conducted To Date	39
Rationale.....	42
Study 1: Dog Walking	49
Method.....	50
Participants.....	50
Study Eligibility Criteria	50
Procedure.....	51
Measures for Time Spent Dog Waking (Part 1a).....	54
Measures for Factors Affecting Time Spent Dog Walking (Part 1b)	56
Measures for Psychological Health Study (Part 1c)	63

Results for Time Spent Dog Walking (Part 1a) and Factors Affecting Time Spent Dog Walking (Part 1b)	65
Preliminary Analyses	65
Examination of the Time Spent Dog Walking (Part 1a)	72
Descriptive Statistics for Factors Affecting Time Spent Dog Walking (Part 1b).....	77
Main Analyses of Factors Affecting Time Spent Dog Walking (Part 1b).....	85
Summary for Part 1a and Part 1b	93
Results for Psychological Health Study (Part 1c)	95
Preliminary Analyses	95
Main Analyses for Psychological Health Study (Part 1c).....	99
Summary.....	101
Study 2: Longitudinal Study	102
Method.....	103
Participants.....	103
Procedure.....	104
Measures	108
Dog Walking	118
Results	121
Preliminary Analyses	121
Main Analyses.....	147
Physical activity.....	147
Meeting the physical activity guidelines.	153

Physical and psychological health	158
Dog walking	168
Summary.....	175
Discussion.....	177
Understanding Dog Walking as a Form of Physical Activity	178
Short-Term Health Benefits from Dog Walking	180
Changes in Physical Activity After Acquiring a Dog	183
Long-Term Changes in Health After Acquiring a Dog.....	187
Strengths and Limitations of the Current Research.....	190
Future Research	194
Conclusions	199
References.....	202
Appendices.....	229

List of Tables

Table 1	<i>WHO Physical Activity Information</i>	7
Table 2	<i>Most Recent National Physical Activity Guidelines for Adults by Country</i>	9
Table 3	<i>Percentage of Americans who are Physically Active According to the 2008 Physical Activity Guidelines for Americans</i>	13
Table 4	<i>Percentage of Dog Owners who Do Not Walk their Dog</i>	19
Table 5	<i>Studies Examining Whether Dog Walkers, Non-Dog Walkers and Non-Dog Owners Meet Physical Activity Guidelines</i>	22
Table 6	<i>Physical Activity Intensity Cut-Points for Actical Accelerometer</i>	53
Table 7	<i>Descriptive Statistics for Weekly Time Spent Dog Walking and Missing Data</i> ..	68
Table 8	<i>Descriptive Statistics for Participants' Personal Characteristics</i>	71
Table 9	<i>Information about Time Spent on Each Dog Walk by Intensity Level</i>	72
Table 10	<i>Descriptive Statistics for Time Spent Dog Walking Weekly by Intensity Level (No Bouts)</i>	73
Table 11	<i>Descriptive Statistics for Weekly Time Spent Dog Walking at a MVPAI Level</i>	74
Table 12	<i>Percentage of Participants Attaining Weekly Physical Activity Criteria Through Dog Walking</i>	75
Table 13	<i>Percentage of Participants Attaining 30 Minutes of MVPAI on 5 Days of the Week Through Dog Walking</i>	75
Table 14	<i>Number of Days Participants Achieved 30 Minutes of MVPAI Through Dog Walking</i>	76
Table 15	<i>Percentage Attaining 10,000 Steps by Day Through Dog Walking</i>	77

Table 16	<i>Descriptive Statistics for Participants' Personal Characteristics</i>	78
Table 17	<i>Descriptive Statistics for Dog-Related Variables</i>	79
Table 18	<i>Descriptive Statistics for Social Interaction Variables</i>	82
Table 19	<i>Descriptive Statistics for TIPI Scales</i>	83
Table 20	<i>Descriptive Statistics for Other Possible Factors Affecting Time Spent Dog Walking Week Wore Device</i>	85
Table 21	<i>Analyses of Relationship Between Personal Characteristics and Weekly Time Spent Dog Walking</i>	87
Table 22	<i>Analyses of Relationship Between Dog Walkers' Social Interactions and Weekly Time Spent Dog Walking</i>	90
Table 23	<i>Correlations Between TIPI Scales and Weekly Time Spent Dog Walking</i>	90
Table 24	<i>Analyses of Relationship Between Other Possible Factors and Weekly Time Spent Dog Walking</i>	91
Table 25	<i>Descriptive Statistics for Psychological Health Dependent Variables Before and After Dog Walk</i>	97
Table 26	<i>Correlations Between Psychological Health Dependent Variables Before and After Dog Walk</i>	98
Table 27	<i>ANOVA Results and Means and Standard Deviations for Psychological Health Dependent Variables Before and After Dog Walk (Significant at $p < .006$)</i>	100
Table 28	<i>Demographic Characteristics According to Whether Completed All Aspects of Study</i>	125

Table 29	<i>Comparison of Completers and Non-Completers on Dependent Variables at Baseline</i>	127
Table 30	<i>Reductions in Sample Size</i>	128
Table 31	<i>Demographic Characteristics of Participants at Baseline by Dog Ownership Status</i>	130
Table 32	<i>Comparison of Cat and Non-Cat Owners on Health Dependent Variables at Baseline</i>	132
Table 33	<i>Percentage of Participants who Swam or Biked Weekly at Baseline and 8 Months by Dog Ownership Status</i>	133
Table 34	<i>Descriptive Statistics for Dependent Variables Assessed at Two Time Periods</i>	135
Table 35	<i>Descriptive Statistics for Health Dependent Variables Assessed at Three Time Periods</i>	136
Table 36	<i>Correlations Between Health Dependent Variables at Two Time Periods</i>	138
Table 37	<i>Correlations Between Health Dependent Variables at Three Time Periods</i> ..	139
Table 38	<i>Correlations Between Social Desirability and Health Measures at Baseline and 8 Months</i>	140
Table 39	<i>Correlations Between Social Desirability and Health Measures at Three Time Periods</i>	140
Table 40	<i>Percentage of Time Spent at Each Intensity Level Weekly (No Bouts) at Baseline and 8 Months by Dog Ownership Status</i>	142
Table 41	<i>Descriptive Statistics for Weekly Physical Activity at Baseline and 8 Months by Dog Ownership Status</i>	143

Table 42	<i>Descriptive Statistics for Daily Physical Activity at Baseline and 8 Months by Dog Ownership Status</i>	144
Table 43	<i>Weekly MVPAI by Season and Dog Ownership Status</i>	146
Table 44	<i>ANOVA Results and Means and Standard Deviations for MVPAI at Baseline and 8 Months by Dog Ownership Status</i>	149
Table 45	<i>Percentage of Participants Attaining Weekly Physical Activity Criteria at Baseline and 8 Months by Dog Ownership Status</i>	154
Table 46	<i>Percentage of Participants Attaining 30 Minutes of MVPAI on 5 Days of the Week at Baseline and 8 Months by Dog Ownership Status</i>	156
Table 47	<i>Daily Step Count by Dog Ownership Status</i>	157
Table 48	<i>Percentage Attaining 10,000 Steps and Percentage Achieving 10,000 Steps and 150-Minute Guideline at Baseline and 8 Months by Dog Ownership Status</i>	158
Table 49	<i>MANOVA and MANCOVA Results for Physical Health.....</i>	160
Table 50	<i>MANOVA and MANCOVA Results for Psychological Health.....</i>	161
Table 51	<i>ANOVA Results and Means and Standard Deviations for Three Psychological Health Measures at Baseline and 8 Months by Dog Ownership Status</i>	163
Table 52	<i>ANOVA Results and Means and Standard Deviations for Three Health Measures at Three Time Periods by Dog Ownership Status</i>	167
Table 53	<i>Descriptive Statistics for Weekly Time Spent Dog Walking by Intensity Level at 8 Months</i>	169

Table 54	<i>Percentage of Weekly Time Spent at Each Intensity Level Achieved Through Dog Walking (No Bouts) at 8 Months</i>	170
Table 55	<i>Weekly Time Spent Dog Walking at 8 Months by Size, Age and Breed Exercise Requirement</i>	171
Table 56	<i>Weekly Time Spent Dog Walking at 8 Months by Season Walked Dog.....</i>	173

List of Figures

<i>Figure 1.</i> Percentage of time spent dog walking weekly at each intensity level (no bouts).....	74
<i>Figure 2.</i> Mean <i>MVPAI (no bouts)</i> at baseline and 8 months by dog ownership status.....	151
<i>Figure 3.</i> Mean <i>MVPAI (in bouts)</i> at baseline and 8 months by dog ownership status.....	153

List of Appendices

Appendix A: Online Survey for Study 1.....	229
Appendix B: Cover Letter and Instructions (Drop Off Version) for Study 1	239
Appendix C: Dog-Walking Log (Drop Off Version) for Study 1.....	242
Appendix D: Day 8 Paper Survey for Study 1	249
Appendix E: Dog Walking Physical Activity Profile for Study 1	254
Appendix F: Baseline Survey (Completed by Both Groups) for Study 2.....	256
Appendix G: 4-Month Survey (Completed by Both Groups) for Study 2.....	272
Appendix H: 8-Month Survey (Control Group) for Study 2	275
Appendix I: 8-Month Survey (Individuals who Acquired a Dog) for Study 2	279
Appendix J: Baseline Physical Activity Booklet for Study 2	291
Appendix K: 8-Month Physical Activity Booklet for Study 2	295

**An Examination of Dog Ownership in the Promotion of Walking as a Form of
Physical Activity and its Effects on Physical and Psychological Health**

There is growing concern about the increasing rates of physical inactivity worldwide (World Health Organization [WHO], 2014). This concern stems from the considerable research documenting the health consequences of insufficient physical activity in terms of increasing the risk for diseases such as type 2 diabetes, hypertension and some forms of cancer (U.S. Department of Health and Human Services, 2008; Warburton, Katzmarzyk, Rhodes, & Shephard, 2007). The WHO (2010) and a number of countries have responded by developing and publicizing physical activity guidelines, which outline the amount of physical activity recommended for health benefits. The most recent guidelines developed by the WHO (2010), Australia (Australian Government Department of Health, 2014), Canada (Canadian Society for Exercise Physiology, 2011), the United Kingdom (Department of Health, Physical Activity, Health Improvement and Protection, 2011) and the United States (U.S. Department of Health and Human Services, 2008) call for a minimum of 150 minutes of at least moderate-intensity physical activity weekly.

In order to determine whether adult physical activity levels are changing, various countries have conducted national physical activity studies. Initially these studies relied upon self-report measures to assess physical activity levels, however some researchers have now begun using accelerometers to objectively assess physical activity levels (Colley et al., 2011; Craig, Mindell, & Hirani, 2009; Troiano et al., 2008; Tucker, Welk, & Beyler, 2011). Findings have revealed that there is a considerable discrepancy between the two types of measures; studies conducted with accelerometers have found

that individuals are considerably *less* active than the studies conducted with self-report measures (Craig et al., 2009; Statistics Canada, 2015a, 2015b; Tucker et al., 2011).

Dog walking has been identified as one means of obtaining physical activity, given the popularity of dogs as household pets and their need for exercise (Bauman, Russell, Furber, & Dobson, 2001; Epping, 2011). For example, 37% of Americans had a dog in their household in 2011 (American Veterinary Medical Association, 2015), 39% of Australian households in 2013 (Animal Health Alliance, 2013), 34% of Canadian households in 2014 (Canadian Animal Health Institute, 2015) and 24% of households in the United Kingdom in 2014 (Pet Food Manufacturers' Association, 2015). The fact that dogs need exercise may help dog owners obtain regular physical activity. In fact, according to Morgan (2001) *purposeful physical activities*, such as dog walking, that are done in the process of achieving another goal (exercise for the dog) are more likely to promote long-term adherence than physical activities engaged in for the sole purpose of improving fitness. However, an area that warrants further investigation is whether the physical activity obtained through dog walking is done long enough at a sufficiently high intensity level to provide health benefits. Therefore, for my dissertation research, I utilized accelerometers to determine whether the physical activity obtained through dog walking meets the requirements to provide health benefits.

Through two studies, this dissertation research explored the role of dog walking in obtaining physical activity and the possible health benefits from the exercise obtained dog walking. In the first study, I examined the physical activity obtained through dog walking using accelerometers and explored possible factors affecting the length of time spent dog walking. As well, I examined whether dog owners experienced improved

psychological health at the end of their dog walks. In the second study, I addressed the need for a longitudinal study of the possible changes in physical activity and health that result from acquiring a dog and walking it.

My dissertation begins with a review of the literature examining the health consequences of physical inactivity and the resulting health care costs. I then outline the action that has been taken by the WHO and various countries to address the problem of physical inactivity through the development of physical activity guidelines. Next, I highlight the discrepancy that exists between self-report and accelerometer-based physical activity findings by presenting results from national physical activity studies examining overall physical activity levels. I also provide possible explanations for the discrepancy between accelerometer and self-report measures.

Given the popularity of dogs as household pets, I discuss dog walking as one means of obtaining physical activity and review the research on the physical activity levels of dog owners who walk their dog versus dog owners who do not walk their dog and non-dog owners. I then identify factors that may affect the time spent dog walking. Next, I present the research conducted to date examining the possible immediate and long-term health benefits arising from the physical activity obtained through dog walking. Following this, I discuss how I address the limitations of current studies by, first, objectively assessing dog walking as a form of physical activity using accelerometers and, second, conducting a longitudinal study examining the changes that occur in physical activity and health as a result of dog walking.

Health Consequences of Insufficient Physical Activity

Insufficient physical activity is the fourth leading risk factor for global mortality after high blood pressure, tobacco use and high blood glucose and is responsible for 6%

of deaths globally¹ (WHO, 2009). It is estimated that approximately 3.2 million people die annually as a result of engaging in insufficient physical activity. Worldwide, in 2008, 31% of adults 15 years of age or older (28% men, 34% women) were insufficiently physically active according to self-report data (WHO, 2011a). The importance of physical activity is reflected by the fact that individuals who are insufficiently physically active have a 20% to 30% higher risk of all-cause mortality than those who engage in moderate physical activity for at least 30 minutes on most days of the week (WHO, 2011b).

As noted by the WHO (2009), engaging in insufficient physical activity is of concern because it increases an individual's risk for noncommunicable diseases (NCDs). In 2011, the WHO released its first report on the worldwide epidemic of NCDs in a document entitled the *Global Status Report on Noncommunicable Diseases 2010* (WHO, 2011a). According to the report, NCDs are now the leading cause of death globally and are responsible for more deaths than other causes combined. Of the 57 million deaths that occurred worldwide in 2008, 36 million (63% percent) were from NCDs. Furthermore, it is estimated that by 2030, NCDs will kill 52 million people annually. Another problem stemming from insufficient physical activity is that it increases the risk of being overweight or obese, defined as "abnormal or excessive fat accumulation that may impair health" (WHO, 2015, What are overweight and obesity?, para. 1). According to the WHO (2015), worldwide more than half of adults were overweight (39%) or obese (13%) in 2014. Of major concern is the fact that an elevated Body Mass Index (BMI),

¹Insufficient physical activity refers to engaging in less than 30 minutes of moderate-intensity physical activity on 5 days of the week, or less than 20 minutes of vigorous-intensity physical activity on 3 days of the week, or an equivalent combination of both.

overweight or obese, is a major risk factor for NCDs. As BMI increases, the risk for NCDs increases along with the risk of mortality (WHO, 2011c, 2015).

Physical activity confers a multitude of benefits for physical health. Physical activity refers to “any bodily movement produced by skeletal muscles that requires energy expenditure” (WHO, 2010, p. 53). Strong evidence exists that regular physical activity lowers the risk of the following NCDs: coronary heart disease, stroke, high blood pressure, adverse blood lipid profile, type 2 diabetes, metabolic syndrome, and colon and breast cancer (U.S. Department of Health and Human Services, 2008). It is estimated that engaging in regular physical activity reduces the risk of ischaemic heart disease by 30%, the risk of diabetes by 27% and the risk of breast and colon cancer by 21% to 25% (WHO, 2011b). There is also some evidence that regular physical activity provides other physical health benefits such as a reduced risk of falling, increased bone density and a decreased risk of lung and endometrial cancer (U.S. Department of Health and Human Services, 2008).

With respect to the link between physical activity and psychological health, the findings are less conclusive. Some researchers have found that physical activity reduces symptoms of depression for nonclinical populations (U.S. Department of Health and Human Services, 2008), while others argue that additional research is needed prior to drawing a definitive conclusion (Warburton et al., 2007). Researchers have also suggested that physical activity may be beneficial in terms of reducing stress (Gilmour, 2007; Rahl, 2010) and symptoms of anxiety (Rahl, 2010; U.S. Department of Health and Human Services, 1996; Warburton et al., 2007) and increasing positive affect (Rahl, 2010; U.S. Department of Health and Human Services, 1996), self-esteem (Warburton et

al., 2007) and general well-being (U.S. Department of Health and Human Services, 1996). Finally, there is conflicting evidence as to whether physical activity is linked to increased life satisfaction (Sharpe, Ghangro, Johnson, & Kidwai, 2011; Warburton et al., 2007).

In Canada, physical inactivity presents a threat to public health (Katzmarzyk & Janssen, 2004). Not only does physical inactivity affect Canadians' health, but there are also significant economic costs. According to Katzmarzyk, Gledhill, and Shephard (2000) approximately 21,000 individuals die prematurely in Canada each year as a result of physical inactivity. Furthermore, in 2012, physical inactivity in Canada resulted in health care costs of approximately \$10 billion dollars (Krueger, Turner, Krueger, & Ready, 2014). This estimate was calculated from the cost of the following chronic diseases associated with physical inactivity: cardiovascular, respiratory, cancers, diabetes, musculoskeletal and others (e.g., osteoarthritis). The \$10 billion included \$3 billion in direct costs (hospital and physician care, drugs, care in other institutions and additional health expenditures such as other professionals) and \$7 billion in indirect costs (premature death and short- and long-term disability). These figures highlight the importance of physical activity for Canadians, both in terms of the health of individuals and national health care costs.

Physical Activity Guidelines

The recognition that physical activity is important for health has resulted in the WHO and a number of countries (e.g., Australia, Canada, the United Kingdom and the United States) developing guidelines for adults outlining the amount of physical activity required to obtain health benefits.

World Health Organization. As shown in Table 1, the WHO has prepared a number of documents to assist countries in promoting physical activity and developing their own physical activity guidelines.

Table 1

WHO Physical Activity Information

Year	Title	Description
2004a	<i>Global Strategy on Diet, Physical Activity and Health</i>	Provides strategy to promote healthier diets and increase physical activity
2007	<i>A Guide for Population-Based Approaches to Increasing Levels of Physical Activity: Implementation of the WHO Global Strategy on Diet, Physical Activity and Health</i>	Provides information to assist in the development and implementation of national physical activity plans
2008	<i>2008-2013 Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases</i>	Encourages development and implementation of national physical activity guidelines for health
2010	<i>Global Recommendations on Physical Activity for Health</i>	Provides global physical activity guidelines for adults

The WHO's (2010) guidelines recommend that adults, 18 to 64 years of age, achieve at least 150 minutes of moderate-intensity aerobic physical activity per week, or at least 75 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity aerobic physical activity. Examples of moderate-intensity physical activities include curling and golf, while examples of vigorous-intensity physical activities include jogging and soccer (Ainsworth et al., 2011). The guidelines also specify that physical activity must be engaged in for periods lasting at least 10 minutes. Furthermore, it is stated that adults can obtain

additional health benefits if they engage in 300 minutes of moderate-intensity aerobic physical activity per week, or 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity aerobic physical activity.

Canada. In 1998, Health Canada and the Canadian Society for Exercise Physiology released Canada's first physical activity guidelines for adults (20 to 55 years), which were entitled *Canada's Physical Activity Guide to Healthy Active Living*. In 2011, the Canadian Society for Exercise Physiology released new physical activity guidelines for Canadian adults. The new guidelines recommend that in order to obtain health benefits, adults 18 to 64 years of age should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity weekly (Canadian Society for Exercise Physiology, 2011). This physical activity can be broken into bouts lasting at least 10 minutes. Finally, the guidelines state that additional physical activity will confer greater health benefits.

Given the beneficial effects of physical activity for well-being, a number of other countries (e.g., Australia, United Kingdom and United States) have developed physical activity guidelines. As can be seen from Table 2, the guidelines developed by the WHO (2010), the United States (U.S. Department of Health and Human Services, 2008) and the United Kingdom (Department of Health, Physical Activity, Health Improvement and Protection, 2011) are similar to Canada's guidelines. The guidelines released by the WHO, Canada and the United States note that additional health benefits can be achieved through engaging in physical activity beyond the minimum 150 minutes, with the United States and the WHO recommending that individuals achieve 300 minutes of moderate- to

vigorous-intensity physical activity in bouts lasting at least 10 minutes for additional health benefits. Australia's 2014 guidelines differ from the other guidelines in that there is no reference to bouts and, rather than specifying a precise figure to obtain additional health benefits, they provide a suggested range for weekly physical activity (Australian Government Department of Health, 2014).

Table 2

Most Recent National Physical Activity Guidelines for Adults by Country

Country	Year published	Time	Intensity level	Minimum duration of physical activity
United States	2008	150 minutes weekly	moderate ^a	10 minutes
World Health Organization	2010	150 minutes weekly	moderate ^a	10 minutes
United Kingdom	2011	150 minutes weekly	moderate ^a	10 minutes
Canada	2011	150 minutes weekly	moderate to vigorous	10 minutes
Australia	2014	150 to 300 minutes weekly	moderate ^b	no minimum

^aPhysical activity can also be obtained through 75 minutes of vigorous-intensity physical activity or an equivalent combination of moderate- and vigorous-intensity physical activity.

^bPhysical activity can also be obtained through 75 to 150 minutes of vigorous-intensity physical activity or an equivalent combination of moderate- and vigorous-intensity physical activity.

Assessing Physical Activity Levels

Although self-report techniques are the most commonly used method to assess physical activity (Dale, Welk, & Matthews, 2002), researchers in a number of countries have begun using accelerometers in order to objectively assess physical activity levels.

Below, the results of studies conducted with accelerometers are compared to studies conducted using self-report measures. As well, the limitations of accelerometer and self-report physical activity measures are discussed.

Canada. National surveys conducted in Canada have primarily relied upon self-report measures of physical activity to assess Canadians' physical activity levels (Colley et al., 2011; Katzmarzyk & Tremblay, 2007). For example, both Statistics Canada's National Population Health Surveys (NPHS) and Canadian Community Health Surveys (CCHS) used self-report measures to assess physical activity levels (Statistics Canada, 2008, 2011). The cross-sectional component of the NPHS was conducted from 1994/1995 to 1998/1999 and then replaced by the CCHS in 2000/2001 (Katzmarzyk & Tremblay, 2007).

In both the NPHS and CCHS, Canadians 12 years of age or older were classified as being inactive, moderately active or active according to their self-reported leisure time physical activity during the past 3 months (Katzmarzyk & Tremblay, 2007; Statistics Canada, 2008, 2011). Specifically, participants were asked about the frequency and average duration of each physical activity that they engaged in during their leisure time. Participants' average daily energy expenditure during leisure time was then calculated using the following equation: AEE (average energy expenditure) = $\sum(N_i \times D_i \times METS_i)/d$ where N_i refers to the number of times the activity was performed, D_i the average duration of the activity in hours, $METS_i$ the estimated energy cost of the physical activity (in kilocalories per kilogram of body weight per hour) and d the number of days in the recall period. Participants were classified as *inactive* (< 1.5 kcal/kg/day), *moderately active* (1.5 to 2.9 kcal/kg/day) or *active* (≥ 3 kcal/kg/day). The percentage of

Canadians who were physically active (moderately active or active) during their leisure time increased from 43% in the 1996/1997 NPHS to 54% in the 2014 CCHS (Gilmour, 2007; Statistics Canada, 2015a).

In 2011, Statistics Canada released a landmark report on its 2007 to 2009 Canadian Health Measures Survey (CHMS; Colley et al., 2011). For the first time, the physical activity levels of a nationally representative sample of Canadians (20 to 79 years of age) were assessed directly using accelerometers, physical activity monitoring devices that are capable of assessing the frequency, intensity and duration of physical activity (Dale et al., 2002). Researchers examined the percentage of Canadians who met the 2011 Canadian physical activity guideline of 150 minutes of moderate-to vigorous-intensity physical activity weekly in bouts lasting at least 10 minutes.

Colley et al. (2011) found that only 15.4% of Canadian adults engaged in at least 150 minutes of moderate- to vigorous-intensity physical activity a week in bouts of at least 10 minutes. Although 53.4% of Canadians accumulated at least 30 minutes of moderate- to vigorous-intensity physical activity at least 1 day per week in bouts, only 4.8% of Canadians achieved at least 30 minutes of moderate- to vigorous-intensity physical activity on at least 5 days of the week in bouts. It is noteworthy that, according to the results from the 2012-2013 CHMS, when physical activity was assessed using accelerometers the percentage of adults achieving the recommended guideline in bouts increased to 22% (Statistics Canada, 2015b).²

From these findings, it is apparent that there is a sizeable discrepancy between

²Statistics Canada (2015b) did not provide information regarding the number of days Canadians achieved at least 30 minutes of moderate- to vigorous-intensity physical activity in the 2012-2013 CHMS.

Canadians' self-reported leisure time physical activity and their accelerometer-measured physical activity. Specifically, based on self-report data 54% of Canadians were classified as being physically active during their leisure time in 2014 (Statistics Canada, 2015a), yet when physical activity was assessed using accelerometers only 22% of Canadians achieved the recommended 150 minutes of moderate- to vigorous-intensity physical activity weekly (Statistics Canada, 2015b).

United States. Researchers in other countries have found similar discrepancies when comparing national self-reported physical activity with accelerometer-based measures of physical activity. For example, in the United States, as part of the 2003-2004 National Health and Nutrition Examination Survey (NHANES), adults 20 to 59 years completed a self-report questionnaire and also wore an accelerometer for 7 days (Troiano et al., 2008). This was the first nationally representative health survey to directly assess the physical activity levels of Americans using accelerometers. According to the accelerometer data, only 3.5% of American adults achieved 30 minutes of moderate- to vigorous-intensity physical activity on at least 5 days of the week in bouts lasting 10 minutes. On the other hand, based on self-report data, 51% of Americans achieved 150 minutes of at least moderate-intensity physical activity weekly in 10-minute bouts through their leisure, household and transportation-related physical activities.

More recently, using data from the 2005-2006 NHANES, Tucker et al. (2011) examined the percentage of Americans meeting the latest physical activity guidelines through both self-reported physical activity and accelerometer-measured physical activity. The researchers analyzed participants' moderate- and vigorous-intensity physical activity in 10-minute bouts in two ways. First, the researchers summed

participants' total number of minutes of moderate- and vigorous-intensity physical activity (*MVPA*). Second, given that the most recent American guidelines state that 1 minute of vigorous-intensity physical activity is equal to 2 minutes of moderate-intensity physical activity (U.S. Department of Health and Human Services, 2008), the researchers doubled participants' number of minutes of vigorous-intensity physical activity (*M2VPA*). As displayed in Table 3, the percentage of Americans who were physically active was considerably higher when a self-report measure of physical activity was used rather than accelerometers for both *MVPA* and *M2VPA*.

Table 3

Percentage of Americans who are Physically Active According to the 2008 Physical Activity Guidelines for Americans

Approach	Physical activity measures	
	Self-report	Accelerometer
<i>MVPA</i> ^a	59.6%	8.2%
<i>M2VPA</i> ^b	62.0%	9.6%

^aParticipants classified as physically active if achieved 150 minutes when weekly moderate and vigorous activity were summed.

^bParticipants classified as physically active if achieved 150 minutes when moderate and vigorous (doubled) physical activity were summed.

It is noteworthy that based on the 2005-2006 NHANES accelerometer data (Tucker et al., 2011), the percentage of Americans who were physically active (8.2%) increased since the 2003-2004 NHANES study, which found that 3.5% of Americans were physically active (Troiano et al., 2008). The researchers suggest that one reason for this difference is that in the 2003-2004 NHANES in order to meet the physical activity guidelines participants needed to obtain 30 minutes of at least moderate-intensity physical

activity on 5 days of the week, while in the more recent 2005-2006 NHANES participants only needed to accumulate 150 minutes of at least moderate-intensity physical activity over the course of the week.

England. A discrepancy has also been noted between self-reported and accelerometer-measured physical activity in England. The *2008 Health Survey for England* (HSE) was comprised of self-report questions assessing the physical activity of adults 16 years of age or older (Craig et al., 2009). In addition, in order to provide an objective measurement of physical activity levels, a subsample of these adults wore an accelerometer for a week. According to the accelerometer data, 6% of men and 4% of women met the Chief Medical Officer's physical activity guideline (at least 30 minutes of moderate-intensity physical activity on 5 or more days of the week; Department of Health, 2004). On the other hand, based on the self-report data, 34% (39% of men and 29% of women) satisfied the Chief Medical Officer's guideline.

Explanations for the discrepancy between self-report and accelerometer findings. When accelerometers were used to assess physical activity levels in national studies conducted in Canada, the United States and England, the percentage of adults in each country who were physically active was considerably lower than from self-report measures. Furthermore, Tucker et al. (2011) found a correlation of only .27 between self-report and accelerometer-measured moderate- to vigorous-intensity physical activity. There are a number of reasons for this discrepancy.

According to Troiano et al. (2008), possible explanations for the higher figures observed in self-report relative to accelerometer studies is that participants may incorrectly self-report sedentary or light activities as moderate activities and they may

overestimate how much time they engage in physical activity. Self-report data are also affected by response bias resulting from recall issues, such as inaccurate memory, and social desirability concerns (Colley et al., 2011; Prince et al., 2008). Since the importance of physical activity for health is widely publicized, participants may feel that it is socially desirable to report that they have an active lifestyle.

Another concern that arises with self-report surveys is that participants may purposefully misrepresent information (Dale et al., 2002) or misinterpret survey questions (Dale et al., 2002; Tucker et al., 2011), which may result in misleading findings.

According to Sallis and Saelens (2000), participants completing self-report surveys may have difficulty understanding ambiguous terms such as “physical activity,” “leisure-time” and “moderate intensity.” In addition, they may not follow instructions; for example they may include periods of physical activity lasting less than 10 minutes although instructed not to do so (Tucker et al., 2011). Finally, self-report responses may vary depending on the data collection mode, for example whether the survey is self-administered, administered by an interviewer or conducted by telephone (Katzmarzyk & Tremblay, 2007).

Although accelerometers are thought to provide more accurate estimates of energy expended (Prince et al., 2008), they also suffer from a number of limitations. Not only are accelerometers costly, but processing and analyzing the data is time consuming (Garatachea, Torres Luque, & González Gallego, 2010; Prince et al., 2008) and they are more intrusive for participants (Prince et al., 2008). Furthermore, because accelerometers are mechanical devices there is the possibility that they will malfunction (Colley, Gorber, & Tremblay, 2010). Although accelerometers measure physical activity in all contexts

(Troiano et al., 2008), they cannot assess physical activity by domain (Warren et al., 2010), and there is a lack of contextual information regarding how the physical activity is obtained (Colley et al., 2011). It is also noteworthy that accelerometers are unable to capture activities that are not step based (e.g., swimming and bicycling) and cannot accurately assess the energy expenditure for activities that use the upper body, such as weight lifting and rowing (Colley et al., 2011; Garatachea et al., 2010; Tucker et al., 2011; Warren et al., 2010; Welk, 2002). However, it should be noted that, according to Welk (2002), the fact that accelerometers are unable to accurately measure all activities is not a major limitation, given that they are generally accurate when measuring locomotor movements, which comprise the bulk of adults' daily physical activity.

A different type of limitation of accelerometers stems from the fact that it is necessary to apply physical activity intensity cut-points to classify activity as sedentary, light, moderate or vigorous. When Watson, Carlson, Carroll, and Fulton (2014) examined the cut-points that were used in nine studies to classify physical activity as moderate or vigorous using the Actigraph accelerometer, they found that the cut-points differed radically. They state that one reason for this difference is that, while some cut-points are derived solely from ambulatory activities (walking or running), other cut-points are determined from lifestyle activities, which include activities such as gardening, raking, vacuuming, playing with children as well as ambulatory activities. For the three out of nine studies that were based on lifestyle activities, they found that moderate-intensity cut-points ranged from 191 to 760, while the six studies that were based on ambulatory activities had moderate-intensity cut-points that ranged from 1,267 to 2,743. When only ambulatory activities are included, the cut-points are considerably higher and,

as a result, the percentage of individuals achieving the recommended guidelines is lower. Watson et al. applied the cut-points used in the nine studies to a sample of 6,547 individuals who completed the 2003-2006 NHANES. They found that the percentage who achieved the latest American guidelines (U.S. Department of Health and Human Services, 2008) ranged dramatically depending on whether the cut-points were derived from ambulatory (6.3% to 27.4%) versus lifestyle activities (60.6% to 98.3%).³

In summary, recently researchers have begun to use accelerometers to assess national physical activity levels. Researchers from a number of countries (e.g., Canada, the United States and England) have found that the percentage of individuals meeting recommended physical activity guidelines is considerably higher when self-report measures are used rather than accelerometers (Craig et al., 2009; Statistics Canada, 2015a, 2015b; Tucker et al., 2011). Researchers have suggested a number of possible explanations for this discrepancy, one of which is that participants may overestimate their physical activity levels when completing self-report surveys (Troiano et al., 2008). Given this possibility, additional research is needed using objective measures, such as accelerometers, in order to accurately determine the percentage of individuals meeting the recommended physical activity guidelines.

Dog Walking as a Form of Physical Activity

Dogs are a popular household pet—1 in 3 Canadian households have a dog (Canadian Animal Health Institute, 2015)—and they are unique in that, unlike other

³In light of the difference in the cut-points derived based on ambulatory versus lifestyle activities, this dissertation utilized the ambulatory based moderate- to vigorous-intensity cut-points developed by Colley and Tremblay (2011). These cut-points were used by Statistics Canada in its national studies assessing the physical activity level of Canadians (Colley et al., 2011; Statistics Canada, 2015b).

household pets, they require exercise. Furthermore, the need for dog owners to walk their dog remains constant. As a result, researchers are exploring dog walking as one means of addressing the problem of physical inactivity.

Physical activity of dog owners versus non-dog owners. Researchers examining the role of dog walking as a means of obtaining physical activity compared the physical activity levels of dog owners and non-dog owners with mixed results. In five cross-sectional studies, dog owners were found to be more physically active than people without dogs (Brown & Rhodes, 2006; Cutt, Giles-Corti, Knuiman, Timperio, & Bull, 2008b; Feng et al., 2014; Headey, Na, & Zheng, 2008; Oka & Shibata, 2009). However, in one longitudinal study (Cutt, Knuiman, & Giles-Corti, 2008d) and one cross-sectional study (Schofield, Mummery, & Steele, 2005), there was no difference in the physical activity levels of dog owners and non-dog owners. One explanation for the difference in findings is provided by research indicating that not all dog owners walk their dog. As may be seen from Table 4, researchers from a number of countries have found that 20% to 40% of dog owners do *not* walk their dog, with two studies finding that more than half of dog owners do not walk their dog (Bauman et al., 2001; Gretebeck et al., 2013). A number of studies examining dog owners' physical activity levels have taken into account the fact that some dog walkers do not walk their dog by dividing dog owners according to whether they do or do not walk their dog.

Table 4

Percentage of Dog Owners who Do Not Walk their Dog

Researchers	Sample	Do not walk their dog
Bauman et al. (2001)	410 Australian dog owners	59%
Coleman et al. (2008)	612 American dog owners	30%
Cutt et al. (2008a)	629 Australian dog owners	23%
Cutt et al. (2008b)	804 Australian dog owners	22%
Feng et al. (2014)	50 Scottish dog owners	25%
Gretebeck et al. (2013)	160 American dog owners	52% ^a
Ham & Epping (2006)	1,282 American dog owners	20% ^b
Hoerster et al. (2011)	984 American dog owners	32% ^b
Lentino et al. (2012)	536 American dog owners	26%
Oka and Shibata (2012)	930 Japanese dog owners	36% ^b
Reeves et al. (2011)	2170 American dog owners	39% ^b
Richards et al. (2013)	391 American dog owners	20%
Schofield et al. (2005)	646 Australian dog owners	40%
Shibata et al. (2012)	270 Japanese dog owners	29% ^b
Slater et al. (1995)	69 American dog owners	33%
Suminski et al. (2005)	215 American dog owners	39%
Wood et al. (2005)	126 Australian dog owners	21%

^aDog owners were classified as *dog walkers* if they listed walking their dog as one of their reasons for walking regularly (at least 30 minutes/3 days of the week).

^bDog walking was defined as walking the dog for a period of at least 10 minutes.

Physical activity of dog walkers versus non-dog walkers and non-dog owners.

Researchers in Australia, Canada, Japan and the United States have conducted cross-sectional studies examining the physical activity levels of dog walkers, non-dog walkers and non-dog owners. The one study conducted with accelerometers (Coleman et al.,

2008) and the numerous self-report studies have revealed that dog walkers are more physically active than their counterparts who do not walk their dog (Cutt, Giles-Corti, & Knuiman, 2008a; Duvall Antonacopoulos, 2009; Gretebeck et al., 2013; Lentino, Visek, McDonnell, & DiPietro, 2012; Oka & Shibata, 2012; Reeves, Rafferty, Miller, & Lyon-Callo, 2011; Shibata et al., 2012) and non-dog owners (Coleman et al., 2008; Duvall Antonacopoulos, 2009; Gretebeck et al., 2013; Lentino et al., 2012; Reeves et al., 2011; Shibata et al., 2012).

Researchers have explored the possibility that it is because of time spent dog walking that dog walkers are more physically active than non-dog walkers and non-dog owners. Cutt et al. (2008a) found that a substantial percentage of dog walkers' overall physical activity, 38%, consisted of dog walking, suggesting that dog walkers choose to spend time dog walking rather than engaging in other physical activities. Consistent with this, when Duvall Antonacopoulos (2009) removed time spent dog walking, dog walkers were less physically active over the course of a week than non-dog owners. Surprisingly, dog walkers were more physically active compared to non-dog walkers, even with minutes dog walking removed.

Meeting physical activity guidelines. Researchers have also examined whether dog walkers are more likely than non-dog walkers and non-dog owners to meet recommended physical activity guidelines, given that dog walkers are more physically active compared to non-dog walkers and non-dog owners. As may be seen from Table 5, all of the studies comparing dog owners who do and do not walk their dog found that dog walkers are more likely than non-dog walkers to meet physical activity recommendations (Coleman et al., 2008; Cutt et al., 2008a; Hoerster et al., 2011; Oka & Shibata, 2012;

Reeves et al., 2011; Shibata et al., 2012; Soares et al., 2015). When researchers compared dog walkers and non-dog owners, three studies found that dog walkers are more likely to meet recommended physical activity guidelines compared to non-dog owners (Coleman et al., 2008; Reeves et al., 2011; Shibata et al., 2012) and a fourth study found that dog walkers who walk their dog for at least 1 hour a week are more likely than non-dog owners to meet the recommended physical activity guidelines (Bauman et al., 2001).

Table 5

Studies Examining Whether Dog Walkers, Non-Dog Walkers and Non-Dog Owners Meet Physical Activity Guidelines

Researchers	Sample	Guideline	Results
Accelerometer Data			
Coleman et al. (2008)	2,199 Americans	Achieve an average of 30 or more minutes of moderate- to vigorous-intensity physical activity daily	Dog walkers (53%) > Non-dog walkers (33%) Dog walkers (53%) > Non-dog owners (46%)
Self-Report Data			
Bauman et al. (2001)	894 Australians	Adjusted odds ratio for achieving at least 150 minutes of moderate- to vigorous-intensity physical activity during previous week	Dog walkers who walk their dog for at least 1 hour a week 1.89 times more likely to meet recommended guidelines than non-dog owners
Cutt et al. (2008a)	629 Australians	Achieve at least 150 minutes of moderate- to vigorous-intensity physical activity in a typical week	Dog walkers (72%) > Non-dog walkers (44%)
Hoerster et al. (2011)	984 Americans	Achieve at least 150 minutes of moderate- to vigorous-intensity physical activity during past 7 days	Dog walkers (64%) > Non-dog walkers (55%)
Oka & Shibata (2012)	930 Japanese	Achieve at least 150 minutes of total physical activity in previous week ^a	Dog walkers (73%) > Non-dog walkers (42%)
		Adjusted odds ratio for achieving at least 150 minutes of total physical activity in previous week ^a	Dog walkers 3.47 times more likely to achieve recommended guidelines compared to non-dog walkers

Researchers	Sample	Guideline	Results
Reeves et al. (2011)	5,902 Americans	Achieve regular moderate- and/or vigorous-intensity physical activity in a typical week ^b	Dog walkers (61%) > Non-dog walkers (45%) Dog walkers (61%) > Non-dog owners (47%)
		Adjusted odds ratio for achieving regular moderate- and/or vigorous-intensity physical activity in a typical week ^b	Dog walkers 1.53 times more likely to achieve regular moderate- and/or vigorous-intensity physical activity compared to non-dog owners
Shibata et al. (2012)	1,926 Japanese	Achieve at least 150 minutes of total physical activity in a usual week ^a	Dog walkers (89%) > Non-dog walkers (61%) Dog walkers (89%) > Non-dog owners (73%)
		Adjusted odds ratio for achieving at least 150 minutes of total physical activity in a usual week ^a	Dog walkers 4.71 times more likely to achieve recommended guidelines compared to non-dog walkers Dog walkers 3.43 times more likely to achieve recommended guidelines compared to non-dog owners
Soares et al. (2015)	Meta-analysis of 6,980 dog owners	Achieve at least 150 minutes of at least moderate-intensity physical activity weekly	Dog walkers (61%) > Non-dog walkers (38%)
		Odds ratio for achieving at least 150 minutes of moderate-intensity physical activity weekly	Dog walkers 2.5 times more likely to achieve recommended guidelines compared to non-dog walkers

^a*Total physical activity* includes weekly time spent walking and other moderate and vigorous physical activity engaged in for periods lasting at least 10 minutes.

^b*Regular moderate physical activity* refers to at least 30 minutes of moderate-intensity physical activity on at least 5 days of the week and *regular vigorous physical activity* refers to at least 20 minutes of vigorous-intensity physical activity on at least 3 days of the week.

These findings suggest that dog walking contributes to dog walkers meeting the recommended physical activity guidelines. Using self-report measures, researchers have found that many dog walkers either come close to or meet the recommended 150 minutes of physical activity a week through dog walking. In a recent study, Reeves et al. (2011) found that 27% of dog walkers in the United States achieved 150 minutes of physical activity through dog walking alone. In addition, one Australian study found that dog walkers reported walking their dog on average for 134 minutes a week (Cutt et al., 2008a), while a study conducted in the United States found that dog walkers reported walking their dog on average for 186 minutes a week (Hoerster et al., 2011).

In summary, results from numerous self-report studies (e.g., Lentino et al., 2012; Reeves et al., 2011) and an accelerometer study (Coleman et al., 2008) revealed that dog walkers are more physically active compared to non-dog walkers and non-dog owners. Furthermore, dog walkers are also more likely than non-dog walkers and non-dog owners to meet recommended physical activity guidelines (e.g., Reeves et al., 2011; Shibata et al., 2012). Indeed, researchers have found that some dog walkers come close to or achieve the recommended physical activity guidelines through dog walking alone (Cutt et al., 2008a; Hoerster et al., 2011; Reeves et al., 2011). Taken together, these findings suggest that dog walking has a considerable impact on dog walkers' physical activity levels.

Factors Affecting Time Spent Dog Walking

Researchers have explored factors that may affect the amount of time spent dog walking. For the purpose of this dissertation, the factors were divided into the following six categories: personal characteristics of the dog walker, characteristics of the dog, the

weather, the environment in which the dog is walked, dog walkers' social interactions on their walks⁴ and dog walkers' personality.

Personal characteristics of the dog walker. The following variables have been identified as possible correlates of time spent dog walking: sex, age, marital status, education, income, living alone, children under 18 living at home and weight status (Westgarth, Christley, & Christian, 2014). Another personal characteristic that could affect time spent dog walking is whether the dog owner has a fenced backyard. In a qualitative study, Cutt et al. (2008c) found that some dog owners perceived that having a very small backyard or no backyard served as a motivator for walking the dog more often. An additional personal characteristic of dog walkers that may affect their walking behaviour is whether the dog was acquired to increase the owner's level of physical activity. Surprisingly, when Westgarth, Christian, and Christley (2015) explored this possibility they found that individuals who acquired their dog for exercise were *not* more likely to walk it at least once daily compared to those whose dog was not acquired for exercise.

Characteristics of the dog. Dog-related variables, such as the size and age of the dog, may affect the time dog owners spend walking it. Schofield et al. (2005) found that owners of small dogs spent less time weekly walking for leisure compared to those with both medium and large dogs. Similarly, Westgarth et al. (2008) found that small dogs

⁴According to Wood and Christian (2011), the social interactions that occur through dog walking form a continuum that begins with subtle forms of acknowledgement, such as waving or smiling. The dog walker may then move to conversing, become familiar with the name of the dog and subsequently learn the dog owner's name. Following this, the dog walker may start arranging to meet for the purpose of dog walking. Finally, a friendship may develop that is limited to dog walking initially, but may later extend outside of dog walking.

were walked less frequently compared to medium and large dogs. In a later study, Westgarth et al. (2015) found that small dogs were less likely than medium size dogs to be walked at least once daily, while Reeves et al. (2011) found that small dogs were taken on shorter walks than large dogs. Finally, two studies found no evidence that dog size affected either the frequency of dog walks over the course of a week (Kobelt, Hemsworth, Barnett, & Coleman, 2003) or the time dog owners spent walking weekly for leisure (Brown & Rhodes, 2006).

Researchers have examined whether the age of the dog is associated with time spent dog walking. Westgarth et al. (2008) found that as the age of the dog increased, the length of walks decreased. As well, Reeves et al. (2011) found that young dogs were walked for more time weekly compared to geriatric dogs. However, in a qualitative study conducted by Cutt et al. (2008c) some participants indicated that having a very young dog acted as a barrier to walking more often with their dog. Finally, Westgarth et al. (2015) did not find an association between the age of the dog and the dog being walked at least once daily.

The possibility that the breed of the dog affects dog owners' walking behaviour was explored by Degeling, Burton, and McCormack (2012) using the UK Kennel Club's breed exercise guidelines. They divided participants into three categories according to whether their dog was from a breed that required a little (low), moderate or considerable (high) amount of exercise. They found that owners of breeds that required a considerable amount of exercise were twice as likely to achieve 150 minutes of physical activity weekly through dog walking compared to owners of breeds that required little exercise, although there were no differences in the frequency of dog walking according to the

breed exercise level. Finally, researchers have examined whether having a dog in poor health affects the dog owner's walking behaviour. In Cutt et al.'s (2008c) qualitative study, dog owners indicated that having a dog who was in poor health acted as a barrier to walking their dog more often.

Weather. When researchers examined whether the season affects time spent dog walking, two recent Canadian studies had contradictory results. Lail, McCormack, and Rock (2011) found that dog owners in Calgary *increased* the amount of time they spent walking for recreation weekly by 40 minutes in the winter compared to the summer. On the other hand, Hope, Farrell, and Spaulding (2014) found that dog owners in Thunder Bay *decreased* the amount of time they spent dog walking weekly by 61 minutes from the summer to winter months.

When researchers examined the possible influence of weather conditions, four studies found no evidence that dog walking is affected by inclement weather. First, Suminski, Poston, Market, Hyder, and Sara (2008) found that, among dog owners in Ohio, time spent dog walking was not associated with the following weather conditions: temperature, apparent temperature, wind speed, relative humidity, dew point and barometric pressure. Second, Temple, Rhodes, and Wharf Higgins (2011) found that the percentage of dog owners who walked their dog at six dog parks in British Columbia did not vary depending on whether the weather was sunny and fair (favourable) or rainy and windy (inclement). Third, in Knight and Edwards' (2008) qualitative study of dog walkers in England, one of the themes that emerged was that dogs motivated their owners to walk in all weather conditions. Fourth, in a qualitative study of regular dog walkers (defined as > 4 times a week for ≥ 30 minutes at a brisk pace) in Calgary, Wharf Higgins,

Temple, Murray, Kumm, and Rhodes (2013) found that dog owners were committed to walking their dog even in foul weather conditions.

On the other hand, two studies found that weather conditions affect dog walking behaviour. Lee, Shepley, and Huang (2009) found that warm weather was identified as a barrier to visiting off-leash dog parks in Texas and Florida. Schneider et al. (2015) conducted a study in Massachusetts that was comprised of both a qualitative (focus group) and quantitative (questionnaire) component to examine barriers affecting dog owners' walking behaviour. Results from the qualitative study revealed that poor weather conditions including heat, rain, snow and cold temperatures acted as barriers to dog walking. Findings from the quantitative study revealed that weather barriers were negatively associated with both the number of times and the number of minutes the dog was walked weekly.

Environment in which the dog is walked. Researchers have explored the role that greenspaces may play in the time dog owners spend dog walking. Evidence that people prefer natural over urban environments (Herzog, Maguire, & Nebel, 2003; Kaplan, Kaplan, & Wendt, 1972; van den Berg, Koole, & van der Wulp, 2003) suggests that dog owners who walk their dog in a natural environment may find their walks more enjoyable and, as a result, walk their dog for longer periods than dog owners who walk their dog in an urban environment. Support for this position is provided by Duvall Antonacopoulos' (2008) finding that dog owners who walked their dog in a natural environment (e.g., park, forest) spent more time dog walking weekly compared to owners who exclusively walked their dog in an urban environment (e.g., street).

Another type of environment in which dog owners may walk their dog is an off-

leash dog park. It is possible that, when dog owners take their dog to a park with an off-leash dog area, they may spend more time walking their dog, given that Lee et al. (2009) found that a high percentage of dog owners (71%) perceived that off-leash dog parks were beneficial for the physical health of their dog. It is noteworthy that in Cutt et al.'s (2008c) qualitative study, dog owners stated that having parks with off-leash areas acted as a motivator for them to walk their dog more often.

Dog walkers' social interactions. Findings from a number of studies suggest that dogs act as social catalysts on dog walks, as they facilitate social interactions (Messent, 1985; Wells, 2007). Researchers have found that a high percentage of dog walkers (84%) talk to other dog owners on their walks (Wood, Giles-Corti, Bulsara, & Bosch, 2007), with interactions ranging from informal chats to the formation of dog walking groups (Wharf Higgins et al., 2013). Furthermore, some dog owners develop friendships that extend outside of dog walking (Duvall Antonacopoulos & Pychyl, 2014). Finally, dog walking also provides the opportunity to meet neighbours and allows dog owners to develop a sense of community (Duvall Antonacopoulos & Pychyl, 2014; Toohey, McCormack, Doyle-Baker, Adams, & Rock, 2013; Wood et al., 2007).

Limited research has been conducted to date examining the possibility that dog walkers' social interactions affect their walking behaviour. Results from one study revealed that dog owners who regularly walked their dog in a group were 3.2 times more likely to walk their dog at least once a day compared to those whose dog was not regularly walked in a group (Westgarth et al., 2015). Duvall Antonacopoulos and Pychyl (2014) found that dog owners who typically engaged in conversations with the people they met while dog walking spent more time walking their dog weekly compared to those

who either did not interact or only exchanged brief greetings (e.g., hello) with the people they met on their dog walks. Finally, in Cutt et al.'s (2008c) qualitative study, a theme that emerged was that the opportunity to meet people, become acquainted with neighbours and, in some cases, establish new friendships through dog walking acted as a motivator to walk the dog more often.

Personality. Researchers have examined possible associations between the Big-Five personality dimensions (Extraversion, Agreeableness, Conscientiousness, Neuroticism [emotional instability] and Openness to Experience; John, Naumann, & Soto, 2008) and physical activity. In a meta-analysis of 33 studies, Rhodes and Smith (2006) found that Extraversion ($r = .23$), Neuroticism ($r = -.11$) and Conscientiousness ($r = .20$) were correlates of physical activity. Similarly, in a recent meta-analysis of 64 studies, Wilson and Dishman (2015) found that Extraversion ($r = .11$), Neuroticism ($r = -.07$) and Conscientiousness ($r = .10$) were associated with physical activity, although the effect sizes were smaller than those in the 2006 meta-analysis. Wilson and Dishman also detected a small, albeit significant association between Openness to Experience and physical activity ($r = .03$). Given these findings, research is needed to explore whether the Big-Five personality factors are associated with time spent dog walking.

In summary, a variety of different types of factors that may affect the time spent dog walking have been identified. Additional research is needed to assess which of these factors are associated with time spent dog walking at a moderate- to vigorous-intensity level when physical activity is objectively assessed.

Health Benefits Associated With Dog Walking

Researchers from a number of countries have conducted cross-sectional and longitudinal studies to explore the possible health benefits that may occur as a result of

the physical activity obtained through dog walking. The health benefits from dog walking may take the form of immediate benefits from a single walk or benefits acquired over time.

Immediate benefits from dog walking. Researchers have examined the effect on physical and psychological health of engaging in a single episode of physical activity. From a review of the literature, Thompson et al. (2001) noted that there is evidence that engaging in a single episode of physical activity confers physical health benefits, such as lower triglycerides, lower blood pressure (diastolic and systolic), increased high-density lipoprotein cholesterol and reduced insulin resistance. As well, a number of studies have found that engaging in a single episode of physical activity is associated with psychological health benefits, such as an increase in positive well-being and a decrease in psychological distress (Cox, Thomas, & Davis, 2001; Daley & Welch, 2004), improved mood (Berger & Owen, 1998; Sibold & Berg, 2010; Maroulakis & Zervais, 1993; Szabo, 2003), reduced anxiety (Landers & Petruzzello, 1994) and decreased depression (North, McCullagh, & Tran, 1990).

To date, no quantitative studies have examined whether dog owners experience immediate physical and psychological health benefits after walking their dog. However, the findings from a qualitative study suggest that dog walking may confer immediate health benefits. Knight and Edwards (2008) conducted 10 focus groups with 62 dog walkers (*M* age = 60 years) from 12 dog walking sites in England. Among the dog walkers, a common theme that emerged was that the dogs motivated their owners to take them for a walk, even when the owners did not feel like leaving their house, such as when they were feeling lethargic, ill or depressed. Furthermore, participants stated that, once

they were outside walking their dog, they felt better both physically and psychologically.

In summary, findings from numerous studies provide evidence that engaging in acute physical activity (i.e., a single session) is beneficial for both physical and psychological health. Given the dearth of research on the immediate health benefits from dog walking, there is a need for quantitative research assessing the possible changes in dog owners' health after walking their dog.

Long-term benefits from dog walking. Researchers have conducted studies examining the possible long-term health benefits from dog walking in two ways. Some researchers have focused on the possible health benefits for well-being arising from dog walking, while others have compared the health of dog walkers with that of non-dog walkers and non-dog owners.

Dog walking and well-being. A number of studies have explored the possible physical and psychological health benefits obtained through dog walking. To begin, three recent quantitative studies conducted in the United States examined whether there are physical activity-related health benefits from walking with a loaner dog. In the first study, a community dog walking program was conducted among 69 adults, ranging in age from 19 to 85 years (Johnson & McKenney, 2011). Participants walked on a nature trail with a shelter dog for one-hour a week for 4 consecutive weeks. The researchers found that participants' weight decreased significantly over the course of the 4-week study ($Mdn = 3$ pounds). In addition, participants experienced a small, albeit significant, decrease in their BMI.

In the second study, Johnson and Meadows (2010) conducted a study in which adults, ranging in age from 40 to 82 years, from two public housing residences were

paired with a certified therapy dog and a handler. Participants from the first residence were assigned to a 50-week walking group ($n = 13$), while participants from the second residence were assigned to a 26-week walking group ($n = 13$). All participants began by walking for 10 minutes/3 days a week for 3 weeks, then 20 minutes/3 days a week for 3 weeks and finally 20 minutes/5 days a week for the remainder of the study. Results revealed that participants in the 50-week group lost a significant amount of weight ($M = 14.4$ pounds) and had a significant decrease in their BMIs over the course of the study. On the other hand, participants in the 26-week group did not lose a significant amount of weight ($M = 5$ pounds) and their BMIs did not differ significantly from the beginning to the end of the study. It is noteworthy that the most common reason provided by participants for adhering to the program was that the dogs needed to be walked and were waiting for them. The researchers concluded that feeling committed to a dog, even if it is a loaner dog, may encourage adherence to physical activity.

In the third study 54 seniors, age 67 to 97 years, from three retirement facilities took part in a 12-week dog walking program on 5 days of the week (Johnson, McKenney, & McCune, 2010). The seniors were assigned to one of the following conditions: walk with a shelter dog and a handler ($n = 12$), walk with a human walking companion ($n = 23$) or a no-treatment control group who did not walk ($n = 19$). When physical functioning was assessed through a 6-minute walk, the seniors who were assigned to walk with a dog increased their mean walking speed over the course of the 12 weeks by 28% ($p = .012$), while there were non-significant increases in the mean walking speed among those who walked with a human companion (4%) or were in the control group (6%).

One qualitative study and three quantitative studies examined the possible health benefits for dog owners from walking their own dog. In the qualitative study, Tatschl, Finsterer, and Stöllberger (2006) conducted a case study in which they examined the effects of dog walking on a 68-year-old retired woman in Austria. After acquiring a dog, the woman increased her physical activity from 1 hour two to three times a week to 3 hours daily. Two months after becoming a dog owner, she no longer needed to take an antidepressant drug and after 4 months she no longer needed anti-hypercholesterolemia therapy to treat her high cholesterol. The researchers suggest that dogs, with their natural desire for physical activity, are important motivators for physical activity and that dog walking appears to be beneficial for both dog walkers' physical and psychological health.

The first quantitative study examined the possible stress-reduction benefits associated with dog walking among women. Lacey (2004) conducted a cross-sectional study in which she examined whether, among 318 female dog owners in the United States, dog walking reduced the women's stress levels. She found that, as both the amount of time spent dog walking per week ($r = -.10$) and the number of times dog owners walked their dog per week increased ($r = -.13$), their stress levels decreased slightly. The second quantitative study examined the possible association between time spent dog walking and health among 499 Canadian dog walkers who were 18 years of age or older (Duvall Antonacopoulos, 2009). In this cross-sectional study, dog walkers' physical health (doctor visits, number of medications, self-report rating of health and BMI) and psychological health (depression, positive and negative affect and trait anxiety) were assessed. Results revealed that more time spent dog walking over the course of a week was associated with slightly better overall physical ($\beta = -.15, p < .01$) and

psychological health ($\beta = -.16, p < .001$).

The third quantitative study was Serpell's (1991) 10-month study of adults in the United Kingdom who acquired a dog, the overwhelming majority of which were from two animal shelters. This longitudinal study examined the relationship between recreational walking and health. Serpell assessed physical health through a 20-item checklist of minor health problems and psychological health through a 30-item measure of psychological health (the General Health Questionnaire [GHQ]). Results revealed that dog owners increased the number/duration of their recreational walks 1 month after acquiring a dog, an increase that persisted at 6 and 10 months. However, when Serpell examined the possible health benefits associated with dog owners increased recreational walking, there was no relation between the number/duration of recreational walks and dog owners' physical health 1 month, 6 months or 10 months after acquiring a dog. When psychological health was examined, there was a positive relation between the number/duration of recreational walks and mental health at 6 months (Kendall $r = .34$), but the association did not hold at 10 months.

Taken together, findings from a qualitative study (Tatschl et al., 2006) and three longitudinal studies in which participants walked with a loaner dog (Johnson et al., 2010; Johnson & McKenney, 2011; Johnson & Meadows, 2010) suggest that dog walking confers health benefits. As well, when researchers explored the possible relation between minutes dog walking and well-being, cross-sectional studies revealed that spending more time dog walking was associated with better overall physical and psychological health (Duvall Antonacopoulos, 2009) and reduced stress levels (Lacey, 2004), while a longitudinal study of new dog owners did not find an association between increased

recreational walking and physical and psychological health (Serpell, 1991). In summary, the majority of these findings suggest that there are health benefits from dog walking and that more time spent dog walking is associated with physical and psychological health benefits. However, the fact that the one longitudinal study conducted among dog owners came to a different conclusion indicates that there is a need for additional research on the relationship between dog walking and health.

Well-being of dog walkers versus non-dog walkers and non-dog owners.

Findings from numerous self-report studies (e.g., Cutt et al., 2008a, Duvall Antonacopoulos, 2009; Lentino et al., 2012; Reeves et al., 2011) and one accelerometer study (Coleman et al., 2008) suggest that dog walkers are more physically active compared to non-dog walkers and non-dog owners. Given that physical activity is beneficial for well-being (U.S. Department of Health and Human Services, 2008), six cross-sectional studies and one longitudinal study have examined whether dog walkers have better health than non-dog walkers and non-dog owners.

Four of the cross-sectional studies were conducted in the general population. In the first study, Richards et al. (2013) divided 391 American dog owners, 18 years of age or older, according to whether they walked their dog ($n = 312$) or did not walk their dog ($n = 79$). They found that participants who walked their dog were less likely to be overweight or obese compared to those who did not walk their dog. In the second study, Coleman et al. (2008) divided 2,199 Americans, ranging from 20 to 65 years of age, according to whether they walked their dog ($n = 429$), did not walk their dog ($n = 183$) or did not own a dog ($n = 1,578$). They found that dog owners who walked their dog were less likely to be obese than both dog owners who did not walk their dog and non-dog

owners. However, a significantly higher percentage of dog owners who walked their dog were overweight compared to dog owners who did not walk their dog and non-dog owners. One possible explanation for this finding is that overweight individuals may walk their dog in an effort to lose weight through the physical activity obtained dog walking.

In the third study, Duvall Antonacopoulos (2009) divided 658 Canadians, ranging from 18 to 77 years, according to whether they were dog walkers ($n = 499$), non-dog walkers ($n = 71$) or non-dog owners ($n = 88$) and compared the groups on composite measures of physical health (doctor visits, number of medications, self-report rating of health and BMI) and psychological health (depression, positive and negative affect and trait anxiety). Results revealed that dog walkers had slightly better overall physical and psychological health than non-dog walkers, although the latter relation was confounded or, alternatively, mediated by stress. In addition, dog walkers had slightly poorer overall physical health relative to non-dog owners, but did not differ in their overall psychological health from non-dog owners.

In the fourth study, Lentino et al. (2012) divided 916 Americans, 18 to 85 years of age, according to whether they were dog walkers ($n = 399$), non-dog walkers ($n = 137$) or non-dog owners ($n = 380$). They then compared the groups on health risk indicators (physical activity, BMI, systolic blood pressure, diastolic blood pressure, self-report rating of health and stress) and the odds of having chronic health conditions (diabetes, hypertension, high cholesterol and depression). The researchers found that compared to dog walkers, individuals who did not walk their dog were less physically active, had higher BMIs and rated their health as poorer. In addition, compared to dog walkers, non-

dog owners were less physically active, had higher BMIs and had greater odds of self-reported diabetes, hypertension, high cholesterol and depression.

The other two cross-sectional studies were conducted among seniors residing in the community. First, Shibata et al. (2012) divided 1,926 Japanese seniors, ranging from 65 to 74 years, according to whether they were dog walkers ($n = 191$), non-dog walkers ($n = 79$) or non-dog owners ($n = 1,656$). They found that dog walkers did not differ from non-dog walkers or non-dog owners with respect to either their BMI (normal weight vs. overweight/obese) or their self-rated health (good vs. poor). Second, Gretebeck et al. (2013) conducted a study of 1,091 American seniors, ranging from 65 to 95 years, who were dog walkers ($n = 77$), non-dog walkers ($n = 83$) or non-dog owners ($n = 931$). The researchers found that dog walkers did not differ in their BMIs from either non-dog walkers or non-dog owners. The researchers also assessed participants' functional ability by having participants rate the difficulty level of six functional ability tasks, such as stair climbing, lifting a 10 pound weight and heavy housework. The researchers found that dog walkers had greater functional ability than both non-dog walkers and non-dog owners.

The sole longitudinal study was a 3-year study of 2,533 community-dwelling seniors in the United States who ranged in age from 71 to 82 years at baseline (Thorpe et al., 2006). At baseline, both senior dog owners who walked their dog at least three times a week and seniors without a dog who walked at least three times a week had mobility advantages, including higher usual and rapid walking speeds, than dog owners who walked their dog fewer than three times a week and seniors without a dog who walked fewer than three times a week. Three years later, all seniors experienced declines in their

rapid and usual walking speeds, but only dog owners who walked their dog at least three times a week maintained their initial mobility advantage over dog owners who did not walk their dog at least three times a week and seniors who did not own a dog. It should be noted that the ability to make a causal inference about the effects of dog walking on health based on this study is limited because the researchers did not examine whether participants in any of the groups lost or acquired a dog over the course of the 3-year study.

The preceding studies provide some evidence that dog walkers have better physical health than non-dog walkers and non-dog owners on a number of physical health measures (Gretebeck et al., 2013; Lentino et al. 2012; Richards et al., 2013). With respect to psychological health, it is unclear from the two studies conducted to date whether dog walkers have better psychological health than non-dog walkers and non-dog owners (Duvall Antonacopoulos, 2009; Lentino et al., 2012). Furthermore, given that these studies used only a limited number of psychological health measures (including a composite measure of overall psychological health, stress and depression), additional research is needed comparing the psychological health of the three groups.

Limitations of Studies Conducted To Date

The current research on dog walking as a form of physical activity has a number of limitations that need to be addressed in order to assess the possible health benefits of dog walking. One limitation stems from the lack of studies examining the percentage of time dog walkers spend at a sedentary-, light-, moderate- and vigorous-intensity level on their dog walks. There is likely considerable variation in the intensity level of the physical activity obtained through dog walking, given that researchers have found that

dogs and their owners do not walk continuously. Gaunet, Pari-Perrin, and Bernardin (2014) found that dogs stop in order to urinate, defecate and sniff the ground. In addition, Lee et al. (2009) found that some dog walkers stop to chat with other dog owners while their dogs play together. Oka and Shibata (2012) note that, as a result of dog owners stopping and starting on their dog walks, they may overestimate both the duration and intensity level of their time spent dog walking.

Yet another limitation of the research conducted to date is that, while some researchers define dog walkers as those who walk their dog for periods lasting at least 10 minutes (Duvall Antonacopoulos, 2009; Hoerster et al., 2011; Reeves et al., 2011), others define dog walkers as those who spend any time walking their dog (e.g., Coleman et al., 2008; Cutt et al., 2008a; Lentino et al., 2012). According to the physical activity guidelines developed by the WHO (2010), Canada (Canadian Society for Exercise Physiology, 2011), the United Kingdom (Department of Health, Physical Activity, Health Improvement and Protection, 2011) and the United States (U.S. Department of Health and Human Services, 2008), a minimum of 10 minutes of physical activity at each session is recommended for health benefits. Therefore, it is important for researchers to take into consideration whether dog walkers are spending sufficient time walking their dog to realize health benefits from dog walking. It is noteworthy that researchers have found that a sizeable percentage of dog owners either do not walk their dog at all or do not walk their dog long enough to receive health benefits. For example, 33% of the dog owners in Slater, Robinson, Zoran, Wallace, and Scarlett's (1995) sample of 69 American dog owners did not walk their dog and an additional 9% walked their dog for periods lasting less than 10 minutes.

Another concern arises from the discrepancy noted earlier between findings from national studies that used accelerometers versus self-report physical activity measures (Craig et al., 2009; Statistics Canada, 2015a, 2015b; Tucker et al., 2011), with physical activity levels from self-report studies being considerably higher than those obtained using accelerometers. There is a need for studies comparing the physical activity levels of dog walkers relative to non-dog walkers and non-dog owners using objective measures (e.g., accelerometers); however, to date, only one dog walking study conducted in the general population has compared the physical activity levels of the three groups using accelerometers (Coleman et al., 2008). This study utilized cut-points that were derived from ambulatory physical activities.⁵ It should be noted that the physical activity levels reported in Coleman et al.'s study were considerably higher than those reported in national studies that assessed physical activity using accelerometers. They reported that 46% of their American sample achieved at least 30 minutes of moderate- to vigorous-intensity physical activity daily, yet national accelerometer studies reported that less than 3.5% of American adults and only 4.8% of Canadian adults obtained at least 30 minutes of moderate- to vigorous-intensity physical activity at least 5 days a week (Colley et al., 2011; Troiano et al., 2008). This difference may be due, at least in part, to the fact that Coleman et al. (2008) did not exclude bouts of physical activity that lasted less than 10 minutes.

⁵A pilot study was recently conducted in the United States to objectively assess the physical activity obtained through dog walking using Actigraph accelerometers (Richards, Troped, & Lim, 2014). The researchers utilized Matthew's (2005) cut-points that were derived from lifestyle activities: sedentary = < 100; light = 100-759; moderate = 760-5,724; vigorous = \geq 5,725. Given that in this dissertation, the moderate- and vigorous-intensity cut-points that were utilized for the Actical accelerometer were derived based on ambulatory activities (Colley & Tremblay, 2011), the findings from Richards et al.'s (2014) study are not comparable and, therefore, are not discussed.

In summary, studies using accelerometers are needed in order to understand the intensity of the physical activity obtained dog walking and to accurately measure the amount of time spent dog walking over the course of a week at a moderate- to vigorous-intensity level for periods of at least 10 minutes. As well, Canadian research is needed in this area, given that the Canadian studies conducted to date have relied upon self-report physical activity measures when examining the physical activity levels of dog owners (e.g., Brown & Rhodes, 2006; Duvall Antonacopoulos, 2009). Therefore, there is a need for a study using accelerometers in order to understand how dog walking affects physical activity levels and the possible benefits for dog walkers' physical and psychological health.

Rationale

There is concern about the low percentage of adults who engage in sufficient physical activity (Colley et al., 2011; Statistics Canada, 2015b; Tucker et al., 2011), given that insufficient physical activity is associated with an increased risk for a variety of diseases (U.S. Department of Health and Human Services, 2008). The possibility that dog walking is an effective means of obtaining the physical activity necessary for health benefits merits examination, as 34% of Canadian households have a dog (Canadian Animal Health Institute, 2015). This dissertation addressed this need through two studies: a week-long study of dog walking and an 8-month study of the physical activity and health of individuals who acquired a dog compared to a control group of non-dog owners.

Study 1: Dog walking. The first part of this dissertation explored dog walking from three perspectives. First, I looked at whether dog walking is an effective means of

obtaining physical activity at the intensity level recommended for health benefits.

Second, I conducted an exploratory examination of factors that may affect weekly time spent dog walking at a moderate- to vigorous-intensity level. Third, I examined whether dog walking results in dog owners experiencing an improvement in their psychological health at the end of their dog walks. My dissertation research for each of these areas is described below.

Part 1a: Time spent dog walking. The purpose of the first part of this study was to provide insight into dog walking as a means of obtaining physical activity. I began by, first, examining the amount of time spent dog walking at each intensity level. Second, I determined the percentage of dog walkers achieving the recommended physical activity guidelines of 150- and 300-minutes of moderate- to vigorous-intensity physical activity weekly. Third, I determined the percentage of dog walkers who achieved at least 30 minutes of moderate- to vigorous-intensity physical activity on at least five days of the week. Fourth, I examined the number of steps obtained through dog walking and determined the percentage of dog owners achieving the recommended 10,000 steps daily.

Given that previous studies have relied upon self-report measures to determine the amount of time dog walkers spend walking their dog over the course of a week (e.g., Coleman et al., 2008; Cutt et al., 2008a; Hoerster et al., 2011; Reeves et al., 2011), it is possible that dog walkers overestimate the amount of time they spend dog walking. As an example, dog walkers may include time spent standing still while chatting with other dog walkers. Therefore, a study using accelerometers is needed in order to accurately determine the amount of time spent dog walking at each intensity level.

Researchers have recommended that, for health benefits, adults should engage in

physical activity at a moderate- or vigorous-intensity level (Canadian Society for Exercise Physiology, 2011; U.S. Department of Health and Human Services, 2008); therefore, research is needed to determine the amount of time dog walkers spend dog walking at a moderate- to vigorous-intensity level. To achieve this, accelerometers were used to objectively assess the physical activity obtained through dog walking. The information from the accelerometers was then used to calculate the amount of time dog walking that was spent at a sedentary-, light-, moderate- and vigorous-intensity level over the course of a week.

As noted earlier, according to the current Canadian physical activity guidelines, adults should engage in at least 150 minutes of moderate- to vigorous-intensity physical activity weekly in bouts of at least 10 minutes (Canadian Society for Exercise Physiology, 2011). Therefore, I determined the percentage of dog walkers who attained this guideline through dog walking. As well, if dog walkers are walking their dog for lengthy periods, this may provide additional health benefits. I determined the percentage of dog walkers who obtained sufficient physical activity through dog walking to meet the WHO's (2010) recommendation of 300 minutes of moderate- to vigorous-intensity physical activity weekly in bouts lasting at least 10 minutes for more extensive health benefits. As it was expected that some of the dog walking physical activity would not be in bouts, the percentage of dog walkers meeting the 150- and 300-minute guideline was also examined without taking 10-minute bouts into consideration.

As noted earlier, Colley et al. (2011) found that only 4.8% of Canadians achieved at least 30 minutes of moderate- to vigorous-intensity physical activity in bouts on at least 5 days of the week. In order to assess whether dog walking is an effective means of

obtaining regular physical activity, I determined the percentage of dog walkers who obtained at least 30 minutes of moderate-to vigorous-intensity physical activity with and without bouts on at least 5 days of the week. Given the low percentage of Canadians who achieve at least 30 minutes on 5 days of the week, I also examined the number of days on which dog walkers achieved at least 30 minutes of moderate- to vigorous-intensity physical activity.

The accelerometer that was used in the present study has a built in pedometer function that provides information on the number of steps taken per minute. Although pedometers are unable to capture physical activity intensity levels, they are more practical than accelerometers for most individuals, given that a single accelerometer unit can cost \$500 and special equipment is needed to download the accelerometer data (Bio-Lynx Scientific Equipment, 2011). As well, pedometers are relatively inexpensive and provide results that are conceptually easier to understand (Colley et al., 2011). Tudor-Locke and Bassett (2004) have suggested that to be active individuals should accumulate 10,000 steps per day. Therefore, using the information from participants' dog walks, I determined the average number of steps taken daily by dog walkers, the number of days on which dog walkers achieved at least 10,000 steps and the percentage of dog walkers who averaged at least 10,000 steps per day and also met the Canadian physical activity guideline of 150 minutes of moderate- to vigorous-intensity physical activity weekly.

Part 1b: Factors affecting time spent dog walking. The second part of the study was designed to provide insight into possible factors that may affect the length of time spent dog walking weekly at a moderate- to vigorous-intensity level in 10-minute bouts. Participants were asked questions about their personal characteristics (e.g., marital

status), the characteristics of their dog (e.g., size), the weather on their dog walks (e.g., temperature), the environment in which they walked their dog (e.g., dog park), their social interactions on their dog walks (e.g., walked with other dog owners) and their personality (e.g., level of extraversion). In addition, they were asked questions about factors that may affect the length of time spent dog walking the week they wore the device (e.g., employment status week wore accelerometer). Finally, participants were asked to complete four open-ended questions: why they acquired a dog, why they walk their dog, what affects the amount of time they spend dog walking and how owning a dog affects the amount of exercise they receive.

Part 1c: Psychological health study. The purpose of the third part of this study was to compare dog walkers' psychological health immediately before and after they walked their dog. Researchers have found that engaging in a single bout of physical activity confers health benefits (Cox et al., 2001; Landers & Petruzzello, 1994; North et al., 1990; Sibold & Berg, 2010; Thompson et al., 2001). However, to date only one qualitative study has identified possible immediate health benefits from dog walking (Knight & Edwards, 2008). This study addressed the need for research on the possible immediate psychological health benefits that may result from dog walking⁶ by assessing dog owners' psychological health immediately before and after they walked their dog using 1-item visual analogue scales. As well, on the final day of the study, through an open-ended question participants were asked to describe the benefits, if any, that they receive from walking their dog in order to determine whether participants perceived that

⁶A decision was made not to examine whether there were immediate changes in physical health from dog walking, given the challenges associated with measuring the physical health indicators (e.g., blood pressure, triglyceride levels) that researchers have found are affected by a single bout of physical activity (Thompson et al., 2001).

dog walking was beneficial for their psychological health.

Study 2: Longitudinal study. In the second half of this dissertation, the effect of acquiring a dog on physical activity and health was examined through an 8-month longitudinal study of adults before and after they acquired a dog. The sample also included a control group comprised of individuals who did not own a dog over the course of the study. The original intent was to divide those participants who acquired a dog into two categories: 1) participants who did not walk their dog or typically walked it for very brief periods (i.e., less than 10 minutes), and 2) participants who walked their dog and typically did so for 10 or more minutes. The overwhelming majority of the participants who acquired a dog fell into the second category. As only five participants who acquired a dog fell into the first category, this group had to be excluded from the study.

This study compared the physical activity of individuals who acquired a dog and a control group using accelerometers to obtain an objective measure of physical activity. I hypothesized that, while individuals who acquired a dog would increase their moderate- to vigorous-intensity physical activity in 10-minute bouts over the course of the study on account of time spent dog walking, there would not be a change in the physical activity of the control group over time. I expected that some of the physical activity obtained through dog walking would not be in bouts, given that dog owners may reduce their pace or stop either on account of their dog (Gaunet et al., 2014) or to talk to other dog owners (Lee et al., 2009). Accordingly, for the physical activity hypotheses, total moderate- to vigorous-intensity physical activity was also examined without taking bouts into consideration.

If, as a result of time spent dog walking, dog owners increase their physical

activity over the course of the 8-month study, they would then be more likely to meet the recommended physical activity guideline of 150 minutes of moderate-to vigorous-intensity physical activity in bouts lasting at least 10 minutes. Therefore, I examined the odds of individuals who acquired a dog meeting the recommended physical activity guideline relative to non-dog owners at both baseline and 8 months. I hypothesized that, while the groups would not differ at baseline, dog owners would be more likely than non-dog owners to meet the 150-minute guideline at 8 months.

According to the WHO (2010), additional health benefits can be obtained if adults engage in 300 minutes of moderate- to vigorous-intensity physical activity in bouts lasting at least 10 minutes. Therefore, I examined the odds of dog owners achieving the time required for additional health benefits relative to non-dog owners at both baseline and 8 months. I hypothesized that, while the groups would not differ at baseline, dog owners would be more likely than non-dog owners to achieve the recommended time necessary for additional health benefits at 8 months.

As noted earlier, the accelerometer that was used in the present study also serves as a pedometer (i.e., provides step counts per minute). The step count information was used to determine the average number of steps taken daily by dog owners and non-dog owners. Given that 10,000 steps daily has been recommended as the benchmark for daily steps (Tudor-Locke & Bassett, 2004), I determined the percentage of individuals in both groups who achieved this guideline. In addition, for those dog owners and non-dog owners who achieved the 10,000 step guideline, I determined the percentage who also achieved the Canadian physical activity guideline of 150 minutes of moderate- to vigorous-intensity physical activity at baseline and 8 months.

Researchers have found that physical activity confers health benefits (U.S. Department of Health and Human Services, 2008; Warburton et al., 2007). Therefore, if acquiring a dog results in dog owners increasing the amount of time they engage in physical activity at a moderate- to vigorous-intensity level, this should be beneficial for their well-being. I hypothesized that individuals who acquired a dog would experience improvements in their physical and psychological health over the course of the 8-month study, while individuals in the control group would not experience changes in their health over time.

Finally, at 8 months dog owners provided information about the start and end time of their dog walks. This information was used to identify participants' dog walks in their accelerometer data, which enabled me to determine the contribution that dog walking made to dog owners' total moderate- to vigorous-intensity physical activity. Dog owners also completed a series of closed- and open-ended questions relating to their dog and to possible changes in physical activity and health from acquiring a dog.

Study 1: Dog Walking

This study addressed the need to obtain more insight into the physical activity obtained dog walking through the use of accelerometers. I began with an in-depth examination of the intensity level of the physical activity obtained dog walking and then determined whether dog walking is one way of meeting the physical activity guidelines. Next, I explored factors that may affect time spent dog walking weekly at the recommended moderate- to vigorous-intensity level. Finally, I examined participants' psychological health before and after each of their dog walks in order to assess whether dog walking confers short-term psychological health benefits.

Method

Participants

The sample was comprised of 61 dog walkers who went on 630 dog walks over the course of a week. Participants were recruited from June to October of 2012 through a variety of methods. First, a sheet containing a description of the study was distributed to dog owners at numerous dog parks in Ottawa. Second, copies of the sheet describing the study were made available at various locations (e.g., veterinarians' offices and animal hospitals). Third, participants were recruited through websites for classified ads, including Craigslist and Kijiji, and dog-related Internet websites, such as Ottawa Dog Blog (<http://ottawadogblog.ca/>). Fourth, ads were placed on Ottawa Facebook dog groups (e.g., dog park groups in Ottawa). Fifth, posters were placed in various locations in the community (e.g., libraries and community centers).

Study Eligibility Criteria

Participants were only eligible to participate in this study if they met the following criteria:

- lived in Ottawa
- were at least 18 years of age
- only owned one dog
- on average, walked their dog at least three times per week⁷ (to restrict the sample to regular dog walkers)
- usually walked their dog for periods lasting at least 10 minutes (to eliminate

⁷In the American physical activity guidelines, it is stated that aerobic physical activity (e.g., dog walking) should be engaged in on at least 3 days a week to confer health benefits (U.S. Department of Health and Human Services, 2008).

participants who only walked their dog for very brief periods)

- were not a professional dog walker

Procedure

Participants were invited to take part in a study that involved completing online and paper surveys, wearing a physical activity monitoring device on all of their dog walks over the course of a week and completing a dog-walking log. Interested participants were instructed to contact the researcher through the e-mail address that was provided in the recruitment announcement.

Online survey. Participants were e-mailed the link to the online survey on Survey Monkey (<https://www.surveymonkey.com/>) along with a unique code that they were required to enter to begin completing the survey (Appendix A). In the informed consent, participants were told that the online survey would take approximately 10 minutes to complete. To obtain the study materials for the physical activity component of the study, on the last page of the online survey, participants were instructed to e-mail the researcher their contact information (name, phone number,⁸ mailing address) and unique code.

Physical activity monitor and booklet. Participants were either hand delivered or mailed a package containing a booklet, a physical activity monitoring device, a waistband and a postage paid return envelope (when the package was mailed to participants). The booklet consisted of three components. First, there was a cover letter and instructions for wearing the monitoring device (Appendix B). Participants were instructed to wear the monitoring device for one week on all of their dog walks. Second,

⁸Participants who did not return the accelerometer were contacted by phone if they did not respond to e-mails.

there was a dog-walking log that included a series of questions that participants were instructed to complete by hand immediately before and after walking their dog (Appendix C). Third, there was a brief 5-minute paper survey that participants were instructed to complete on Day 8 of the study (Appendix D).

Participants were able to choose a \$10 gift card from a selection of stores listed at the end of the booklet. When the study materials (accelerometer, waist band and booklet) were either picked up by the researcher or returned by mail, participants were hand delivered or mailed their gift card. Participants were later given a personalized profile of their dog walking physical activity to thank them for taking part in the study (see Appendix E for a sample profile).

Wearing the accelerometer. Participants wore an Actical accelerometer (*Bio-Lynx Scientific Equipment, Montreal, Quebec*) over their right hip on a waist band. The Actical is a small, lightweight waterproof electronic device (dimensions: 28 x 27 x 10 mm; weight: 17 grams) that is omnidirectional and, therefore, capable of capturing motion in all directions (Bio-Lynx Scientific Equipment, 2011; Respironics, 2006). The accelerometers were set to record data in 1-minute intervals (epochs), resulting in a count value per minute. Participants were unable to view any physical activity data on the accelerometer, as this information is only available to researchers once it is downloaded from the device.

Researchers have found that the Actical is a valid tool to assess adults' physical activity levels (Heil, 2006) and also has better intra- and inter-instrument reliability compared to other accelerometer models, including the Actigraph and RT3 (Esliger & Tremblay, 2006). The Actical has also been determined to be a valid measure of step

counts (Esliger et al., 2007). Furthermore, the Actical was Statistics Canada's instrument of choice when objectively examining the physical activity level of Canadians (Colley et al., 2011).

In order to interpret the raw accelerometer dog walking data, which are provided in counts per minute, it is necessary to apply cut-points to examine participants' level of movement intensity. I used the cut-point of less than 100 counts per minute that was developed for the Actical by Wong, Colley, Gorber, and Tremblay (2011) to determine the amount of time that participants were sedentary on their dog walks. I applied the cut-points for the Actical that have been developed by Colley and Tremblay (2011) to assess the amount of time spent dog walking at a light-, moderate- and vigorous-intensity level (see Table 6). The cut-points outlined here for sedentary-, light-, moderate- and vigorous-intensity movement were used by Statistics Canada when assessing Canadians' physical activity levels using Actical accelerometers (Colley et al., 2011).

Table 6

Physical Activity Intensity Cut-Points for Actical Accelerometer

Intensity	Metabolic equivalent (METS)	Example	Accelerometer count ranges (counts per min)
Sedentary	1 to less than 2	Sitting	less than 100 ^a
Light	2 to less than 3	Billiards	100 to less than 1,535
Moderate	3 to less than 6	Golf	1,535 to less than 3,962
Vigorous	6 or more	Jogging	3,962 or more

Note. Intensity, METS and accelerometer count ranges were reproduced from "Physical Activity of Canadian Adults: Accelerometer Results From the 2007 to 2009 Canadian Health Measures Survey," by R. C. Colley et al., 2011, *Health Reports*, 22, p. 3. Examples are from Ainsworth et al. (2011).

^aIncluding wear-time zeros.

Participants wore the Actical accelerometer on all of their dog walks for one week. They were asked to begin wearing the accelerometer on their dog walks the day after they received it. Given that, according to Trost, McIver, and Pate (2005), one way to promote compliance is to have participants complete a self-report log, participants were asked to keep a log in which they recorded all of their dog walks over the 7 day period. For the Day 8 paper survey, participants were asked to indicate whether there were any days on which they did not walk their dog and, if so, to list the days. This information was used to ensure that, if participants did not record any dog walks on a particular day, it was because they did not walk their dog rather than because they forgot to record their dog walks that day.

Measures for Time Spent Dog Waking (Part 1a)

Data for the physical activity measures assessing time spent dog walking were collected by having participants wear an accelerometer on their dog walks and complete a dog-walking log, in which they indicated the start and end time for each of their dog walks.

Intensity level. The amount of time spent dog walking at a sedentary-, light-, moderate- and vigorous-intensity level was determined by applying the cut-points outlined in Table 6 to participants' raw accelerometer dog walking data. This information was used to calculate the amount of time spent at each intensity level on each dog walk. Weekly time spent dog walking was determined by summing participants' total number of minutes dog walking at each intensity level over the course of a week.

Moderate- to vigorous-intensity physical activity (MVPA). The total amount of time participants spent dog walking at a moderate- to vigorous-intensity level was

examined using two different approaches. First, following Canada's physical activity guidelines (Canadian Society for Exercise Physiology, 2011), the variable *MVPA1 (in bouts)* was created by summing participants' total number of minutes of moderate- to vigorous-intensity physical activity in bouts on each dog walk over the course of the week. To be classified as a bout, the dog walk had to last at least 10 minutes and 8 out of the 10 minutes had to be at a moderate- or vigorous-intensity level, an approach that is consistent with previous research (Colley et al., 2011; Troiano et al., 2008; Tucker et al., 2011).⁹ As noted earlier, dog walkers may slow their pace or stop because of the needs of their dog (Gaunet et al., 2014) or to chat with other dog owners (Lee et al., 2009); therefore, descriptive information is presented for time spent dog walking without bouts. The variable, *MVPA1 (no bouts)*, was created by summing any time spent dog walking at a moderate- or vigorous-intensity level over the course of the week.

Second, based on the WHO's (2010) physical activity guidelines, the original intent was to create two variables, *MVPA2 (in bouts)* and *MVPA2 (no bouts)*, by doubling time spent dog walking at a vigorous-intensity level before adding it to time spent dog walking at a moderate-intensity level over the course of the week. However, given that on 78.10% of the dogs walks over the course of the week participants engaged in 1 minute or less of vigorous-intensity physical activity, these two variables were dropped from the study.

Attaining selected physical activity levels. Participants were classified first according to whether they achieved the recommended guideline of at least 150 minutes of

⁹According to Tucker et al. (2011), the purpose of the 2 minute allowance of physical activity at a less than moderate-intensity level is to take into account occasional stops during periods of continuous activity.

MVPAI weekly through dog walking with and without bouts: *sufficient* (≥ 150 minutes) or *insufficient* (< 150 minutes). Second, participants were classified according to whether they achieved at least 300 minutes of *MVPAI* weekly through dog walking with and without bouts: *sufficient* (≥ 300 minutes) or *insufficient* (< 300 minutes). Third, participants were classified according to whether they achieved 30 minutes of *MVPAI* on at least 5 days of the week through dog walking with and without bouts: *sufficient* (≥ 30 minutes on 5 days) or *insufficient* (< 30 minutes on 5 days). Fourth, information was provided as to the number of days on which participants achieved at least 30 minutes of *MVPAI* with and without bouts through dog walking.

Pedometer step counts. Using the pedometer function of the Actical accelerometer, the number of steps that were taken on each day over the course of the week while dog walking was determined. This information was then used to calculate the average number of steps taken daily on dog walks.

Attaining 10,000 steps. According to Tudor-Locke and Bassett (2004), individuals should achieve 10,000 steps daily to be considered active. Therefore, participants were classified according to whether they achieved a daily average of at least 10,000 steps through dog walking over the course of the week: *achieving* ($\geq 10,000$ steps) or *not achieving* ($< 10,000$ steps).

Measures for Factors Affecting Time Spent Dog Walking (Part 1b)

Data for the measures for this section were collected through online and paper surveys, a dog-walking log and by having participants wear an accelerometer on their dog walks.

Independent variables. Thirty-two factors that may affect the length of time

spent dog walking weekly were examined. Twenty-eight of these factors were presented in the introduction under the following six categories: personal characteristics of the dog walker, characteristics of the dog, weather, environment in which the dog is walked, dog walkers' social interactions and personality. A seventh category consisting of four factors that may have affected the amount of time participants spent dog walking the week they wore the device was also included. This category was entitled "Questions relating to the week the device was worn." The independent variables are presented below.

Personal characteristics of the dog walker. Participants were asked to provide information about the following variables:

- sex (male, female)
- age (continuous)
- marital status (single/separated/divorced/widowed vs. married/cohabitating/common-law)
- level of education (< 1 university degree vs. ≥ 1 university degree)
- family household income before tax (< \$80,000 vs. ≥ \$80,000)¹⁰
- living alone (yes, no)
- children under 18 years of age living at home (yes, no)
- dwelling has fenced backyard (yes, no)
- acquired dog to obtain more exercise (yes, no)
- BMI (see below)

¹⁰Participants' annual family household income was divided at \$80,000 before tax, given that the average 2011 income before tax in Canada was \$75,000 (Statistics Canada, 2013).

Participants were asked to provide their height and weight in order to calculate their BMI using the following formula: $BMI = \text{weight (kg)}/\text{height (m)}^2$ (Health Canada, 2003). Given that when self-report measures are used to assess BMI, there is a tendency for people to underestimate their weight and overestimate their height (Shields, Connor Gorber, & Tremblay, 2008), a BMI correction factor was applied to adjust for this bias (Connor Gorber, Shields, Tremblay, & McDowell, 2008). As pregnancy leads to a weight increase, female participants were asked to indicate whether they were pregnant.

Characteristics of the dog.

Size of dog. Participants were asked to indicate the size of their dog. In order to take into account the fact that some participants may have been unsure of their dog's size or may have described it inaccurately, participants were also asked to specify their dog's height, weight and breed. Using this information, participants' dogs were classified as small, medium or large.

Age of dog. Participants were asked to indicate the age of their dog.

Breed exercise requirement. Using participants' responses to the question about the breed of their dog, the UK Kennel Club's (2015a) breed exercise classifications were used to categorize each participant's dog according to whether the breed required a low (up to 30 minutes/day), moderate (up to 1 hour/day) or high (more than 2 hours/day) level of exercise.

Dog's health. Participants were asked to indicate whether their dog had any health conditions that affected how long it could be walked (yes, no).

Weather.

Temperature. Using the hourly temperatures that are available from Environment

Canada (2015), the temperature on each dog walk was determined. This information was used to determine the average temperature on each participant's dog walks over the course of the week.

Perceived weather. After each dog walk, participants were asked to indicate whether the weather was miserable, fair, good or gorgeous on their walk. This information was used to determine the percentage of each participant's dog walks that were rated as gorgeous over the course of the week.

Season. Participants were divided according to the season they wore the accelerometer on their dog walks.

Environment in which the dog is walked.

Greenspace. After each dog walk, participants were asked to indicate whether they only walked/jogged on streets, walked/jogged to a park, drove to a park, walked/jogged to another location or drove to another location. Those participants who went to another location were asked to specify the location. All of the other locations described by participants were greenspaces (e.g., forest). For each dog walk, participants were divided according to whether they went to a greenspace versus only walked/jogged on the street. This information was used to determine the percentage of walks on which the participant walked/jogged or drove to a greenspace over the course of the week.

Dog park. After each dog walk, participants were asked whether they went to a dog park (described as a park where dogs can play off leash) on their walk (yes, no). This information was used to determine the percentage of walks on which the participant went to a dog park over the week.

Dog walkers' social interactions.

Encountered anyone on walk. After each dog walk, participants were asked whether they encountered anyone on their walk (yes, no). This information was used to determine the percentage of walks over the week on which the participant met someone. For descriptive purposes, a follow-up question was included for participants who encountered someone on their dog walk. These participants were asked to indicate how many of the people they encountered on their walk they talked to.

Household companion on walk. After each dog walk, participants were asked whether someone from their household accompanied them on their walk (yes, no). This information was used to determine the percentage of dog walks on which the participant was accompanied by a household member over the course of the week.

Walked with other dog owners. Participants were asked whether in a typical week there were other dog owners with whom they walked on some of their dog walks (yes, no). Those participants who indicated that they walked with other dog owners on some of their dog walks were asked a follow-up question for descriptive purposes. They were asked whether they walked with other dog owners always, often, occasionally or rarely.

Social interactions on dog walks. Participants were asked which of the following three statements describes their typical social interactions with the people they encounter on their dog walks: a) I do not interact with the people I encounter, b) I only exchange brief greetings (e.g., hello) with the people I encounter or c) I converse with the people I encounter.

Personality. Participants completed the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003), which is a very brief measure of the Big-Five

personality dimensions: Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experience. For each personality dimension, two items were included assessing both poles of the dimension (e.g., item 1: "extraverted, enthusiastic" and item 6: "reserved, quiet" for the extraversion scale). Participants indicated the extent to which the two traits applied to them on a scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*). According to Gosling et al., the TIPI demonstrates adequate test-retest reliability correlations¹¹ (mean $r = .72$ after a 6 week period) as well as convergent and discriminant validity, as assessed through correlations between the TIPI and John and Srivastava's (1999) 44-item Big-Five Inventory (mean convergent $r = .77$, absolute mean discriminant $r = .20$). The TIPI was scored by calculating the mean for the two items in each scale, with higher scores indicating higher levels of Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experience.

Questions relating to the week the device was worn.

Week wore device typical. Participants were asked whether the week they wore the device was a typical week in terms of the amount of time they spent walking their dog (yes, no). Participants who indicated that it was not a typical week were asked two follow-up questions for descriptive purposes: whether they spent more or less time than

¹¹According to Gosling (2015), given that only two items were used to assess each personality domain it is more appropriate to report test-retest reliabilities rather than Cronbach's alpha. Researchers have noted that when a scale is comprised of a small number of items, Cronbach's alpha may be misleading (Kline, 2000; Pallant, 2005; Woods & Hampson, 2005). Therefore, the coefficient alphas for the TIPI are only reported in this footnote. Gosling et al. (2003) reported Cronbach's alphas of .68, .40, .50, .73 and .45 for Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experience. In the present study, Cronbach's alphas and the correlations between the two items forming each scale were as follows: Extraversion, ($\alpha = .79$, $r[59] = .66$), Agreeableness ($\alpha = .36$, $r[59] = .25$), Conscientiousness ($\alpha = .62$, $r[59] = .52$), Emotional Stability ($\alpha = .73$, $r[58] = .61$) and Openness to Experience ($\alpha = .40$, $r[59] = .26$).

usual walking their dog and to explain why this was the case.

Employment status week wore device. Participants were asked whether they worked full time, part time or not at all during the week they wore the device.

Someone else walks the dog. Participants were asked whether in a typical week someone else walks their dog without them (yes, no). Participants who responded positively were asked two follow-up questions for descriptive purposes. First, they were asked to indicate who typically walks their dog without them. Second, they were asked to indicate how often someone else typically walks their dog without them on a scale ranging from *1 day a week* to *7 days a week*.

Dog owner's health. Participants were asked to indicate whether they had any health conditions that affected how long they could walk their dog (yes, no).

Open-ended questions about dog walking. Participants were asked four open-ended questions. First, in the online survey completed at the beginning of the study, participants were asked to describe their main reasons for getting a dog. This question was asked to determine whether participants acquired a dog for exercise. Second, in the online survey completed at the beginning of the study, participants were asked to describe why they walk their dog. The purpose of this question was to determine whether participants walked their dog for exercise. Third, on the Day 8 paper survey, participants were asked to describe what affects the length of time they spend dog walking. Fourth, on the Day 8 paper survey, participants were asked to describe how owning a dog affects the amount of exercise they obtain.

Physical activity dependent variable. The dependent variable *MVPAI (in bouts)* was created by summing participants' total number of minutes of moderate- to-

vigorous-intensity physical activity in 10-minute bouts on each dog walk over the course of the week. This variable is described in greater detail under the heading "Moderate- to vigorous-intensity physical activity (MVPA)" in the measures section of Part 1a. Given that the variables *MVPAI (no bouts)* and *MVPAI (in bouts)* correlated at .96 and the Canadian physical activity guidelines specify that physical activity should be engaged in for bouts lasting at least 10 minutes, only the variable *MVPAI (in bouts)* was included as a dependent variable when examining possible factors that may affect time spent dog walking.

Measures for Psychological Health Study (Part 1c)

Data for the psychological health measures were collected through the dog-walking log and Day 8 paper survey.

Psychological health independent variable. This independent variable, *time*, consisted of two periods: before the dog walk and after the dog walk.

Psychological health dependent variables. In the dog-walking log, participants were asked to complete seven visual analogue scales assessing their psychological health before and after each of their dog walks. They were instructed to place a vertical line on a 100-point continuum to indicate where they fell. The seven dependent variables that were assessed using visual analogue scales are presented below.

Energy. Participants were asked to indicate how energetic they felt at the moment on a scale that ranged from 0 (*not at all energetic*) to 100 (*very energetic*). This measure was adapted based on St-Onge et al.'s (2004) energy visual analogue scale.

Mood. Participants were asked to indicate their current mood on a scale that ranged from 0 (*worst possible mood*) to 100 (*best possible mood*). This mood measure

was adapted based on the visual analogue mood scale that was used by Black, O'Connor, and McCully (2005).

Self-esteem. Participants were asked to indicate their opinion of themselves at the moment on a scale that ranged from 0 (*low opinion*) to 100 (*high opinion*). This measure was based on the self-esteem visual analogue scale that was used by Lamb (1991).

Depression. Participants were asked to indicate how depressed they felt at the moment on a scale that ranged from 0 (*not at all depressed*) to 100 (*very depressed*). This depression measure was adapted based on the visual analogue depression scale that was used by Durkin and Paxton (2002).

Satisfaction with social life. Participants were asked to indicate how satisfied they were with their social life at the moment on a scale that ranged from 0 (*not at all satisfied*) to 100 (*very satisfied*). This measure was adapted based on the visual analogue scale that Hedborg, Anderberg, and Muhr (2011) used to assess social life satisfaction.

Life satisfaction. Participants were asked to indicate how satisfied they were with their life at the moment on a scale that ranged from 0 (*not at all satisfied*) to 100 (*very satisfied*). This item was adapted based on the life satisfaction measure from Statistics Canada's CCHS (Lu, Schellenberg, Hou, & Helliwell, 2015).

Stress. Participants were asked to indicate their current stress level on a scale that ranged from 0 (*not at all stressed*) to 100 (*very stressed*). This measure was adapted based on the visual analogue scale that Hedborg et al. (2011) used to assess stress.

After each dog walk, participants were asked to indicate whether they had experienced any stressful situations on their dog walk and, if so, to describe the stressful

situations. When comparing participants' stress level before and after they walked their dog, analyses were run both with and without the walks on which participants experienced a stressful event.

Open-ended question about benefits of dog walking. In the Day 8 paper survey, participants were asked to describe the benefits, if any, that they receive from walking their dog. This information was used to determine whether participants perceived that they received psychological health benefits from walking their dog.

Results for Time Spent Dog Walking (Part 1a) and Factors Affecting Time Spent Dog Walking (Part 1b)

Preliminary Analyses

Checking assumptions. While Part 1a consisted solely of descriptive statistics, three types of analyses were conducted in Part 1b: correlations, independent samples *t*-tests and one-way between-groups analyses of variance (ANOVAs). Before conducting the Pearson-product moment correlations, the following assumptions were tested: normality, independence of observations, linearity, homoscedasticity and outliers. Prior to conducting the independent samples *t*-tests and one-way between-groups ANOVAs, the following assumptions were examined: normality, independence of observations, homogeneity of variance and outliers.

In order to identify the presence of statistical outliers, standardized *z* scores were calculated with scores in excess of ± 3.29 considered to be outliers (Tabachnik & Fidell, 2013). Whenever an outlier was identified, analyses were conducted both with and without the outlier included and the outcomes subsequently compared in order to assess the impact that the case exerted. If the results did not differ, results are reported with the

outlier included. Information is provided below for the one instance where the results differed once an outlier was deleted.

One participant (case 10) was identified as an outlier with respect to weekly time spent dog walking without and with bouts. This individual walked her dog at a *MVPAI level (no bouts)* for 703 minutes weekly and at a *MVPAI level (in bouts)* for 620 minutes weekly. This physical activity was obtained through one dog walk in the early morning and one in the evening every day of the week. On average, each dog walk consisted of 44 minutes of *MVPAI (in bouts)* and 50 minutes of *MVPAI (no bouts)*. When the dog walking data from case 10 were further examined, in total (i.e., time spent at all intensity levels) each dog walk lasted on average for 61 minutes.

In a recent UK study, when Westgarth et al. (2015) examined the frequency and length of dog walks, they found that dogs were most commonly walked twice a day and that the average length of dog walks were as follows: 6.5% lasted ≤ 15 minutes, 40.6% lasted 16-30 minutes, 41.9% lasted 31-60 minutes and 11.1% lasted > 60 minutes. This suggests that case 10 falls into the small class of dog owners who walk their dog for more than 60 minutes and that this individual is in fact from the intended population. For the analyses conducted to explore possible factors affecting the amount of time spent dog walking, whenever the results differed when case 10 was deleted a footnote was included explaining how the results differed.

Missing data. Missing data were examined for both the data set comprised of 630 dog walks and the data set comprised of 61 participants. Missing data were first examined for the data set comprised of 630 dog walks, as the data from these dog walks were used to create variables for the 61 participants.

Dog walk level data (N = 630). SPSS missing value analyses were conducted using the data set that was comprised of 630 dog walks. The data set included the following physical activity variables for each dog walk: time spent at each intensity level, total duration, *MVPAI* without and with bouts and step counts. On 4.76% of the dog walks ($n = 30$ walks) participants did not wear the accelerometer. For these 30 walks, although participants provided the start and end time of the walks in the dog-walking log, as the accelerometer was not worn, there was no information about the intensity level and number of steps taken on these dog walks. The data set also included the following dog-walking log questions that were completed after each dog walk: perceived weather, whether went to a greenspace, whether went to a dog park, whether encountered anyone on walk and whether accompanied by a household member. Only 1.27% of the data were missing for any of these variables.

Dealing with missing data for dog walks. The data from the 630 dog walks were used to create the following physical activity variables for each of the 61 participants: weekly time spent dog walking at each intensity level, total weekly time spent dog walking, weekly *MVPAI* without and with bouts and average daily step count. Although participants did not wear the accelerometer on 30 dog walks (which resulted in 21 participants having missing data for at least one dog walk), it was possible to estimate the intensity level without bouts for each of these walks, as participants provided the length for all of their dog walks. To do this, first, I calculated the total number of minutes the participant spent dog walking over the course of the week excluding the walk with missing data. Second, I calculated the percentage of time spent dog walking weekly at each intensity level. Third, using the percentages from step two, I calculated the number

of minutes spent at each intensity level on the missing dog walk.

For the 30 dog walks with missing data, it was not possible to estimate the intensity level of the physical activity in 10-minute bouts. In order to calculate time spent dog walking in bouts at a *MVPAI* level, it was necessary to know the intensity level of the physical activity for each minute in order to determine whether the participant walked at a *MVPAI* level for 8 out of 10 minutes. Given that time spent dog walking in bouts could not be calculated for the 30 missing dog walks, the variable weekly time spent dog walking at a *MVPAI* level (*in bouts*) was calculated for the 40 participants who were not missing any data for their individual dog walks and compared to the whole sample ($N = 61$) on their *MVPAI* (*in bouts*). As may be seen from Table 7, there was virtually no difference in weekly time spent dog walking in bouts at a *MVPAI* level between the two groups. Therefore, descriptive statistics and analyses are presented only for the 61 participants.¹²

Table 7

Descriptive Statistics for Weekly Time Spent Dog Walking and Missing Data

Intensity level	<i>N</i>	Weekly time spent dog walking			
		<i>M</i>	<i>SD</i>	Min	Max
<i>MVPAI</i> (<i>in bouts</i>), missing data ^a	61	146.07	123.10	0.00	620.00
<i>MVPAI</i> (<i>in bouts</i>), no missing data	40	149.00	136.34	0.00	620.00

^aIncludes 21 participants who had missing data for one or more dog walks.

¹²The percentage who achieved the 150 and 300 minute weekly guideline of *MVPAI* (*in bouts*) was virtually identical for the 61 participants and 40 participants who had no missing data.

To determine the average number of steps taken daily over the course of the week, it was necessary to deal with the missing step count data for the 30 dog walks. First, in order to calculate the number of steps taken per minute, each participant's total number of steps taken dog walking weekly was divided by the participant's total number of minutes spent dog walking weekly excluding the walk with missing data. Second, the number of steps taken per minute dog walking by each participant was multiplied by the number of minutes the missing walk lasted in order to obtain the number of steps taken per minute on the missing dog walk.

The questions in the dog-walking log that were asked after each of the 630 dog walks were used to create five independent variables for the 61 participants. This was achieved by calculating weekly percentages for each participant for the following independent variables: walks that were rated as gorgeous, walks on which the participant went to a greenspace, walks on which the participant went to a dog park, walks on which the participant encountered someone and walks on which the participant was accompanied by a household member. Finally, a sixth independent variable, temperature, was calculated using Environment Canada's weather data to calculate the average weekly temperature on each participant's dog walks (Environment Canada, 2015).

Participant level data (N = 61). SPSS missing value analyses were conducted for the 26 independent variables that were completed at the participant level ($n = 61$ participants) rather than at the dog walk level ($n = 630$ walks). The 26 independent variables included: the 10 personal characteristics of the dog walker, the four characteristics of the dog, one weather variable (the season the device was worn), two of the dog walkers' social interactions variables (whether the dog walker typically walks

with other dog owners on some of their walks and which statement best describes their typical social interactions with the people they encounter on their dog walks), the five variables assessing personality (the TIPI) and the four variables that may have affected time spent dog walking the week the device was worn (whether week wore device was typical, employment status week wore device, whether someone else typically walks the dog and the dog owner's health).¹³

On all but one of the above 26 independent variables less than 5% of the data were missing. The exception was the variable age, for which 8.20% of the data were missing. Although age was a demographic variable, rather than being placed in the section of the online survey containing demographic variables, it was included as an indented sub-question on the page containing screening questions. Specifically, it was placed after a question inquiring whether participants were under 18 years of age or 18 years or older. The fact that five participants did not provide their age indicates that it may not have been clear to participants that they needed to complete this sub-question.

Dealing with the missing data. The minimal missing data on the 26 independent variables that were asked at the participant level ($n = 61$) were dealt with using pairwise deletion. Participants were only excluded from an analysis if they were missing data on the independent variable being examined. The rationale for using pairwise deletion was that the analyses for this exploratory study consisted of a number of individual tests that were conducted in order to identify possible variables affecting the length of time spent dog walking. By using pairwise deletion, it was not necessary to eliminate participants if

¹³Prior to conducting the missing value analyses, missing data were dealt with at the item level on the TIPI (the only scale that participants completed for the study of factors affecting time spent dog walking) by calculating average scale scores. One participant did not respond to a single item in the 10-item TIPI scale.

they did not respond to one of the numerous independent variables.

Demographic characteristics. The sample was comprised of 61 regular dog walkers who had a mean age of 41.71 years ($SD = 12.65$), with a range of 23 to 75 years. As may be seen from Table 8, the sample was comprised primarily of participants who were female, were married, cohabitating or living common-law, had at least one university degree, had a household income before tax of at least \$80,000, did not live alone and did not have any children under 18 years living at home.

Table 8

Descriptive Statistics for Participants' Personal Characteristics

Personal characteristic	<i>n</i>	%
Sex		
Male	14	22.95
Female	47	77.05
Marital status		
Single/separated/divorced/widowed	17	27.87
Married/cohabitating/common-law	44	72.13
At least one university degree		
Yes	43	70.49
No	18	29.51
Household income ^a		
< \$80,000	18	30.51
≥ 80,000	41	69.49
Living alone ^a		
Yes	12	20.34
No	47	79.66
Children under 18 living at home		
Yes	12	19.67
No	49	80.33

^aTwo participants did not respond to this question.

Examination of the Time Spent Dog Walking (Part 1a)

Dog walking physical activity by intensity level. On average, participants went on 1.57 dog walks daily ($SD = 0.48$), with the average number of daily dog walks ranging from 1.00 to 3.14. The majority of participants walked their dog either once (47.69%) or twice (43.33%) a day. The remaining participants walked their dog either three (8.72%) or four times a day (0.26%). Table 9 provides information about the amount of time spent at each intensity level and at a *MVPAI* level without and with bouts on individual dog walks. It is apparent from this table that some participants did not walk at a moderate- or vigorous-intensity level on any of their dog walks.

Table 9

Information about Time Spent on Each Dog Walk by Intensity Level

	<i>N</i>	Time spent on each dog walk			
		<i>M</i>	<i>SD</i>	Min	Max
Sedentary	630	5.66	14.65	0.00	164.00
Light	630	13.36	11.84	1.00	104.00
Moderate	630	18.10	13.60	0.00	100.00
Vigorous	630	2.19	5.79	0.00	41.00
Total ^a	630	39.32	25.64	8.00	211.00
<i>MVPAI (no bouts)</i>	630	20.29	14.76	0.00	100.00
<i>MVPAI (in bouts)</i>	600	14.85	15.12	0.00	100.00

^aTime spent dog walking at all intensity levels.

The weekly amount of time spent dog walking at each intensity level is presented in Table 10 and Figure 1. Participants most frequently walked their dog at a moderate-

intensity level (187 minutes on average weekly or 46% of the time spent dog walking weekly). The next most common intensity level was light, with participants engaging in 138 minutes on average weekly (34% of the time spent dog walking weekly). On average, participants spent approximately 1 hour sedentary weekly on their dog walks (14% of the time spent dog walking weekly). Finally, on average participants only engaged in 23 minutes of vigorous-intensity physical activity over the course of the week (6% of the time spent dog walking weekly).

Table 10

Descriptive Statistics for Time Spent Dog Walking Weekly by Intensity Level (No Bouts)

Intensity level	N	Weekly time spent dog walking			
		M	SD	Min	Max
Sedentary	61	58.49	123.92	2.00	866.00
Light	61	137.98	99.03	14.00	503.00
Moderate	61	186.95	117.89	14.00	649.00
Vigorous	61	22.62	44.07	0.00	232.00
Total ^a	61	406.05	257.19	70.00	1,442.00

^aTime spent dog walking at all intensity levels.

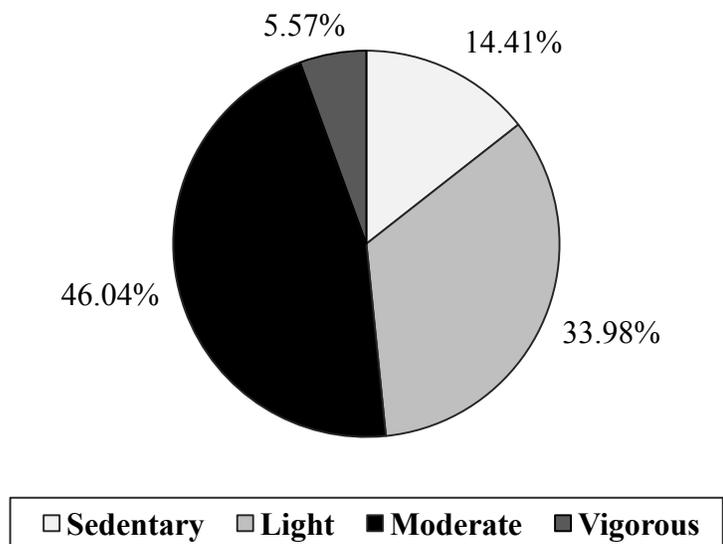


Figure 1. Percentage of time spent dog walking weekly at each intensity level (no bouts).

In Table 11, the percentage of time spent dog walking weekly at a *MVPAI* level is presented without and with bouts. The figures in this table highlight the fact that there was a notable difference in weekly time spent dog walking at a *MVPAI level (no bouts)* and *MVPAI level (in bouts)*.

Table 11

Descriptive Statistics for Weekly Time Spent Dog Walking at a MVPAI Level

Intensity level	N	Weekly time spent dog walking			
		M	SD	Min	Max
<i>MVPAI (no bouts)</i>	61	209.57	139.01	14.00	703.00
<i>MVPAI (in bouts)</i>	61	146.07	123.10	0.00	620.00

Physical activity guidelines. As may be seen from Table 12, there was a considerable difference in the percentage of participants who achieved the 150-minute guideline without and with bouts through dog walking and a somewhat smaller difference in the percentage who achieved the 300-minute guideline without and with bouts.

Table 12

Percentage of Participants Attaining Weekly Physical Activity Criteria Through Dog Walking

	<i>N</i>	% meeting guideline
≥ 150 minutes of <i>MVPAI</i> (no bouts)	61	59.02
≥ 150 minutes of <i>MVPAI</i> (in bouts)	61	37.70
≥ 300 minutes of <i>MVPAI</i> (no bouts)	61	22.95
≥ 300 minutes of <i>MVPAI</i> (in bouts)	61	11.48

In Table 13, the percentage of participants who attained at least 30 minutes of *MVPAI* through dog walking on 5 or more days of the week is presented. From these figures, it is apparent that approximately 1 in 4 participants achieved at least 30 minutes of *MVPAI* on 5 days of the week through dog walking both without and with bouts.

Table 13

Percentage of Participants Attaining 30 Minutes of MVPAI on 5 Days of the Week Through Dog Walking

	<i>N</i>	%
At least 30 minutes of <i>MVPAI</i> on 5 or more days (no bouts)	61	27.87
At least 30 minutes of <i>MVPAI</i> on 5 or more days (in bouts)	61	27.87

In order to further understand the physical activity that was accumulated daily through dog walking at a *MVPAI* level, Table 14 presents the number of days on which participants achieved at least 30 minutes of *MVPAI*. It is noteworthy that approximately 30% of the participants did not achieve 30 or more minutes of *MVPAI* on any days

through dog walking.

Table 14

Number of Days Participants Achieved 30 Minutes of MVPAI Through Dog Walking

Number days	30 minutes of MVPAI (no bouts)		30 minutes of MVPAI (in bouts)	
	<i>n</i>	%	<i>n</i>	%
0 days	18	29.51	20	32.79
1 day	6	9.84	8	13.11
2 days	6	9.84	7	11.48
3 days	7	11.48	5	8.19
4 days	7	11.48	4	6.56
5 days	4	6.56	8	13.11
6 days	7	11.48	5	8.19
7 days	6	9.84	4	6.56

Step Counts. The pedometer function of the accelerometer was used to assess participants' steps. On average, participants achieved 4,470.21 steps daily ($SD = 2403.48$) through dog walking, with the number of steps taken daily ranging from 1,348.00 to 13,159.29. Table 15 displays the percentage of participants who achieved the guideline of at least 10,000 steps each day through dog walking. The overwhelming majority of the participants did not achieve at least 10,000 steps on a single day through dog walking and only two participants achieved 10,000 steps on at least 5 days. The two participants who achieved an average of at least 10,000 steps on at least 5 days also achieved 150 minutes of MVPAI both without and with bouts.

Table 15

Percentage Attaining 10,000 Steps by Day Through Dog Walking

	<i>n</i>	%
Number days achieved \geq 10, 000 steps		
0 days	52	85.25
1 day	4	6.56
2 days	3	4.92
3 days	0	0.00
4 days	0	0.00
5 days	1	1.64
6 days	1	1.64
7 days	0	0.00

Descriptive Statistics for Factors Affecting Time Spent Dog Walking (Part 1b)

Personal characteristics of the dog walkers. In addition to the demographic variables presented in Table 8 under the heading "Demographic characteristics," participants were asked about the following personal characteristics: their BMI, whether their dwelling has a fenced backyard and whether they acquired a dog to obtain more exercise. For descriptive purposes, participants' BMIs are presented according to whether the participant was underweight, normal weight, overweight or obese, however BMI was left as a continuous variable for the analyses. It should be noted that the one participant who was pregnant was excluded from the BMI descriptive statistics and analyses. As may be seen from Table 16, slightly more than half of the participants were overweight or obese, nearly three-quarters had a fenced backyard and approximately 40% acquired a dog to obtain more exercise.

Table 16

Descriptive Statistics for Participants' Personal Characteristics

Personal characteristic	<i>n</i>	%
BMI (corrected)		
Underweight (BMI < 18.5)	0	0.00
Normal weight (BMIs 18.5 - 24.9)	29	48.33
Overweight (BMIs 25.0 to 29.9)	11	18.33
Obese (BMI \geq 30.0) ^a	20	33.33
Dwelling has fenced backyard		
Yes	44	72.13
No	17	27.87
Acquired dog to obtain more exercise ^b		
Yes	23	38.98
No	36	61.02

^aObese individuals can be further divided into three classes: Class 1 (30.0 to 34.9 = high risk of developing health problems), Class 2 (35.0 to 39.9 = very high risk of developing health problems) or Class 3 (\geq 40.0 = extremely high risk of developing health problems; Health Canada, 2003). The 20 obese participants in this study fell into the following categories: 23.33% ($n = 14$) Class 1, 8.33%, ($n = 5$) Class 2 and 1.67%, ($n = 1$) Class 3.

^bTwo participants did not respond to this question.

Characteristics of the dog. Table 17 presents descriptive statistics for the four dog-related variables: size of dog, age of dog, breed exercise requirement and dog's health. Participants most commonly owned a large dog, a dog that was 4 to 5 years of age, a dog from a breed that required a high level of exercise and a dog that did not have any health conditions that affected how long it could be walked. Given that only four participants had a dog from a breed that required a low level of exercise, this variable was excluded from the analyses examining factors affecting weekly time spent dog walking, as Degeling et al. (2012) found that the difference in physical activity was between

breeds that required a low versus high amount of exercise.¹⁴

Table 17

Descriptive Statistics for Dog-Related Variables

Characteristics of the dog	<i>n</i>	%
Size of dog		
Small	13	21.31
Medium	19	31.15
Large	29	47.54
Age of dog		
≤ 1 year	9	14.75
2 to 3 years	13	21.31
4 to 5 years	19	31.15
6 to 7 years	8	13.11
8 to 9 years	5	8.20
≥ 10 years	7	11.48
Breed exercise requirement ^a		
Low	4	7.14
Moderate	22	39.29
High	30	53.57
Dog health condition(s)		
Yes	8	13.11
No	53	86.89

^aFive participants who had a mixed breed dog that was from breeds that required different levels of exercise were excluded.

Weather.

Temperature. For each dog walk, the hourly temperature was determined. This information was used to calculate the average weekly temperature for each participant's dog walks. On average, the temperature was 20.08 degrees Celsius ($SD = 5.66$) on

¹⁴For information purposes, it is apparent that the four participants who had a dog from a breed that required a low level of exercise spent less time weekly walking their dog at a *MVPAI* in 10-minute bouts ($M = 60.00$, $SD = 28.28$) compared to the 22 participants who had a dog from a breed that required either a moderate level of exercise ($M = 132.73$, $SD = 105.75$) or a high level of exercise ($M = 175.67$, $SD = 141.51$).

participants' dog walks over the course of the week, with a range of 6.71 to 29.02 degrees Celsius.

Perceived weather. On each dog walk, participants were asked to indicate whether the weather was miserable, fair, good or gorgeous in order to determine the percentage of each participant's dog walks that were rated as gorgeous versus miserable, fair or good.¹⁵ On average, participants rated 50.77% ($SD = 28.93$) of their dog walks over the course of the week as gorgeous, with a range of 0% to 100% of dog walks being rated as gorgeous.

Season. Participants were divided according to the season during which they wore the accelerometer. Among the 61 participants, 13.11% ($n = 8$) wore the device in the fall, 6.56% ($n = 4$) in the spring and 80.33% ($n = 49$) in the summer. Given that no participants wore the device in the winter and 80% wore it in the summer, when analyses were conducted this variable was recoded as fall/spring (19.67%, $n = 12$) versus summer (80.33%, $n = 49$).

Environment in which the dog is walked dog.

Greenspace. For each dog walk, participants were asked to indicate where they walked their dog in order to determine the percentage of dog walks on which the participant walked/jogged or drove to a greenspace. On average, participants went to a

¹⁵The weather on the 623 dog walks for which participants provided information was divided as follows: miserable 6.74% ($n = 42$), fair 12.68% ($n = 79$), good 30.02% ($n = 187$) and gorgeous 50.56% ($n = 315$). The fact that 81% of the dog walks were rated as either good or gorgeous reflects the fact that the summer the data were collected was exceptionally warm and dry. Given that less than 7% of the dog walks occurred in weather that was rated as miserable, the decision was made to examine the relationship between weekly time spent dog walking and the percentage of each participant's dog walks that were rated as very favourable (i.e., gorgeous) versus other weather conditions instead of examining the percentage of each participant's dog walks that were rated as miserable versus more favourable conditions.

greenspace on 49.98% ($SD = 35.91$) of their weekly dog walks, with a range of 0% to 100% of walks.

Dog park. For each dog walk, participants were asked whether they went to a dog park in order to determine the percentage of dog walks on which the participant went to a dog park. On average, participants went to a dog park on 41.60% ($SD = 32.61$) of their weekly dog walks, with a range of 0% to 100% of walks.

Dog walkers' social interactions.

Encountered anyone on walk. The percentage of dog walks on which participants encountered someone was examined. On average, participants encountered someone on 67.48% ($SD = 27.46$) of their weekly dog walks, with a range of 0% to 100% of walks. For descriptive purposes, those participants who indicated that they encountered someone on their dog walk were asked to indicate how many of these people they talked to, if any. On average, participants talked to 3.37 people ($SD = 3.39$), with a range of 0 to 26 people.

Household companion on walk. The percentage of dog walks on which participants were accompanied by a household member was examined. On average, participants walked their dog with someone from their household on 23.60% ($SD = 26.59$) of their weekly dog walks, with a range of 0% to 100% of walks.

Walked with other dog owners. As may be seen from Table 18, approximately half (50.82%, $n = 31$) of the participants typically walked with other dog owners on some of their dog walks. These 31 participants were asked a follow-up descriptive question inquiring whether they always, often, occasionally or rarely walked with other dog owners. Their responses were broken down as follows: always 0%, often 32.26% ($n =$

10), occasionally 48.39% ($n = 15$) and rarely 19.35% ($n = 6$).

Social interactions on dog walks. From Table 18, it is apparent that the overwhelming majority of participants typically conversed with the people they encountered on their dog walks. Given that only one participant did not interact with the people she encountered on her dog walks, when analyses were conducted this variable was recoded into two categories: did not interact/only exchanged brief greetings (36.07%, $n = 22$) versus conversed with people encountered on dog walks (63.93%, $n = 39$).

Table 18

Descriptive Statistics for Social Interaction Variables

Social interaction variables	<i>n</i>	%
Typically walked with other dog owners		
Yes	31	50.82
No	30	49.18
Typical social interactions on dog walks		
Did not interact	1	1.64
Exchanged brief greetings	21	34.43
Conversed	39	63.93

Personality. In Table 19, descriptive statistics are provided for the Big-Five personality dimensions. The sample as a whole had moderate levels for extraversion, high levels for conscientiousness and somewhat high levels for agreeableness, emotional stability and openness to experience.

Table 19

Descriptive Statistics for TIPI Scales

TIPI scale	N	Descriptive statistics			
		M	SD	Min	Max
Extraversion	61	4.58	1.56	1.00	7.00
Agreeableness	61	5.69	1.08	1.50	7.00
Conscientiousness	61	6.07	1.12	3.00	7.00
Emotional Stability	60	5.48	1.40	2.00	7.00
Openness to Experience	61	5.34	1.15	2.50	7.00

Questions relating to the week the device was worn.

Week wore device typical. Slightly more than half of the participants (53.45%, $n = 31$) indicated that the week they wore the device was not typical in terms of the amount of time they spent dog walking (Table 20). For descriptive purposes, these 31 participants were asked two follow-up questions to understand why this was the case. First, when they were asked whether they spent more or less time than usual dog walking, the overwhelming majority indicated that they walked their dog for less time during the week they wore the device (93.55%, $n = 29$),¹⁶ while only 6.45% ($n = 2$) indicated that they spent more time dog walking. Second, when the 29 participants were asked to explain why they spent less time dog walking they provided the following reasons: the weather 37.93% ($n = 11$), illness 20.69% ($n = 6$), other commitments 17.24% ($n = 5$), job demands 17.24% ($n = 5$) and vacation 6.90% ($n = 2$).

¹⁶It is possible that this high percentage reflects a social desirability response bias, as participants may have indicated that they walked their dog for less time if they perceived that they should have spent more time walking their dog. However, given that the 29 participants all provided specific reasons as to why they walked their dog for less time the week they wore device, this appears unlikely.

Employment status week wore device. The majority (65.52%, $n = 38$) of the participants worked full time during the week they wore the device (Table 20). Given that only seven participants worked part time during the week they wore the device, when analyses were conducted this variable was collapsed into the following two categories: full time (65.52%, $n = 38$) versus part time/not at all (34.48%, $n = 20$).

Someone else walks the dog. As may be seen from Table 20, more than half of the participants (60.66%, $n = 37$) indicated that someone else typically walks their dog without them some of the time. The 37 participants who indicated that this was the case were asked two follow-up descriptive questions. First, participants were asked who walks their dog without them. Among the 36 participants who responded to this question, the most common response was that their spouse walks the dog (75.00%, $n = 27$). Other responses included a friend (11.11%, $n = 4$), a child (5.56%, $n = 2$), a dog walker (2.78%, $n = 1$) a co-worker (2.78%, $n = 1$) and sister (2.78%, $n = 1$). Second, the 37 participants were asked how many days a week someone else typically walks their dog without them. On average, someone other than the participant walks the dog on 3.03 days ($SD = 2.05$), with a range of 1 day to 7 days.

Dog owner's health. As shown in Table 20, given that only four participants (6.56%) had a health condition that affected how long they could walk their dog, this variable was excluded from the analyses of factors affecting weekly time spent dog walking.¹⁷

¹⁷For information purposes, it is apparent that the four participants who had a health condition that affected how long they could walk their dog spent less time weekly walking their dog at a *MVPAI* level in 10-minute bouts ($M = 117.50$, $SD = 65.00$) compared to the 57 participants who did not have such a health condition ($M = 148.07$, $SD = 126.29$).

Table 20

*Descriptive Statistics for Other Possible Factors Affecting Time Spent Dog Walking**Week Wore Device*

Variable	<i>n</i>	%
Typical dog walking week ^a		
Yes	27	46.55
No	31	53.45
Employment status week wore device ^a		
Full time	38	65.52
Part time	7	12.07
Not at all	13	22.41
Someone else walks the dog		
Yes	37	60.66
No	24	39.34
Participant health condition(s)		
Yes	4	6.56
No	57	93.44

^aThree participants did not respond to this question.

Main Analyses of Factors Affecting Time Spent Dog Walking (Part 1b)

Analyses (correlations, independent samples *t*-tests and one-way between-groups ANOVAs) were conducted in order to determine which factors affected the length of time spent dog walking weekly at a *MVPA1 level (in bouts)*. It should be noted that effect sizes were primarily relied upon to interpret the results, rather than significance levels (i.e., *p*-level), given the increased familywise error rate when multiple tests are conducted (30 tests in this case). The familywise error rate refers to the probability of making at least one Type 1 error (falsely rejecting the null hypothesis) across a family of tests (Field, 2009). Cohen's (1988) conventions were followed in order to interpret the magnitude of the effect sizes for the following statistical tests: correlations (small: $r =$

.10, medium: $r = .30$, large: $r = .50$), t -tests (small: $d = .20$, medium: $d = .50$, large: $d = .80$) and ANOVAs (small: $\eta^2 = .01$, medium: $\eta^2 = .06$, large: $\eta^2 = .14$).

Personal characteristics of the dog walkers. Correlations and independent samples t -tests were conducted in order to ascertain whether participants' time spent dog walking at a *MVPAI level (in bouts)* differed according to their personal characteristics. There was a positive correlation between age and weekly time spent dog walking at a *MVPAI level (in bouts)*, $r(54) = .32, p = .016$; older participants spent more time weekly walking their dog. When the relationship between BMI and weekly time spent dog walking at a *MVPAI level (in bouts)* was examined, the two variables were not associated, $r(58) = .10, p = .462$.

When independent samples t -tests were conducted (Table 21), results revealed that participants who were married, cohabitating or living common-law spent more time weekly dog walking at a *MVPAI level (in bouts)* than those who were single, separated, divorced or widowed. Although the finding that participants who lived with other people spent more time weekly dog walking at a *MVPAI level (in bouts)* than those who lived alone was only marginally significant ($p = .050$), it is noteworthy that this result had a moderate effect size (Cohen, 1988). Finally, results revealed that weekly time spent dog walking at a *MVPAI level (in bouts)* did not differ according to participants' sex, level of education, household income, whether there were children under 18 years living at home, whether they had a fenced backyard¹⁸ or whether they acquired their dog to obtain more exercise.

¹⁸After deleting the outlier (case 10) on the variable weekly time spent dog walking in bouts, participants with a fenced backyard ($M = 156.82, SD = 114.22$) spent more time dog walking weekly at a *MVPAI level (in bouts)* than those without a fenced backyard ($M = 86.88, SD = 64.57$), $t(58) = 2.31, p = .024, d = 0.69$.

Table 21

Analyses of Relationship Between Personal Characteristics and Weekly Time Spent Dog Walking

Personal characteristic	<i>M</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>	<i>d</i>
Sex						
Male	140.71	82.69	59	-0.18	.855	0.06
Female	147.66	133.50				
Marital status						
Single/separated/divorced/widowed	83.53	61.54	59	-2.58	.012	0.75
Married/cohabitating/common-law	170.23	132.64				
At least one university degree						
Yes	131.40	100.16	59	-1.45	.152	0.41
No	181.11	163.88				
Household income						
< \$80,000	137.78	149.85	57	-0.28	.777	0.08
≥ 80,000	147.80	112.37				
Living alone						
Yes	86.67	76.91	57	-2.00	.050	0.66
No	164.89	129.34				
Children under 18 living at home						
Yes	143.33	99.03	59	-0.09	.932	0.03
No	146.73	129.20				
Dwelling has fenced backyard						
Yes	156.82	114.22	59	1.10	.276	0.33
No	118.24	143.62				
Acquired dog to obtain more exercise						
Yes	155.22	107.70	57	0.91	.366	0.32
No	128.89	108.57				

Characteristics of the dog. When the relationship between the age of the dog and weekly time spent dog walking at a *MVPAI level (in bouts)* was examined, the two variables were not correlated, $r(59) = -.16, p = .208$. Next, a one-way ANOVA revealed

that time spent dog walking weekly at a *MVPAI level (in bouts)* varied according to the size of the dog, $F(2, 58) = 3.63, p = .033, \eta^2 = .111$ (small: $M = 79.23, SD = 61.03$; medium: $M = 193.68, SD = 155.32$; large: $M = 144.83, SD = 103.42$). Given that the assumption of homogeneity of variance was violated, the Games-Howell post hoc test was selected, as it does not assume that variances are equal across groups (Field, 2009). The post hoc tests revealed that small dogs were walked for significantly less time weekly at a *MVPAI level (in bouts)* than medium ($p = .020, d = 0.94$) and large dogs ($p = .044, d = 0.70$). Finally, an independent samples *t*-test revealed that time spent dog walking weekly varied according to whether the dog had a health condition; participants spent less time dog walking weekly at a *MVPAI level (in bouts)* if the dog had a health condition ($M = 45.00, SD = 39.64$) compared to if the dog did not have a health condition ($M = 161.32, SD = 124.36$), $t(59) = -2.61, p = .011, d = 1.01$.

Weather. When the relationship between the average weekly temperature on participants' dog walks and weekly time spent dog walking at a *MVPAI level (in bouts)* was examined, the two variables were not associated, $r(59) = .02, p = .881$. As well, the percentage of dog walks that participants rated as gorgeous was not associated with weekly time spent dog walking at a *MVPAI level (in bouts)*, $r(59) = .20, p = .120$. An independent samples *t*-test was performed to determine whether time spent dog walking weekly varied according to the season that the dog was walked. Results revealed that weekly time spent dog walking at a *MVPAI level (in bouts)* did not differ according to whether the dog was walked in the fall/spring ($M = 160.83, SD = 126.38$) or summer ($M = 142.45, SD = 123.35$), $t(59) = 0.46, p = .647, d = 0.15$.

Environment in which the dog is walked. When the relationship between the percentage of walks on which participants went to a greenspace and weekly time spent dog walking at a *MVPAI level (in bouts)* was examined, the two variables were not associated, $r(59) = .05, p = .710$. Similarly, the percentage of walks on which participants went to a dog park and weekly time spent dog walking at a *MVPAI level (in bouts)* were not correlated, $r(59) = .15, p = .263$.

Dog walkers' social interactions. The correlation between the percentage of dog walks on which participants met someone and weekly time spent dog walking at a *MVPAI level (in bouts)* was not significant, $r(59) = .25, p = .052$.¹⁹ The percentage of dog walks on which participants were accompanied by a household member was not associated with weekly time spent dog walking at a *MVPAI level (in bouts)*, $r(59) = .10, p = .458$. Finally, results from independent samples *t*-tests revealed that participants' weekly time spent dog walking at a *MVPAI level (in bouts)* did not differ according to whether they typically walked with other dog owners or the type of social interactions they typically engaged in on their dog walks (see Table 22).

¹⁹After deleting the outlier (case 10) on the variable weekly time spent dog walking in bouts, a positive correlation emerged between the percentage of dog walks on which participants met someone and weekly time spent dog walking at a *MVPAI level (in bouts)*, $r(58) = .30, p = .021$; participants who encountered people on more of their dog walks spent more time dog walking over the course of the week.

Table 22

Analyses of Relationship Between Dog Walkers' Social Interactions and Weekly Time Spent Dog Walking

Social interaction variable	<i>M</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>	<i>d</i>
Typically walked with other dog owners						
Yes	149.68	109.13	59	0.23	.818	0.06
No	142.33	137.86				
Typical social interactions on dog walks						
Did not interact/exchanged brief greetings	121.82	107.33	59	-1.16	.251	0.31
Conversed	159.74	130.49				

Personality. Correlations were conducted to examine the relationship between each of the Big-Five personality dimensions and weekly time spent dog walking. As may be seen from Table 23, none of the TIPI scales correlated with weekly time spent dog walking at a *MVPAI level (in bouts)*.²⁰

Table 23

Correlations Between TIPI Scales and Weekly Time Spent Dog Walking

TIPI scale	<i>df</i>	<i>r</i>	<i>p</i>
Extraversion	59	-.11	.398
Agreeableness	59	-.01	.955
Conscientiousness	59	.12	.351
Emotional Stability	58	.15	.263
Openness to Experience	59	-.14	.277

²⁰After deleting the outlier (case 10) on weekly time spent dog walking in bouts, a positive correlation was detected between emotional stability and time spent dog walking weekly at a *MVPAI level (in bouts)*, $r(57) = .28$, $p = .030$; participants who spent more time walking their dog weekly had higher levels of emotional stability.

Questions relating to the week the device was worn. As may be seen from Table 24, independent samples *t*-tests revealed that weekly time spent dog walking at a *MVPA1 level (in bouts)* did not differ according to whether the week participants wore the device was a typical dog walking week. As well, weekly time spent dog walking did not vary depending on participants' employment status the week they wore the device or whether someone other than the participant typically walks the dog some of the time.

Table 24

Analyses of Relationship Between Other Possible Factors and Weekly Time Spent Dog Walking

Variable	<i>M</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>	<i>d</i>
Typical dog walking week						
Yes	152.59	124.33	56	0.81	.422	0.22
No	129.35	93.84				
Employment status week wore device						
Full time	134.47	113.58	56	-0.63	.529	0.18
Part time/Not at all	153.50	98.21				
Someone else walks the dog						
Yes	144.59	113.54	59	-0.12	.909	0.03
No	148.33	139.09				

Open-ended questions. As part of the online and Day 8 paper surveys, participants were asked to complete four open-ended questions related to dog walking. It should be noted that most participants provided more than one reason when responding to these questions.

Reason acquired a dog. All participants responded when asked to describe their main reasons for acquiring a dog. The four most frequently cited reasons were companionship 55.74% ($n = 34$), previous dog ownership 36.07% ($n = 22$), exercise

32.79% ($n = 20$) and a love of dogs 29.51% ($n = 18$).

Why dog is walked. All of the participants indicated that they walked their dog for its well-being. Examples of the comments provided by participants included:

I walk my dog because he NEEDS and DESERVES it.

My dog enjoys the walks and I like to see her happy and prancing about. Controls her behaviour (she gets bored at home and into trouble/mischief when we don't walk).

When she gets her exercise she's happy.

Twenty-one percent ($n = 13$) of the participants only talked about walking for the benefit of their dog. In addition to walking for their dog's benefit, the remaining 48 participants identified a number of other reasons why they walk their dog. The most frequently mentioned other reason was exercise for themselves (77.08%, $n = 37$ of 48).

What affects the amount of time spent dog walking. Fifty-nine of the 61 participants responded when asked to describe what affects the amount of time they spend dog walking. Two participants indicated that their dog walks are always the same length. The remaining 57 participants identified two major factors that reduce the amount of time they spend dog walking. The first was the weather, which was mentioned by 71.93% ($n = 41$ of 57). These participants noted that they walked for less time in the following conditions: too hot (56.10%, $n = 23$), too cold or snowing (31.71%, $n = 13$) and raining (29.27%, $n = 12$). The second most frequently mentioned reason for shorter dog walks was time constraints (68.42%, $n = 39$ of 57). This group identified three main types of time constraints that resulted in less time for dog walks: work demands (58.97%,

$n = 23$), social commitments (17.95%, $n = 7$) and family responsibilities (15.38%, $n = 6$).²¹

Effect of dog ownership on exercise. All but two of the participants responded when asked to describe how owning a dog affects the amount of exercise they obtain. The majority of the participants who responded to this question indicated that having a dog results in them obtaining regular exercise (69.49%, $n = 41$). On the other hand, 22.03% ($n = 13$) indicated that they obtain a lot of exercise other than dog walking. They described dog walking as either supplementing their other physical activities or having a limited impact on their total amount of physical activity. Finally, a small group of participants commented that dog walking has a negative impact on their physical activity, as it limits their time for other higher intensity activities (8.47%, $n = 5$). The 41 participants who indicated that owning a dog helps them to obtain regular exercise provided comments such as:

I exercise regularly (i.e., dog walking) instead of sporadically.

It (amount of exercise) has increased dramatically...I have to take her out for walks so there's no excuse.

I definitely would not get nearly the amount of exercise if I didn't have to walk my dog.

Summary for Part 1a and Part 1b

When the physical activity obtained dog walking was objectively assessed using accelerometers, the findings provided evidence that regular dog walking is a source of

²¹The three remaining participants identified other types of time constraints (e.g., volunteer activities).

considerable physical activity at the moderate- to vigorous-intensity level recommended for health benefits. Over the course of a week, participants walked their dog at the recommended intensity level on average for 146 minutes in bouts lasting at least 10 minutes and 210 minutes when not restricted to 10-minute bouts. Furthermore, when the percentage of time spent dog walking at each intensity level was examined, slightly more than half of the time was at a moderate- to vigorous-intensity level. Another key finding was that through dog walking alone, a sizeable percentage of the participants were able to attain the 150-minute guideline: 38% (in bouts) and 59% (no bouts). Finally, data from the pedometer function of the accelerometer revealed that on average participants achieved 4,470 steps daily through dog walking, which indicates that the physical activity obtained through dog walking makes a substantial contribution toward achieving the benchmark of at least 10,000 steps daily.

The results from the analyses of 30 possible factors affecting time spent dog walking at a moderate- to vigorous-intensity level in 10-minute bouts revealed that five factors merit attention based on their medium or large effect size. Three of the *personal characteristics of the participant variables* had medium effect sizes: age, marital status and living alone. Dog walkers who were older, married/cohabitating/in a common-law relationship or living with other people spent more time walking their dog weekly relative to those who were younger, single/separated/divorced/widowed or living alone. In addition, two of the *characteristics of the dog variables* had either medium or large effect sizes: dog size and dog health. First, small dogs were walked for less time weekly compared to both medium dogs (a large effect) and large dogs (a medium effect). Second, dogs who had a health condition that affected their ability to walk were walked

for less time weekly than those without such a health condition (a large effect). Finally, two findings from the open-ended questions about dog walking are of particular relevance. First, the majority (69%) of participants indicated that walking their dog provides a source of regular physical activity. Second, *all* of the participants stated that they walked their dog for its well-being.

Results for Psychological Health Study (Part 1c)

Preliminary Analyses

Checking assumptions. The main analyses for Part 1c consisted of one-way repeated measures ANOVAs. Prior to conducting these analyses, the following assumptions were tested: normality, independence of observations, homogeneity of variance and outliers. It should be noted that, when checking for statistical outliers, standardized z scores were calculated with scores in excess of ± 3.29 considered to be outliers (Tabachnik & Fidell, 2013). Whenever an outlier was identified, analyses were conducted both with and without the outlier included and the outcomes subsequently compared in order to assess the impact the case exerted. No additional information is provided in this section regarding outliers, as none of the results varied according to whether or not an outlier was included in the analysis.

Missing data ($N = 630$). SPSS missing value analyses were conducted for the psychological health dependent variables that participants completed before and after each of their dog walks. Among the 630 dog walks taken by participants over the course of the week, less than 1.2% of the data were missing on any of the pre- and post-dog walk psychological health dependent variables. For the question inquiring whether the participant experienced a stressful event, data were missing for 0.63% of the dog walks.

The psychological health data from the 630 dog walks were used to calculate average pre- and post-dog walk scores on each of the psychological health measures for each participant over the course of the week.

Missing data ($N = 61$). The open-ended question about the benefits of dog walking was completed as part of the Day 8 paper survey. Two participants (3.28%) did not respond to this question.

Descriptive statistics for psychological health dependent variables. As may be seen from Table 25, on average, before walking their dog, the 61 participants had moderately high scores on the visual analogue scales that assessed energy, mood, self-esteem, satisfaction with their social life and overall life satisfaction and moderately low scores on the depression and stress scales. On average, after walking their dog participants' energy, mood, self-esteem, satisfaction with their social life and overall life satisfaction scores improved (i.e., higher scores). In the case of depression and stress, after walking their dog participants reported lower levels of depression and stress (i.e., lower scores).

Table 25

Descriptive Statistics for Psychological Health Dependent Variables Before and After Dog Walk

	Descriptive Statistics			
	<i>M</i>	<i>SD</i>	Min	Max
Before dog walk				
Energy	61.86	13.08	32.00	85.45
Mood	69.43	11.13	40.67	91.15
Self-esteem	71.82	12.89	35.60	99.88
Depression	16.39	14.74	0.00	52.15
Social life satisfaction	72.00	13.56	40.00	99.79
Overall life satisfaction	73.41	11.44	46.25	99.83
Stress	25.54	15.87	0.00	55.93
After dog walk				
Energy	72.38	10.78	38.80	96.00
Mood	76.04	9.52	52.93	95.36
Self-esteem	76.56	11.48	47.54	100.00
Depression	14.44	14.70	0.00	52.06
Social life satisfaction	75.86	13.20	40.00	100.00
Overall life satisfaction	78.05	9.97	43.69	99.91
Stress	20.49	15.75	0.00	54.65

Associations between psychological health dependent variables. As may be seen from Table 26, all of the pre-dog walk psychological health dependent variables

were associated with the exception of the relation between energy and depression. All of the post-dog walk psychological health dependent variables were correlated.

Table 26

Correlations Between Psychological Health Dependent Variables Before and After Dog Walk

Before dog walk	1	2	3	4	5	6	7
1. Energy	-	.76**	.63**	-.21	.47**	.61**	-.31*
2. Mood		-	.81**	-.41**	.60**	.78**	-.46**
3. Self-esteem			-	-.51**	.73**	.72**	-.50**
4. Depression				-	-.44**	-.57**	.74**
5. Social life satisfaction					-	.75**	-.31*
6. Overall life satisfaction						-	-.38**
7. Stress							-
After dog walk	1	2	3	4	5	6	7
1. Energy	-	.77**	.62**	-.34**	.58**	.69**	-.40**
2. Mood		-	.84**	-.57**	.72**	.80**	-.59**
3. Self-esteem			-	-.55**	.75**	.80**	-.47**
4. Depression				-	-.47**	-.50**	.74**
5. Social life satisfaction					-	.80**	-.38**
6. Overall life satisfaction						-	-.43**
7. Stress							-

* $p < .05$. ** $p < .01$.

Stressful event on the dog walk. After each dog walk, participants were asked to indicate whether they had experienced a stressful event while walking their dog.

Participants indicated that they experienced a stressful event on 9.42% ($n = 59$) of their

626 dog walks (4 participants did not respond to this question).²² The 59 stressful events included: dog misbehaved (57.63%, $n = 34$), a dog or cat acted aggressively toward the participant's dog (15.25%, $n = 9$), stress from family member walked with (8.47%, $n = 5$), the weather (5.08%, $n = 3$), stressful actions by others, such as bike rider/skateboarder (5.08%, $n = 3$), illness of dog or participant (5.08%, $n = 3$) and other stressors, such as dogs no longer allowed off leash (3.39%, $n = 2$).

Main Analyses for Psychological Health Study (Part 1c)

One-way repeated measures ANOVAs were conducted to compare participants' psychological health immediately before and after their dog walks.²³ In order to control the Type 1 error rate across the eight tests, a Bonferroni corrected alpha of .006 was adopted ($\alpha/8$). As may be seen from Table 27, participants reported a significant increase in their energy, self-esteem, social life satisfaction and overall life satisfaction as well as a more positive mood. In addition, participants reported feeling significantly less stressed after walking their dog. Although participants were less depressed after ($M = 14.44$, $SD = 14.70$) compared to before ($M = 16.39$, $SD = 14.74$) they walked their dog, this difference was not significant, $F(1, 60) = 6.35$, $p = .014$, partial $\eta^2 = .096$.

²²Slightly more than half of the participants (52.46%, $n = 32$) indicated that they experienced a stressful event on at least one of their dog walks.

²³A one-way repeated measures multivariate analysis of variance (MANOVA) was not conducted to assess pre-post changes from dog walking on a combined psychological health measure, given the strong associations between a number of the dependent variables. According to Pallant (2005), when conducting multivariate analyses it is problematic to include variables that correlate at .80 or higher. In such cases, one of the highly correlated dependent variables should be eliminated or a single measure created. Given that the main purpose of these analyses was to determine whether there were improvements in psychological health after dog walking on *each* of the health dependent variables, separate one-way repeated measures ANOVAs were conducted for each of the dependent variables.

For the dependent variable stress, the analysis was also run with the 59 dog walks on which participants experienced a stressful event excluded when calculating average pre- and post-dog walk stress levels. From Table 27, it is apparent that participants experienced a slightly greater reduction in their level of stress when the 59 dog walks on which they experienced a stressful event were excluded.

Table 27

*ANOVA Results and Means and Standard Deviations for Psychological Health**Dependent Variables Before and After Dog Walk (Significant at $p < .006$)*

Dependent Variable	Before dog walk		After dog walk		$F(1, 60)$	Partial η^2
	M	SD	M	SD		
Energy	61.86	13.08	72.38	10.78	77.59	.564
Mood	69.43	11.13	76.04	9.52	42.19	.413
Self-esteem	71.82	12.89	76.56	11.48	28.34	.321
Social life satisfaction	72.00	13.56	75.86	13.20	17.83	.229
Overall life satisfaction	73.41	11.44	78.05	9.97	25.18	.296
Stress	25.54	15.87	20.49	15.75	46.25	.435
Stress (excluding 59 walks with stressful event)	25.30	15.54	19.25	15.81	51.88	.464

Open-ended question about benefits of dog walking. When participants were asked on the Day 8 paper survey to describe the benefits, if any, they receive from dog walking all but two participants responded. The overwhelming majority identified more than one benefit. More than half of the participants (55.93%, $n = 33$) cited exercise for themselves as a benefit of dog walking. The next most frequently cited benefit was the social interactions with the people accompanying them on the walk (e.g., family member, friend) and with other dog walkers (45.76%, $n = 27$). Other benefits of dog walking

identified by participants included: fresh air/being in nature (33.90%, $n = 20$), stress release/relaxation (30.51%, $n = 18$), interaction with neighbours/sense of community (25.42%, $n = 15$), feel better/improved mood (23.73%, $n = 14$) and time to reflect (10.17%, $n = 6$).

Summary

Taken together, the results from Study 1 provide evidence that dog walking is a form of physical activity that can be engaged in to obtain physical activity at the moderate- to vigorous-intensity level recommended for health benefits. The accelerometer data from 61 regular dog walkers revealed that 52% of the time spent dog walking was at a moderate- to vigorous-intensity level. Furthermore, through dog walking alone, close to 2 in 5 dog walkers achieved 150 minutes of moderate- to vigorous-intensity physical activity in 10-minute bouts and 3 out of 5 dog walkers did so when bouts were not taken into consideration. In addition, on average participants achieved nearly half of the recommended daily 10,000 steps through dog walking.

An examination of possible factors affecting time spent dog walking weekly at a moderate- to vigorous-intensity level in 10-minute bouts revealed that two types of factors warrant attention; namely, the *characteristics of the participant* and the *characteristics of the dog*. One of the dog-related variables, the size of the dog, is of particular importance, as it is something that can be taken into consideration before acquiring a dog. Another key result was the finding that *all* of the participants indicated that they walked their dog for its well-being, as this indicates that dog walking is a purposeful physical activity.

Finally, I also examined whether there were changes in dog owners' psychological

health after walking their dog. Participants experienced short-term psychological health benefits from dog walking, as evidenced by the fact that after dog walking they had ameliorated health on six out of the seven measures of psychological health. These findings suggest that, in addition to being a source of physical activity, spending time dog walking confers immediate psychological health benefits.

Study 2: Longitudinal Study

The second half of this dissertation was comprised of an 8-month longitudinal study that examined the effect of acquiring a dog on physical activity and health. A group of individuals who planned to acquire a dog were followed before and for 8 months after they acquired a dog. As well, a control group of non-dog owners were followed over an 8-month period. I conducted this study in order to ascertain whether individuals who acquire a dog and walk it become more physically active over time compared to a control group of non-dog owners. Specifically, I hypothesized that individuals who acquired a dog would increase their moderate- to vigorous-intensity physical activity over the course of the study, while individuals in the control group would not differ in their physical activity level over time.

If, on account of time spent dog walking, individuals in the acquired-dog group increase their moderate- to vigorous-intensity physical activity, they should also be more likely to meet the recommended physical activity guidelines of 150- and 300-minutes of moderate- to vigorous-intensity physical activity weekly. I hypothesized that, at baseline, individuals in the acquired-dog and control groups would not differ in their likelihood of achieving the 150- and 300-minute guidelines. On the other hand, at 8 months, I hypothesized that individuals in the acquired-dog group would be more likely to meet

both the 150- and 300-minute guidelines compared to those in the control group.

Given the link between physical activity and health (U.S. Department of Health and Human Services, 2008; Warburton et al., 2007), if individuals who acquire a dog increase their physical activity at a moderate- to vigorous-intensity level, this should be beneficial for their health. Therefore, I hypothesized that, as a result of the physical activity obtained through dog walking, individuals who acquired a dog would experience improvements in their physical and psychological health over the course of the 8-month study, while individuals in the control group would not experience changes in their health over time.

Method

Participants

A sample comprised of individuals who were planning to acquire a dog within 3 months and a control group of individuals who were not planning to acquire a dog were recruited to participate in an 8-month longitudinal study that was conducted from October 2012 to June 2014. Participants were only eligible to participate in the study if they satisfied the following criteria: lived in a city or town in Canada, were at least 18 years of age, did not currently own a dog and were not a professional dog walker. Participants who were planning to acquire a dog were recruited from across Canada through a variety of methods. First, ads for the study were placed in the pet-related sections of Kijiji and Craigslist, which are websites for classified ads. Second, participants were recruited through Find Participants (<https://www.findparticipants.com/>) and Research Now (<http://www.researchnow.com/en-CA.aspx>), companies with on-line panels. Third, a description of the study was made available to breeders.

Participants in the control group were recruited from across Canada through ads placed on Kijiji and Craigslist in the volunteer section. In addition, at the end of the online baseline survey, individuals who were seeking to acquire a dog were asked to provide contact information for non-dog owning friends and/or relatives whom they thought might be interested in participating in the study. Given that the non-dog owners who were contacted by e-mail were either not interested or did not respond, this approach was dropped.

At the start of the study, 98 individuals completed the online survey and wore the accelerometer. At 4 months, 71 individuals completed the online survey, while 27 dropped out.²⁴ At 8 months, 62 individuals completed the online survey and wore the accelerometer, while 9 dropped out. Therefore, the attrition rate over the course of the study was 36.73% (36 of 98). The 62 individuals who completed all components of the study consisted of 36 participants from the control group and 26 individuals from the acquired-dog group.

Procedure

Participants were invited to take part in a study that involved completing both an online survey on Survey Monkey (<https://www.surveymonkey.com/>) and wearing a physical activity monitoring device for 7 days at the beginning of the study and again at 8 months. In addition, participants were informed that they would be asked to complete a very brief online survey on Survey Monkey midway through the study.

²⁴Dropouts from the acquired-dog group included individuals who did not end up acquiring a dog or did not respond when they were contacted to take part in the later components of the study. There is no way to determine how many of these individuals did not respond because they did not acquire a dog versus deciding that they did not want to continue taking part in the study.

Baseline component (online survey and accelerometer). When interested participants contacted the researcher, they were e-mailed the link to the baseline online survey along with a unique code that they were required to enter to begin completing the survey. In the informed consent, participants were told that it would take them approximately 25 minutes to complete the baseline survey. In order to obtain the study materials for the physical activity component of the study, on the last page of the online survey, participants were instructed to e-mail the researcher their contact information (name, phone number,²⁵ mailing address) and unique code.

Participants were either mailed or hand delivered a package containing a physical activity monitoring device, waist band, booklet and a postage paid return envelope (when the package was mailed to participants). The booklet contained a cover letter, instructions for wearing the monitoring device and an accelerometer time log to be completed daily for 7 consecutive days. At the end of the booklet, participants were provided with a selection of stores from which they were able to select a \$10 gift card.

Verifying whether a dog was acquired. Participants who indicated in the baseline online survey that they were planning to acquire a dog within 1, 2 or 3 months were contacted after the selected time period to ensure that they had acquired a dog and asked to provide the date that they brought the dog home.

4-month component (brief online survey). Participants were contacted by e-mail at 4 months and provided with the link to a very brief online survey. Participants in the control group were asked to complete the online survey 4 months after the date they completed the baseline survey, while those in the acquired-dog group were asked to

²⁵Participants who did not return the accelerometer were contacted by phone if they did not respond to e-mails.

complete the survey 4 months after the date they brought their dog home. Participants were told that, if they completed the 4-month survey, at 8 months the value of their gift card would be increased by \$2.

8-month component (online survey and accelerometer). Four months after participants in the control and acquired-dog groups completed the 4-month online survey, they were invited to complete the 8-month online survey, wear an accelerometer for 7 days and complete an accelerometer time log. The 8-month time log was identical to the time log completed at baseline with one exception; individuals in the acquired-dog group were also asked to indicate the start and end time for their dog walks. In order to obtain the materials for the physical activity component of the study at 8 months, the same procedure as at baseline was followed.

In the informed consent, the control group was told that the 8-month online survey would take approximately 25 minutes, while the acquired-dog group was told that it would take approximately 30 minutes. This five minute difference is due to dog owners being asked a number of dog-related questions. To thank participants for their time, at 8 months they were able to select a \$12 gift card from a selection of stores.

Wearing the accelerometer. Physical activity was assessed using the Actical accelerometer. Information regarding the Actical is presented in Study 1 under the heading "Wearing the accelerometer." Participants wore the Actical accelerometer during all of their waking hours (with the exception of bathing, showering and swimming) for 7 days. They were instructed to start wearing the accelerometer the day after they received it in the mail and to wear it for 7 consecutive days. In the present study, a *valid day* was defined as wearing the accelerometer for at least 8 hours. Only

participants with *at least 3 days* of valid data were retained in the study. Consistent with Statistics Canada's approach (Colley et al., 2011), *wear time* was determined by subtracting nonwear time from 24 hours, where *nonwear* time refers to at least 60 minutes of zero counts, with at most 1 to 2 minutes of counts between 0 and 100. In order to help participants remember to wear the accelerometer, they were asked to keep an accelerometer time log that was based on Cain and Geremia's (2011) form. Participants were asked to indicate when they put on the accelerometer in the morning and took it off in the evening. In addition, they were asked to record any times during the day when they did not wear the accelerometer and their reason for not wearing it.

A drawback of accelerometers is that there is a lack of control over participants wearing the device. Two potential concerns are participants having another household member wear the device or the participant not wearing the device properly (in the present study over the right hip). A number of steps were taken in an attempt to ensure that participants followed the study protocol. First, when participants contacted the researcher to state that they were ready to receive the physical activity monitoring device, the researcher specified that the participant (not other members of the household) needed to be able to wear the device for one week in order to continue participating in the study. At this point, the researcher also encouraged participants to ask questions regarding the accelerometer. Second, when participants received the accelerometer (either by mail or in person), they were given detailed instructions regarding wearing the accelerometer, including a clearly labelled diagram indicating how the accelerometer should be worn. Third, participants were contacted during the week they wore the device to ensure that they did not have not have any questions or concerns.

Measures

Data for the measures were collected through baseline, 4-month and 8-month online surveys and through the use of accelerometers. The baseline survey (Appendix F) included the following: questions to determine whether participants met the inclusion criteria for the study, demographic measures, questions about participants' pet ownership status (i.e., dog and cat ownership), measures of participants' physical and psychological health and a measure of socially desirable responding. As well, those participants who indicated that they were planning to acquire a dog were asked to complete an open-ended question regarding their reasons for doing so.

The 4-month survey (Appendix G) contained a question about participants' dog ownership status and questions about their health. The 8-month survey (Appendix H control group and Appendix I acquired-dog group) contained measures to obtain information about participants' dog ownership status and physical and psychological health. As well, participants who owned a dog were asked a number of closed- and open-ended dog-related questions. In order to collect data for the physical activity measures, participants wore an accelerometer and completed an accelerometer time log at baseline (Appendix J) and 8 months (Appendix K).

Demographic measures. At baseline, participants were asked to provide information about their sex, age, marital status, whether they lived alone, level of education and family household income before tax. At 8 months, participants were once again asked to indicate their marital status and whether they lived alone. For the variable marital status, participants were divided according to whether they were single/separated/divorced/widowed versus married/cohabitating/common-law. For the

variable education, participants were divided according to whether they had at least one university degree. Participants' annual family household income was divided at \$80,000 before tax.²⁶

Pet ownership. At baseline, participants were asked to indicate whether they owned a cat. This question was included to ensure that participants who owned a cat at baseline did not differ on any of the health dependent variables from those who did not own a cat, as some studies have found that cat ownership is beneficial for physical and psychological health (Headey, 1999; Straede & Gates, 1993). At baseline, participants were also asked to indicate whether they had previously owned a dog and, if so, how long ago. This information was utilized to ensure that none of the participants had owned a dog in the immediate past. Finally, participants were asked whether they owned a dog at baseline, 4 months and 8 months. This question was included in order to ensure that participants in the control group did not own a dog throughout the study and that individuals in the acquired-dog group owned a dog at 4 and 8 months, but not at baseline.

Dog owners' walking behaviour. At 8 months, participants who owned a dog were asked whether they walked their dog. Those participants who indicated that they walked their dog were then asked whether their dog walks typically lasted less than 10 minutes or 10 or more minutes. Any dog owners with multiple dogs were asked the preceding two questions for each of their dogs. The three participants who had more than one dog walked all of their dogs and did so for 10 or more minutes. At 8 months, individuals in the acquired-dog group were asked to indicate how soon after acquiring

²⁶Participants' annual family household income was divided at \$80,000 before tax, given that the average 2011 income before tax in Canada was \$75,000 (Statistics Canada, 2013).

their dog they began walking it. This information was used to verify that dog owners did not wait until near the end of the 8-month study to begin walking their dog.

Independent variables. Three independent variables²⁷ were created. The first independent variable, *dog ownership status*, consisted of two groups: participants who owned a dog for 8 months and typically walked it for periods lasting at least 10 minutes (*acquired-dog group*) and participants who did not own a dog throughout the study (*control group*).²⁸ The second independent variable, *time 2*, consisted of two time periods: baseline and 8 months. The third independent variable, *time 3*, consisted of three time periods: baseline, 4 months and 8 months.

Physical activity dependent variables. The physical activity dependent variables, which were assessed at both baseline and 8 months, consisted of measures of participants' moderate- to vigorous-intensity physical activity and attainment of selected physical activity levels (150 and 300 minutes).

Moderate-to vigorous-intensity physical activity (MVPA). Using Canada's physical activity guideline (Canadian Society for Exercise Physiology, 2011), the variable *MVPAI (in bouts)* was created by multiplying participants' average daily moderate- to vigorous-intensity physical activity in bouts by 7 to obtain weekly physical activity scores in bouts. To be classified as a bout, the physical activity had to last at

²⁷The term *independent variable* was utilized rather than *predictor variable*, as this terminology is commonly used when conducting univariate and multivariate analyses of variance, which were conducted for this component of the dissertation (e.g., Green & Salkind, 2005; Pallant, 2005; Tabachnik & Fidell, 2007, 2013).

²⁸As noted earlier, the original intent was to divide individuals who acquired a dog into two groups: 1) those who did not walk their dog or typically did so for periods lasting less than 10 minutes, and 2) those who typically walked their dog for periods lasting at least 10 minutes. As only five participants fell into the first category, this group was dropped.

least 10 minutes and 8 out of the 10 minutes had to be at a moderate- or vigorous-intensity level (Colley et al., 2011; Troiano et al., 2008; Tucker et al., 2011). I expected that not all of the physical activity obtained through dog walking would be in 10-minute bouts, as dog owners may slow their pace or stop on account of either their dogs' needs (Gaunet et al., 2014) or to chat with other dog owners (Lee et al., 2009). Therefore, a variable, *MVPA1 (no bouts)*, was created by including all of the physical activity engaged in at a moderate- or vigorous-intensity level. This variable was created by summing participants' average daily moderate- and average daily vigorous-intensity physical activity scores and then multiplying by 7 in order to obtain weekly physical activity scores without bouts.

Based on the WHO's (2010) physical activity guidelines, the original intent was to create two variables, *MVPA2 (in bouts)* and *MVPA2 (no bouts)*, by doubling participants' vigorous-intensity physical activity before adding it to their moderate-intensity physical activity both with and without taking bouts into consideration. However, given that less than 1.25% of the control and acquired-dog groups' weekly physical activity at both baseline and 8 months was engaged in at a vigorous-intensity level, these two variables were dropped from the study.

Attaining selected physical activity levels. Participants in the control and acquired-dog groups were classified first according to whether they achieved the recommended physical activity guideline of at least 150 minutes of *MVPA1* weekly with and without bouts: *sufficient* (≥ 150 minutes) or *insufficient* (< 150 minutes). Second, participants were classified according to whether they achieved at least 300 minutes of *MVPA1* weekly with and without bouts: *sufficient* (≥ 300 minutes) or *insufficient* (< 300

minutes). Third, participants in the control and acquired-dog groups were classified according to whether they achieved 30 minutes of *MVPAI* on at least 5 days of the week with and without bouts: *sufficient* (≥ 30 minutes on 5 days) or *insufficient* (< 30 minutes on 5 days).

Other physical activity information.

Physical activity intensity level. The weekly amount of time that participants in the control and acquired-dog groups spent at a sedentary-, light-, moderate- and vigorous-intensity level at both baseline and 8 months was calculated by applying cut-points to participants' raw accelerometer data. The cut-points are provided in Table 6 in the section of Study 1 entitled "Wearing the accelerometer." Participants' average daily minutes of physical activity at each intensity level was multiplied by 7 in order to obtain weekly totals.

Seasonal effects. Based on the dates that participants wore the accelerometer, a variable entitled *season* was created at baseline and 8 months by dividing participants according to whether they wore the accelerometer in the *winter* or in a season other than the winter (*not winter*). This variable was categorized as winter versus other seasons, given that according to findings from the CCHS Canadians are more likely to engage in physical activity during the spring, summer and fall as compared to the winter (Merchant, Dehghan, & Akhtar-Danesh, 2007).

Swimming and biking. One limitation of accelerometers is that they are unable to capture physical activities that are not step based (Welk, 2002). Therefore, when participants completed the daily accelerometer time log at baseline (Appendix J) and 8 months (Appendix K), they were asked to specify how much time, if any, they spent

swimming and/or biking. Participants were asked about these two types of activities, given that according to the CCHS, approximately one-quarter of Canadians swam or biked at least once in the past 3 months (Gilmour, 2007).

Pedometer variables. The pedometer function of the Actical accelerometer was used to determine the average number of steps taken daily at baseline and 8 months. Participants' total number of daily steps were summed and divided by the number of days that they wore the accelerometer. In addition, participants in the control and acquired-dog groups were classified according to whether they achieved a daily average of at least 10,000 steps at baseline and 8 months. Specifically, participants in each group were classified as *achieving* ($\geq 10,000$ steps) or *not achieving* ($< 10,000$ steps) a daily average of at least 10,000 steps.

Health dependent variables assessed at baseline and 8 months. The health dependent variables, which were assessed at both baseline and 8 months, consisted of measures of participants' physical and psychological health. Physical health was assessed through a checklist of physical symptoms and sensations and a self-report rating of health. Psychological health was assessed through the following measures: depression, self-esteem, life satisfaction and positive and negative mood.

Physical symptoms and sensations. Using a 5-point scale ranging from 1 (*never or almost never*) to 5 (*more than once every week*), participants rated how often they experienced each of the 54 physical symptoms and sensations (e.g., chest pains, dizziness, coughing) listed in Pennebaker's (1982) Inventory of Limbic Languidness (PILL). The PILL has been found to be internally consistent ($\alpha = .91$) and has a 2-month test-retest reliability of .83 (Pennebaker, 1982). Evidence of the PILL's construct validity

comes from Pennebaker's finding that individuals with high PILL scores reported more physician visits in the past year, used more aspirin in the last month and had more sick days in the past year. In addition, PILL scores have been found to be moderately correlated with scores on the Hopkins Symptom Checklist, the Autonomic Perception Questionnaire and the composite score on the Cornell Medical Index ($r_s = .48$ to $.57$). The PILL was scored by calculating mean item scores, with higher scores indicating a greater number of health symptoms. Item analyses conducted to examine the homogeneity of the items revealed that Cronbach's alpha was $.96$ at baseline and $.95$ at 8 months.

Self-report rating of health. Participants were asked to rate their health using a self-report measure of health from the CCHS (Gilmour, 2007). Participants rated their health on a scale ranging from 1 (*poor*) to 5 (*excellent*). This item was reverse coded, so that higher scores reflected poorer self-rated health.

Depression. Using a scale ranging from 0 (*rarely or none of the time [less than 1 day a week]*) to 3 (*most or all of the time [5-7 days a week]*) participants completed Radloff's (1977) 20-item Center for Epidemiologic Studies Depression Scale (CES-D). This scale assesses how frequently participants experienced symptoms of depression during the past week (e.g., "I felt sad," "I thought that my life had been a failure"). The CES-D scale is internally consistent ($\alpha = .85$) and has modest test-retest correlations after 2 weeks to 12 months (except in one case, all test-retest $r_s = .45$ to $.70$). The scale also demonstrates concurrent validity as it is highly correlated with the Beck Depression Inventory ($r = .86$, Santor, Zuroff, Ramsay, Cervantes, & Palacios, 1995) and other measures of depression, such as the Lubin Depression Adjective Checklist and the

Bradburn Negative Affect scale ($r_s = .51$ to $.63$, Radloff, 1977). The CES-D was scored by calculating mean item scores, with higher scores indicating more depressive symptoms. Item analyses revealed that Cronbach's alpha was $.93$ at both baseline and 8 months.

Self-esteem. Using a scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*) participants completed the Rosenberg Self-Esteem Scale (SES; Rosenberg, 1965), which assesses global self-esteem through 10-items (e.g., “I take a positive attitude toward myself” and “I am able to do things as well as most other people”). According to Blascovich and Tomaka (1991) the scale is internally consistent (α s range from $.77$ to $.88$) and has test-retest correlations from 1 to 2 weeks of $.82$ and $.85$ respectively. Evidence for the convergent validity of the SES is provided by its negative associations with Beck’s Depression Inventory ($r = -.59$) and Bendig’s Manifest Anxiety Scale ($r = -.64$; Fleming & Courtney, 1984). The SES was scored by calculating mean item scores, with higher scores indicating lower self-esteem. Item analyses revealed that Cronbach's alpha was $.89$ at baseline and $.92$ at 8 months.

Life satisfaction. Using a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) participants completed Diener, Emmons, Larsen, and Griffin’s (1985) 5-item Satisfaction with Life Scale (SWLS), which assesses global life satisfaction (e.g., “In most ways my life is close to my ideal” and “I am satisfied with my life”). The SWLS is internally consistent (α s range from $.79$ to $.89$) and has moderate temporal stability with test-retest correlations ranging from $.84$ at 1 month to $.50$ at 10 weeks (Pavot & Diener, 1993). According to Diener et al. (1985), the convergent validity of the SWLS is reflected by its moderate to high correlations with a variety of measures of subjective

well-being, such as Fordyce's single item happiness measure ($r = .58$) and Cantril's Self-Anchoring Scale ($r = .62$). In the present study, prior to calculating mean item scores the SWLS was reverse coded, so that higher scores indicated more dissatisfaction with life. Item analyses revealed that Cronbach's alpha was .87 at baseline and .85 at 8 months.

Mood. Using a scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*), participants indicated how often, in general, they experienced each of the 20 mood states in Watson, Clark, and Tellegen's (1988) Positive and Negative Affect Schedule (PANAS). The 20 items form two 10-item scales: the positive affect scale includes items such as *interested, strong, enthusiastic* and *proud* and the negative affect scale includes items such as *hostile, scared, guilty* and *ashamed*. Both positive ($\alpha = .88$) and negative ($\alpha = .87$) affect scales of the PANAS are internally consistent and, over a period of eight weeks, had test-retest reliabilities of .68 and .71 for the positive and negative affect scales respectively. When correlated with two corresponding mood factors derived from a lengthier mood scale, the PANAS scales demonstrated excellent convergent ($r_s = .93$ to $.94$) and discriminant ($r_s = -.08$ to $-.12$) validity. In the current study, items on the positive affect scale were reverse coded before mean item scores were calculated, so that higher scores indicated less positive affect. Item analyses indicated that Cronbach's alpha for the positive affect scale was .88 at baseline and .87 at 8 months. The negative affect scale was scored by calculating mean item scores, with higher scores reflecting greater negative affect. Item analyses indicated that Cronbach's alpha for the negative affect scale was .91 at both baseline and 8 months.

Health dependent variables assessed at baseline, 4 months and 8 months.

Participants completed measures to assess their BMI, trouble falling asleep and stress at

each of the three time periods.

BMI. Participants were asked to provide their height and weight in order to calculate their BMI using the following formula: $BMI = \text{weight (kg)}/\text{height (m)}^2$ (Health Canada, 2003). A BMI correction factor (Connor Gorber et al., 2008) was applied to adjust for the bias created by people's tendency to underestimate their weight and overestimate their height (Shields et al., 2008). As pregnancy leads to a weight increase, female participants were asked to indicate whether they were pregnant. No female participants were pregnant at either baseline or 8 months.

Trouble falling asleep. Using an item from the NHANES (Centers for Disease Control and Prevention, 2009), participants were asked to indicate how often they had trouble falling asleep in the past month on a scale ranging from 0 (*never*) to 4 (*almost always [16 - 30 times a month]*). For this measure, higher scores indicated more trouble falling asleep in the past month.

Stress. Using an item from the CHMS (Statistics Canada, 2012), participants were asked to indicate whether when they think about the amount of stress in their life most days are 1 (*not at all stressful*) to 5 (*extremely stressful*). For this measure, higher scores reflected higher levels of stress.

Additional scale completed by all participants. The 13-item short form Marlowe-Crowne Social Desirability Scale was included in the baseline survey to assess the extent to which participants provided socially desirable responses (M-C SDS; Reynolds, 1982). Participants responded either True or False to each item (e.g., “I am always courteous, even to people who are disagreeable,” “I’m always willing to admit it when I make a mistake”). According to Reynolds (1982), the M-C SDS is internally

consistent, $r_{KR-20} = .76$, and its concurrent validity is reflected by its high correlation with the original 33-item Marlowe-Crowne Scale, $r = .93$. The M-C SDS was scored by calculating mean item scores on a scale ranging from 0 to 1, with higher scores indicating a greater degree of socially desirable responding. Item analyses indicated that Cronbach's alpha was .69 at baseline.

Dog Walking

In this section, I describe the measures that were created to assess the physical activity obtained through dog walking. I then present the measures that were created from closed- and open-ended questions to explore factors that may affect time spent dog walking weekly at a moderate- to vigorous-intensity level. Finally, I examine dog owners' reasons for acquiring a dog and the possible physical activity and health changes that may occur following the acquisition of a dog.

Physical activity obtained dog walking. As part of the accelerometer time log completed at 8 months (Appendix K), participants who acquired a dog were asked to provide the start and end time for their dog walks on the 7 days they wore the accelerometer. This self-report information was used to identify time spent dog walking in participants' raw accelerometer data. The cut-points that were developed for the Actical (Colley & Tremblay, 2011; Wong et al., 2011) were then used to classify each minute dog walking as time spent at a sedentary-, light-, moderate-, or vigorous-intensity level. The weekly amount of time that individuals in the acquired-dog group spent at each intensity level on their dog walks was calculated by multiplying the average daily time spent dog walking at the particular intensity level by 7. As well, the weekly amount of time spent dog walking at a moderate- to vigorous-intensity level in bouts was

calculated by multiplying participants' average daily moderate- to vigorous-intensity physical activity dog walking in bouts by 7.

Factors that may affect time spent dog walking. Dog owners completed questions to assess possible factors that may affect time spent dog walking including: the characteristics of the dog, whether the dog was walked by other people, the season the dog was walked and whether the dog owner experienced problems with the dog misbehaving. These factors are described below.

Characteristics of the dog. Three dog-related factors that may affect weekly time spent dog walking were assessed at 8 months. First, through a closed-ended question, dog owners were asked to indicate the *size of their dog*. Given that some dog owners may have been unsure of their dog's size or may have described it inaccurately, dog owners were also asked to specify their dog's height, weight and breed. This information was used to classify participants' dogs as small, medium or large. Second, through a closed-ended question, dog owners were asked to indicate the *age of their dog*. This information was used to determine whether the dog was ≤ 1 year or > 1 year. Third, participants' responses to the question about the breed of their dog were used to create a *breed exercise requirement* variable. Each participant's dog was classified according to whether the breed required a low (up to 30 minutes/day), moderate (up to 1 hour/day) or high (more than 2 hours/day) level of exercise (UK Kennel Club, 2015a).

Dog owners were asked to specify whether they owned more than one dog at 8 months and, if so, to indicate how many dogs they owned. Those who indicated that they owned more than one dog were asked to respond to the questions about size, age and breed for *each* of their dogs. When the variables *size*, *age* and *breed exercise*

requirement were created, information was only included for each participant's largest dog, which for these participants was also their oldest dog. It should be noted that two of the three participants who owned more than one dog had multiple dogs of the same breed.

Whether someone else walks the dog. At 8 months, in order to determine whether the dog owner was the only person who walks the dog, dog owners were asked whether someone else walks their dog instead of them some of the time and, if so, to indicate who walks their dog (e.g., spouse, child, friend, professional dog walker).

Season the dog was walked. At 8 months, a season variable was created using the dates that participants wore the accelerometer. Participants were classified according to whether their dog walks took place in the winter, spring, summer or fall. This variable was not collapsed into winter versus non-winter seasons, given that findings are mixed as to whether dog owners become less physically active in the winter months (Hope et al., 2014; Lail et al., 2011).

Experienced problems with dog misbehaving. To ascertain whether participants had a dog with behavioural problems that could affect the amount of time they spent dog walking, participants were asked at 8 months whether they had experienced any difficulties as a result of acquiring a dog and, if so, to describe the difficulties.

Questions about reasons for acquiring a dog and resulting changes. In order to understand whether one of the *main reasons for acquiring a dog* was to obtain physical activity through dog walking, participants who indicated at baseline that they were planning to acquire a dog were asked to list their top three reasons for doing so. At 8 months, dog owners were asked to describe the *two main benefits of owning a dog*. This information was used to determine whether dog owners perceived that one of the main

benefits of dog ownership was the physical activity obtained through dog walking.

Dog owners were also asked questions to determine whether they perceived that their physical activity and/or health had changed over the course of the study. At 8 months, in order to assess *possible changes in physical activity after acquiring a dog*, dog owners were asked how the amount of time they engaged in physical activities at 8 months compared to the time they spent before they acquired a dog on a 5-point scale ranging from 1 (considerably less) to 5 (considerably more). In order to assess *possible health changes following the acquisition of a dog*, at 8 months participants were asked whether they perceived that acquiring a dog had made a difference to their health and, if it did, to explain how. In addition, at 8 months, using an item from the CHMS (Statistics Canada, 2012), participants were asked to rate their current health compared to their health 8 months ago on a scale ranging from 1 (*much better now*) to 5 (*much worse now*).

Results

Preliminary Analyses

Checking assumptions. The main analyses for Study 2 consisted of mixed analyses of variance (ANOVAs), mixed multivariate analyses of variance (MANOVAs) and mixed multivariate analyses of covariance (MANCOVAs). The assumptions for each test were examined prior to conducting any analyses. With respect to the mixed ANOVAs, the following assumptions were tested: normality, independence of observations, homogeneity of variance, homogeneity of variance-covariance matrices, sphericity (when the within-subjects independent variable had at least three levels) and outliers.

In terms of the mixed MANOVAs and MANCOVAs (a single covariate was

entered), the following assumptions were examined: adequate sample size (i.e., more cases in each cell than dependent variables), normality, independence of observations, homogeneity of variance, homogeneity of variance-covariance matrices, outliers, linearity (between all pairs of dependent variables) and the absence of multicollinearity. The following assumptions were also tested when the covariate was entered: reliability of the covariate, linearity (between each of the dependent variables and the covariate) and homogeneity of regression.

It should be noted that for each analysis, when checking for statistical outliers, standardized z scores were calculated with scores in excess of ± 3.29 considered to be outliers (Tabachnik & Fidell, 2013). At baseline, when checking the assumptions for the independent samples *t*-test that was conducted to determine whether those who completed all aspects of the longitudinal study (*completers*) and those who dropped out after baseline (*non-completers*) differed on the physical activity dependent variables, *MVPAI (no bouts)* and *MVPAI (in bouts)*, two outliers were identified. The first outlier was a completer (case 27) who engaged in 1082.67 minutes weekly of *MVPAI (no bouts)* and 995.17 minutes weekly of *MVPAI (in bouts)*. The second outlier was a non-completer (case 45) who engaged in 746.00 minutes of *MVPAI (no bouts)* and 695.00 minutes of *MVPAI (in bouts)*.

When the data (without bouts) from case 27 were examined further, the individual was only an outlier with respect to physical activity engaged in at a *moderate-intensity level*, not at a light- or vigorous-intensity level or total light-, moderate- and vigorous-intensity physical activity. With respect to case 45, the individual was only an outlier for physical activity engaged in at a *vigorous-intensity level*, not at a light- or moderate-

intensity level or total light-, moderate- and vigorous-intensity level. Given that neither case 27 nor case 45 were outliers for overall weekly physical activity (light-, moderate- and vigorous-intensity physical activity), it appears that they are members of the intended population. However, in order to assess the influence that these cases exerted, the analyses comparing the weekly amount of time completers and non-completers spent at a *MVPA1 level (no bouts)* and *MVPA1 level (in bouts)* were conducted both with and without the two outliers (cases 27 and 45) included. Given that the results of these analyses *did* differ when the two outliers were excluded, a footnote has been included describing these differences when the results are presented.

Missing data. Missing data were dealt with at both the item and variable level. In order to address the issue of missing data at the item level, average scale scores were calculated. At the variable level, SPSS missing value analyses were conducted for each of the three time periods to account for the 98 participants who completed the baseline component of the study, the 71 participants who completed the 4 month online survey and the 62 participants who completed the 8 month component of the study. At each of the three time periods, less than 5% of the data were missing on any of the variables.

Attrition analyses. Analyses were conducted to determine whether the 62 individuals who completed all components of the study (*completers*) differed from the 36 individuals who dropped out after baseline (*non-completers*) with respect to the following: dog ownership status (control group vs. acquired-dog group), demographic characteristics and the dependent variables. First, a chi-square test revealed that whether participants completed all components of the study was not associated with whether they were in the control or planned-to-acquire-a-dog group, $\chi^2 (1, N = 98) = 3.77, p = .052$.

However, it should be noted that this result approached significance; a higher percentage of the participants who completed all aspects of the study were from the control group rather than the group who planned to acquire a dog. Second, as may be seen from Table 28, chi-square and independent samples *t*-tests revealed that the only difference in the demographic characteristics of completers and non-completers was with respect to education, $\chi^2 (1, N = 98) = 4.39, p = .036$. Results from the chi-square test revealed that a higher percentage of the participants who completed all aspects of the study had at least one university degree.

Table 28

Demographic Characteristics According to Whether Completed All Aspects of Study

Demographic variable	Completer (<i>n</i> = 62)	Non-completer (<i>n</i> = 36)	<i>p</i>
Age			
Mean (<i>SD</i>)	36.18 (13.24)	37.50 (12.41)	.627
Range	19-66	19-68	
Sex (%)			
Male	33.87	38.89	.617
Female	66.13	61.11	
Marital status (%)			
Single/separated/divorced/widowed	54.84	55.55	.945
Married/cohabitating/common-law	45.16	44.44	
Live alone (%)			
Yes	22.58	19.44	.715
No	77.42	80.55	
At least one university degree (%)			
Yes	58.06	36.11	.036
No	41.94	63.89	
Household income (%) ^a			
< \$80,000	70.49	80.00	.307
≥ 80,000	29.51	20.00	

^aTwo participants (one completer and one non-completer) did not provide their income at baseline.

Third, independent samples *t*-tests were conducted to ascertain whether completers and non-completers differed on any of the physical activity or health dependent variables at baseline. As may be seen from Table 29, non-completers and completers did not differ in their weekly time spent at a *MVPA1 level (no bouts)* or

MVPAI level (in bouts).²⁹ With respect to the health dependent variables, those who did and did not complete all aspects of the study differed on only one of the ten health dependent variables; non-completers had poorer self-rated health than completers.

²⁹After two outliers (one completer, case 27, and one non-completer, case 45) were deleted, non-completers ($M = 152.28$, $SD = 102.70$) engaged in significantly less *MVPAI (no bouts)* than completers ($M = 224.79$, $SD = 164.56$), $t(88) = -2.21$, $p = .030$. In addition, non-completers ($M = 66.99$, $SD = 88.37$) engaged in significantly less *MVPAI (in bouts)* than completers ($M = 120.86$, $SD = 123.25$), $t(88) = -2.13$, $p = .036$.

Table 29

Comparison of Completers and Non-Completers on Dependent Variables at Baseline

Dependent variable	N	Completers (n = 62)		Non-completers (n = 36)		t	p
		M	SD	M	SD		
MVPAI (no bouts)	92 ^a	238.85	196.70	171.43	146.86	-1.68	.096
MVPAI (in bouts)	92 ^a	135.19	165.74	87.24	142.38	-1.37	.173
PILL	98	1.87	0.53	1.78	0.46	-0.89	.374
Self-rated health	96 ^b	2.69	0.85	3.09	0.98	2.09	.040
Depression	98	0.79	0.59	0.67	0.54	-1.08	.283
Self-esteem	98	1.99	0.60	1.98	0.59	-0.08	.938
Life satisfaction	98	3.91	1.43	3.72	1.49	-0.62	.538
Positive mood	98	2.98	0.73	2.67	0.82	-1.94	.055
Negative mood	98	1.93	0.80	1.74	0.74	-1.18	.241
BMI	97 ^c	27.40	5.64	28.01	6.76	0.48	.630
Trouble falling asleep	98	2.77	1.06	2.92	0.97	0.66	.510
Stress	98	3.02	0.82	3.00	0.76	-0.10	.923

^aSix participants (five completers and one non-completer) were excluded because they did not wear the accelerometer for 8 hours on at least 3 days.

^bTwo participants (one completer and one non-completer) did not complete the self-rated health question at baseline.

^cOne participant in the completer group did not provide the information necessary to calculate her BMI.

Dealing with missing data among completers. Tabachnik and Fidell (2013) state that one approach when only a few participants have missing data is to delete those participants who have missing data on *any* of the variables (i.e., listwise deletion). This method was used and resulted in seven of the 62 participants who completed the three components of the study being deleted. The seven participants consisted of four

individuals from the control group and three individuals from the acquired-dog group.

One participant did not respond to any of the PILL scale items at 8 months, while six of the participants did not respond to a 1-item measure (e.g., self-rated health) at one of the three time periods.

Reduction in sample size. Although 62 participants completed all three components of the study, 17 of these participants were deleted for one of the three reasons outlined in Table 30. This resulted in a sample of 45 participants (28 control and 17 acquired dog).³⁰

Table 30

Reductions in Sample Size

Reason for reduction	Number of participants deleted
Missing data on a variable at one of the three time points (listwise deletion)	7 (4 control, 3 acquired dog)
Did not wear accelerometer for 8 hours on at least 3 days	5 (4 control, 1 acquired dog)
Fell into non-dog walker category, as dog walks typically lasted < 10 minutes	5

Demographic characteristics of control and acquired-dog groups. In order to determine whether participants in the control and acquired-dog groups had similar demographic characteristics at baseline, chi-square and independent samples *t*-tests were

³⁰Using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007), an *ANOVA repeated measures, within-between interaction* power analysis was conducted for two between-subjects groups (control group, acquired-dog group) and two within-subjects measurements (baseline, 8 months). The power analysis was conducted for the within-subjects independent variable that had two (baseline, 8 months) rather than three levels (i.e., baseline, 4 months, 8 months) because the sample size that is required *decreases* as the number of levels of the within-subjects independent variable increases. It was determined that a sample size of 45 was sufficient to detect medium and large effects.

conducted. As shown in Table 31, participants in the control and acquired-dog groups did not differ in their demographic characteristics at baseline.³¹ For the two demographic variables that were also assessed at 8 months, results revealed that the control and acquired-dog groups did not differ at 8 months with respect to either their marital status, $\chi^2(1, N = 45) = 2.74, p = .098$, or whether they lived alone, $p = 1.00$, two-sided Fisher's exact test.³²

³¹Given that for the crosstab between live alone and dog ownership status the expected count was below five in one of the cells, Fisher's exact test was used.

³²Marital status at baseline and 8 months correlated at $r(43) = .96, p = .000$, while living alone at baseline and 8 months correlated at $r(43) = .77, p = .000$.

Table 31

Demographic Characteristics of Participants at Baseline by Dog Ownership Status

Demographic variable	Dog ownership status		<i>p</i>
	Control (<i>n</i> = 28)	Acquired dog (<i>n</i> = 17)	
Age			
Mean (<i>SD</i>)	39.64 (13.92)	34.18 (11.87)	.185
Range	21-65	21-66	
Sex (%)			
Male	35.71	35.29	.997
Female	64.29	64.71	
Marital status (%)			
Single/separated/divorced/widowed	64.29	35.29	.059
Married/cohabitating/common-law	35.71	64.71	
Live alone (%) ^a			
Yes	21.43	23.53	1.00
No	78.57	76.47	
At least one university degree (%)			
Yes	53.57	70.59	.259
No	46.43	29.41	
Household income (%)			
< \$80,000	75.00	52.94	.128
≥ 80,000	25.00	47.06	

^aResult is reported for Fisher's exact test (two-sided).

Other information about control and acquired-dog groups. Participants were asked about previous dog ownership and current cat ownership. As well, those who acquired a dog were asked when they began walking their dog. Finally, participants in both groups were asked about the amount of time they spent swimming and biking at baseline and 8 months.

Previous dog ownership. Participants in the control and acquired-dog groups were asked at baseline whether they had previously owned a dog and, if so, how long ago. A considerably higher percentage of the participants in the acquired-dog group, 64.71%, than in the control group, 35.71%, had previously owned a dog. The time period since participants had owned a dog ranged from 1.5 to 50 years for the control group and 3 months to 20 years for the acquired-dog group.

Cat ownership. Given that there is some evidence that cat ownership is beneficial for people's health (Headey, 1999; Straede & Gates, 1993), the 12 participants (seven control and five acquired dog) who owned a cat at baseline were compared to the 33 participants who did not own a cat at baseline on the baseline health dependent variables using independent samples *t*-tests. As may be seen from Table 32, results revealed that cat owners did not differ from non-cat owners on any of the baseline health measures.

Table 32

Comparison of Cat and Non-Cat Owners on Health Dependent Variables at Baseline

Dependent variable	Cat ownership status				<i>t</i>	<i>p</i>
	Cat owner (<i>n</i> = 12)		Non-cat owner (<i>n</i> = 33)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
PILL	2.04	0.60	1.86	0.55	0.94	.352
Self-rated health	2.67	1.23	2.73	0.72	-0.21	.839
Depression	0.96	0.70	0.76	0.53	1.02	.314
Self-esteem	2.13	0.64	1.99	0.52	0.73	.471
Life satisfaction	4.29	1.60	3.90	1.40	0.79	.437
Positive mood	3.28	1.00	2.78	0.52	1.64	.124
Negative mood	2.17	1.03	1.95	0.73	0.77	.446
BMI	27.49	5.17	26.78	5.30	0.41	.688
Trouble falling asleep	2.92	1.24	2.58	1.06	0.91	.367
Stress	3.25	0.97	2.88	0.82	1.28	.207

Verifying when dog owners began walking their dog. In order to ensure that dog owners did not wait until near the end of the 8-month study to begin walking their dog, they were asked to indicate how soon after acquiring their dog they began walking it. The overwhelming majority of dog owners, 94.12% (*n* = 16), began walking their dog within the first month of acquiring it. The exception was a dog owner who had to wait 2 months to begin dog walking because her dog was fearful of being walked on a leash.

Swimming and biking. Given that accelerometers are unable to capture activities that are not step based, participants were asked about swimming and biking, two activities that are considered to be moderate- to vigorous-intensity physical activities (Ainsworth et al., 2011). As may be seen from Table 33, a higher percentage of the

participants in the control group than in the acquired-dog group swam or biked at both time periods.

Table 33

Percentage of Participants who Swam or Biked Weekly at Baseline and 8 Months by Dog Ownership Status

Activity	Control group				Acquired-dog group			
	Baseline		8 Months		Baseline		8 Months	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Swam	2	7.14	2	7.14	0	-	1	5.88
Biked	6	21.43	5	17.86	2	11.76	2	11.76

Descriptive statistics for dependent variables. Table 34 provides descriptive statistics for the physical activity and health dependent variables that were assessed at baseline and 8 months. From the descriptive statistics provided for the physical activity variables, it is apparent that the average amount of time spent engaging in physical activity weekly at a *MVPAI* level was considerably lower when only physical activity engaged in for periods lasting at least 10 minutes was counted. However, the amount of time spent at a *MVPAI* increased from baseline to 8 months for both *MVPAI (no bouts)* and *MVPAI (in bouts)*.

The physical health descriptive statistics indicate that, on the whole, participants experienced few minor health symptoms and rated their health as good. With respect to psychological health, in general participants experienced few depressive symptoms, had low levels of negative affect and had moderate levels of self-esteem, life satisfaction and positive affect. It is apparent that participants' physical and psychological health was

similar at baseline and 8 months. At baseline, when social desirability was assessed, participants' average social desirability score was 0.50 ($SD = 0.22$), with a range of 0 to 0.92.

Table 34

Descriptive Statistics for Dependent Variables Assessed at Two Time Periods

Variable	Baseline				8 Months			
	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Physical activity								
Weekly <i>MVPAI</i> (no bouts)	247.60	206.12	5.00	1,082.67	282.63	218.31	1.00	1,086.17
Weekly <i>MVPAI</i> (in bouts)	141.81	181.34	0.00	995.17	167.47	193.70	0.00	935.67
Physical health								
PILL	1.91	0.56	1.09	3.59	1.94	0.56	1.02	3.74
Self-rated health ^a	2.71	0.87	1.00	5.00	2.71	0.82	1.00	4.00
Psychological health								
Depression	0.81	0.58	0.05	2.40	0.81	0.57	0.00	2.20
Self-esteem	2.03	0.55	1.00	3.20	2.11	0.59	1.00	3.50
Life satisfaction ^a	4.00	1.44	1.40	6.60	4.05	1.33	1.20	6.80
Positive affect ^a	2.92	0.71	1.60	4.80	2.82	0.67	1.60	4.20
Negative affect	2.01	0.81	1.00	4.40	1.95	0.78	1.00	3.70

^aScale was reverse coded, so that higher scores reflected poorer health.

The descriptive statistics for the health measures that were administered at baseline, 4 months and 8 months (Table 35) revealed that, in general, participants were overweight, occasionally experienced trouble falling asleep and felt that most days were a bit stressful. Furthermore, it is apparent that participants' BMI, trouble sleeping and stress remained relatively similar at the three time periods.

Table 35

Descriptive Statistics for Health Dependent Variables Assessed at Three Time Periods

	Descriptive statistics			
	<i>M</i>	<i>SD</i>	Min	Max
Baseline				
BMI	26.97	5.22	15.63	38.31
Trouble sleeping	2.67	1.11	1.00	5.00
Stress	2.98	0.87	1.00	5.00
4 Months				
BMI	26.73	5.23	15.63	38.31
Trouble sleeping	2.47	0.97	1.00	4.00
Stress	2.80	0.76	1.00	5.00
8 Months				
BMI	26.83	5.17	15.63	38.31
Trouble sleeping	2.62	1.05	1.00	5.00
Stress	2.98	0.87	1.00	5.00

Bivariate correlations.

Associations between physical activity dependent variables. Although the two physical activity dependent variables, *MVPAI (no bouts)* and *MVPAI (in bouts)*, were highly correlated at baseline, $r(43) = .94, p = .000$, and 8 months, $r(43) = .95, p = .000$, both variables were retained in the study. The variable *MVPAI (in bouts)* is important, given that the physical activity guidelines call for physical activity to be obtained in 10-minute bouts. A decision was made to retain the variable *MVPAI (no bouts)*, as a sizeable percentage of the participants did not engage in any *MVPAI* in 10-minute bouts: 17.78% at baseline and 20.00% at 8 months.

Associations between health dependent variables assessed at two time periods.

As may be seen from Table 36, there was a significant association between the two physical health dependent variables (PILL and self-rated health) at both time periods. As well, there were significant associations between the five psychological health dependent variables at both time periods. Given that the associations between depression and negative affect at baseline and between self-esteem and positive affect at 8 months were above .80, as recommended by Pallant (2005), positive and negative affect were dropped as psychological health measures when multivariate analyses were conducted.

Table 36

Correlations Between Health Dependent Variables at Two Time Periods

Baseline	1	2	3	4	5	6	7
1. PILL	-	.57**	.71**	.54**	.45*	.54**	.59**
2. Self-rated health		-	.59**	.44**	.34*	.47**	.44**
3. Depression			-	.76**	.62**	.64**	.86**
4. Self-esteem				-	.75**	.78**	.57**
5. Life satisfaction					-	.60**	.55**
6. Positive affect						-	.41**
7. Negative affect							-

8 Months	1	2	3	4	5	6	7
1. PILL	-	.63**	.65**	.49**	.46**	.50**	.53**
2. Self-rated health		-	.52**	.39**	.49**	.49**	.32*
3. Depression			-	.71**	.69**	.59**	.74**
4. Self-esteem				-	.76**	.81**	.57**
5. Life satisfaction					-	.69**	.60**
6. Positive affect						-	.44**
7. Negative affect							-

* $p < .05$. ** $p < .01$.

Associations between health dependent variables assessed at three time periods.

As may be seen from Table 37, BMI, trouble sleeping and stress were not associated at baseline. On the other hand, at 4 months trouble sleeping and stress were correlated, while at 8 months BMI and stress were correlated.

Table 37

Correlations Between Health Dependent Variables at Three Time Periods

	Baseline			4 Months			8 Months		
	1	2	3	1	2	3	1	2	3
1. BMI	-	.04	.15	-	.07	.21	-	.11	.33*
2. Trouble sleeping		-	.18		-	.32*		-	.22
3. Stress			-			-			-

* $p < .05$.

Associations between social desirability and dependent variables. In order to determine whether social desirability should be entered as a control variable, the relationship between baseline social desirability and each of the dependent variables was examined at baseline and 8 months. Social desirability was not associated with *MVPAI (no bouts)* at baseline, $r(43) = -.08, p = .593$, or 8 months, $r(43) = -.17, p = .263$. Similarly, it was not associated with *MVPAI (in bouts)* at baseline, $r(43) = -.07, p = .660$, or 8 months, $r(43) = -.11, p = .490$. On the other hand, as may be seen from Table 38, social desirability was associated with the PILL and the three psychological health measures (depression, self-esteem and life satisfaction) at both baseline and 8 months.

Table 38

Correlations Between Social Desirability and Health Measures at Baseline and 8 Months

	PILL	Self-rated health	Depression	Self-esteem	Life satisfaction
Baseline					
Social desirability	-.30*	-.17	-.36*	-.40**	-.38**
8 Months					
Social desirability	-.36*	-.12	-.34*	-.31*	-.36**

* $p < .05$. ** $p < .001$.

The relationship between baseline social desirability and BMI, trouble sleeping and stress was assessed at baseline, 4 months and 8 months. As may be seen from Table 39, social desirability was not associated with the three health dependent variables at any of the three time periods.

Table 39

Correlations Between Social Desirability and Health Measures at Three Time Periods

	BMI	Trouble sleeping	Stress
Baseline			
Social desirability	-.13	-.17	-.15
4 Months			
Social desirability	-.14	-.04	-.20
8 Months			
Social desirability	-.11	-.22	-.24

Physical activity descriptive statistics by dog ownership status. In this section, the weekly physical activity of individuals in the control and acquired-dog groups is presented, first, according to the percentage of time spent at each intensity level at

baseline and 8 months and, second, according to the amount of time spent weekly at each intensity level at both time periods. Next, daily physical activity at a moderate- to vigorous-intensity level is presented at both time periods by dog ownership status. Finally, given that participants wore the accelerometer in different seasons, information is provided regarding the time spent dog walking weekly at a moderate- to vigorous-intensity level in the winter versus the three other seasons at baseline and 8 months for both groups.

Weekly. The percentage of time participants spent at each intensity level at baseline and 8 months is presented in Table 40. Participants in the control and acquired-dog groups were sedentary during the majority (i.e., 70% to 74%) of their waking hours. The next most common intensity level was light, which accounted for 20% to 24% of the weekly physical activity of both groups. Moderate- and vigorous-intensity physical activity were engaged in at considerably lower levels; moderate-intensity physical activity accounted for less than 5% of the control and acquired-dog groups' weekly physical activity, while vigorous-intensity physical activity accounted for less than 1.25% of both groups' weekly physical activity.

Table 40

Percentage of Time Spent at Each Intensity Level Weekly (No Bouts) at Baseline and 8 Months by Dog Ownership Status

Group	<i>n</i>	% time at each intensity level			
		Sedentary	Light	Moderate	Vigorous
Baseline					
Control	28	73.95	20.70	4.14	1.21
Acquired dog	17	72.67	23.65	3.21	0.46
8 Months					
Control	28	74.43	20.11	4.49	0.98
Acquired dog	17	70.40	24.22	4.86	0.52

Weekly information is provided in Table 41 for time spent at each intensity level and *MVPAI* without and with bouts for the control and acquired-dog groups at baseline and 8 months. From these figures, it is apparent that average weekly *MVPAI* without and with bouts was similar at baseline and 8 months for participants in the control group. On the other hand, there was a considerable increase in average weekly *MVPAI* (*no bouts*) and *MVPAI* (*in bouts*) over time among individuals in the acquired-dog group.

Table 41

Descriptive Statistics for Weekly Physical Activity at Baseline and 8 Months by Dog Ownership Status

Group	Baseline				8 Months			
	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Control								
Sedentary	3,857.21	522.89	2,346.17	4,823.00	3,762.18	597.82	2,700.60	4,976.00
Light	1,079.52	308.61	642.25	1,718.00	1,016.40	273.19	548.80	1,705.00
Moderate	215.99	196.72	5.00	975.33	226.79	216.94	1.00	1,083.83
Vigorous	63.03	79.07	0.00	341.83	49.58	73.95	0.00	263.67
Total ^a	5,215.75	510.06	4,175.50	6,051.50	5,054.95	669.03	4,169.67	6,500.00
<i>MVPAI (no bouts)</i>	279.02	234.49	5.00	1,082.67	276.37	233.67	1.00	1,086.17
<i>MVPAI (in bouts)</i>	172.13	209.51	0.00	995.17	165.90	204.59	0.00	935.67
Acquired Dog								
Sedentary	3,876.22	635.05	2,230.67	4,882.00	3,832.65	596.44	2,906.40	5,445.00
Light	1,261.58	369.39	529.67	2,163.00	1,318.35	420.42	645.75	2,044.00
Moderate	171.19	121.41	37.33	502.00	264.76	169.28	10.50	616.00
Vigorous	24.66	33.16	0.00	110.83	28.18	39.73	0.00	165.67
Total ^a	5,333.65	652.42	4,239.67	6,310.00	5,443.93	854.94	3,791.20	7,097.00
<i>MVPAI (no bouts)</i>	195.85	139.53	37.33	567.00	292.94	196.84	10.50	781.67
<i>MVPAI (in bouts)</i>	91.87	110.03	0.00	368.00	170.07	180.39	0.00	694.17

^aTime spent at all intensity levels.

Daily. For information purposes, daily information is provided in Table 42 for time spent dog walking at a *MVPAI* level without and with bouts. The same pattern held as when average weekly physical activity was examined at baseline and 8 months by dog ownership status. In other words, while the control group's daily physical activity remained constant over time, individuals in the acquired-dog group increased both their daily *MVPAI* (*no bouts*) and *MVPAI* (*in bouts*) from baseline to 8 months.

Table 42

Descriptive Statistics for Daily Physical Activity at Baseline and 8 Months by Dog Ownership Status

Group	Baseline				8 Months			
	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Control								
<i>MVPAI</i> (<i>no bouts</i>)	39.86	33.50	0.71	154.67	39.48	33.38	0.14	33.38
<i>MVPAI</i> (<i>in bouts</i>)	24.59	29.93	0.00	142.17	23.70	29.23	0.00	133.67
Acquired Dog								
<i>MVPAI</i> (<i>no bouts</i>)	27.98	19.93	5.33	81.00	41.85	28.12	1.50	111.67
<i>MVPAI</i> (<i>in bouts</i>)	13.12	15.72	0.00	52.57	24.30	25.77	0.00	99.17

Season. Table 43 provides descriptive statistics for the amount of time the control and acquired-dog groups engaged in moderate- to vigorous-intensity physical activity weekly according to whether they wore the accelerometer in the winter versus another season. At baseline, the control group had higher levels of *MVPAI* without and with bouts in the winter compared to other seasons, while the acquired-dog group had higher levels of *MVPAI* without and with bouts in the non-winter seasons compared to in the winter. At 8 months, both the control and acquired-dog groups engaged in higher

levels of *MVPAI* without and with bouts in the non-winter seasons compared to in the winter. Given that only one participant in the control group wore the accelerometer in the winter, caution should be exercised when interpreting these results.

Table 43

Weekly MVPAI by Season and Dog Ownership Status

Season	<i>n</i>	Control group				Acquired-dog group				
		<i>MVPAI (no bouts)</i>		<i>MVPAI (in bouts)</i>		<i>MVPAI (no bouts)</i>		<i>MVPAI (in bouts)</i>		
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Baseline										
Winter	16	332.84	277.34	219.20	256.44	4	127.29	95.90	6.46	7.46
Not winter	12	207.27	142.31	109.36	102.68	13	216.94	147.00	118.15	113.79
8 Months										
Winter	1	114.33	-	0.00	-	5	170.40	102.83	48.04	37.23
Not winter	27	282.37	235.91	172.04	205.84	12	343.99	206.98	220.92	192.97

In summary, the preliminary analyses revealed that individuals who withdrew after completing the baseline component of the longitudinal study had a lower level of education and poorer self-rated health relative to those who completed all components of the study. Among the individuals who completed the study, those in the control and acquired-dog groups did not differ on any of the demographic variables. The descriptive information revealed that the average weekly time spent at a *MVPAI* without and with bouts remained the same from baseline to 8 months for the control group, but increased over the course of the study for the acquired-dog group.

Main Analyses

In this section, I begin by conducting analyses to compare the physical activity of individuals in the control and acquired-dog groups over the course of the 8-month study. Next, I determine whether individuals in the control and acquired-dog groups are meeting the physical activity guidelines at baseline and 8 months. Following this, I compare the physical and psychological health of both groups over time. Finally, I explore the role that dog walking plays in the physical activity and health of individuals who acquired a dog.

Physical activity. It was hypothesized that as a result of acquiring a dog, individuals in the acquired-dog group would increase their moderate- to vigorous-intensity physical activity over the course of the study, while individuals in the control group would not differ in their physical activity level over time. In order to determine whether participants in the control and acquired-dog groups differed in their weekly moderate- to vigorous-intensity physical activity over time, a two-way mixed ANOVA was conducted, first, using *MVPAI (no bouts)* as the dependent variable and, second,

using *MVPAI (in bouts)* as the dependent variable. The between-subjects independent variable was dog ownership status (control group, acquired-dog group) and the within-subjects independent variable was time 2 (baseline, 8 months). Social desirability was not entered as a covariate for the physical activity analyses, given that it was not significantly correlated with either of the physical activity dependent variables at baseline or 8 months.

As may be seen from Table 44, results from the two-way mixed ANOVA conducted on *MVPAI (no bouts)* revealed that there was a significant main effect for time 2: participants' moderate- to vigorous-intensity physical activity without bouts increased from baseline to 8 months. On the other hand, the main effect for dog ownership status was *not* significant indicating that the control and acquired-dog groups did not differ in their *MVPAI (no bouts)*. The interaction between time 2 and dog ownership status was significant. In the case of the two-way mixed ANOVA performed on *MVPAI (in bouts)*, both the main effect for time 2 and the main effect for dog ownership status were not significant; however, there was a significant time 2 by dog ownership status interaction.

Table 44

ANOVA Results and Means and Standard Deviations for MVPAI at Baseline and 8 Months by Dog Ownership Status

	Control group		Acquired-dog group		<i>F</i> (1,43)	Partial η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
<i>MVPAI (no bouts)</i>						
Baseline	279.02	234.49	195.85	139.53		
8 Months	276.37	233.67	292.94	196.84		
Time 2					5.98*	.122
Dog ownership					0.28	.007
Time 2 x dog ownership					6.68*	.134
<i>MVPAI (in bouts)</i>						
Baseline	172.13	209.51	91.87	110.03		
8 Months	165.90	204.59	170.07	180.39		
Time 2					4.00	.085
Dog ownership					0.48	.011
Time 2 x dog ownership					5.50*	.113

Note. Dog ownership refers to whether participants were in the control or acquired-dog group.

* $p < .05$.

In order to interpret the significant interaction between time 2 and dog ownership status for *MVPAI (no bouts)* and *MVPAI (in bouts)*, simple effects were conducted using the syntax provided by Tabachnik and Fidell (2007). As recommended, the more conservative approach of using a non-pooled rather than pooled error term was adopted

(Keppel, 1991; Myers & Well, 2003).³³ When conducting the physical activity analyses, in order to control the Type 1 error rate, a Bonferroni corrected alpha of .025 was adopted ($\alpha/2$) both when simple effects were conducted on the within-subjects independent variable at the two levels of the between-subjects independent variable and when simple effects were conducted on the between-subjects independent variable at the two levels of the within-subjects independent variable.

MVPAI (no bouts). Simple effects were conducted for the within-subjects independent variable, time 2, to test for mean differences in *MVPAI (no bouts)* between baseline and 8 months at each level of the between-subjects independent variable, dog ownership status. Among participants in the control group, time spent at a *MVPAI level (no bouts)* did not differ between baseline ($M = 279.02$, $SD = 234.49$) and 8 months ($M = 276.37$, $SD = 233.67$), $F(1, 27) = 0.01$, $p = .915$, partial $\eta^2 = .000$. On the other hand, among participants in the acquired-dog group, there was a significant increase in time spent at a *MVPAI level (no bouts)* from baseline ($M = 195.85$, $SD = 139.53$) to 8 months ($M = 292.94$, $SD = 196.84$), $F(1, 16) = 11.42$, $p = .004$, partial $\eta^2 = .417$.

Simple effects were next conducted for the between-subjects independent variable, dog ownership status, to test for mean differences in *MVPAI (no bouts)* between the control and acquired-dog groups at each level of the within-subjects independent variable, time 2. At baseline, participants in the control group ($M = 279.02$, $SD = 234.49$) did not differ in their *MVPAI (no bouts)* from those in the acquired-dog group

³³When the non-pooled error term is used, separate error terms are used for each simple effect; error terms are based solely on the portion of the data that is relevant for the specific simple effect. Using a pooled error term is not recommended, as the risk of committing a Type 1 or Type 2 error may increase depending on the size of the variances from the additional cells that are included in the pooled error term.

($M = 195.85$, $SD = 139.53$), $F(1, 43) = 1.75$, $p = .193$, partial $\eta^2 = .039$. As well, at 8 months, participants in the control group ($M = 276.37$, $SD = 233.67$) did not differ in their *MVPA1 (no bouts)* from those in the acquired-dog group ($M = 292.94$, $SD = 196.84$), $F(1, 43) = 0.60$, $p = .808$, partial $\eta^2 = .001$. These findings are displayed in Figure 2.

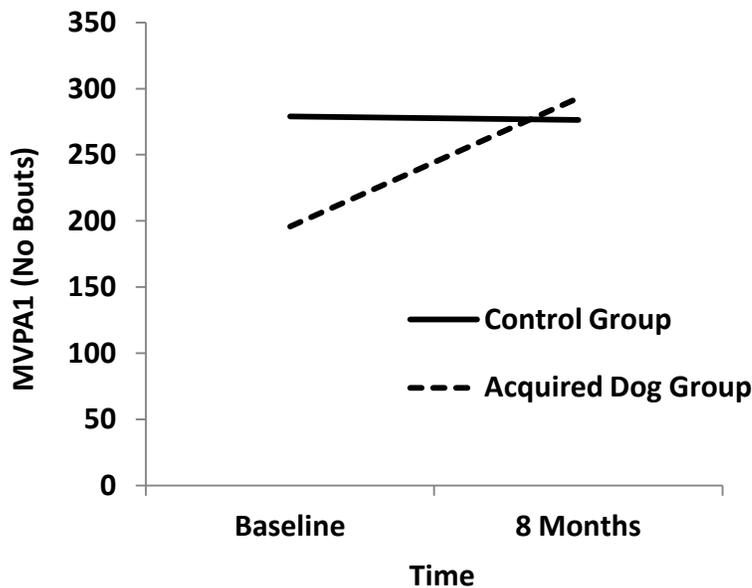


Figure 2. Mean *MVPA1 (no bouts)* at baseline and 8 months by dog ownership status.

MVPA1 (in bouts). Simple effects were conducted for the within-subjects independent variable, time 2, to test for mean differences in *MVPA1 (in bouts)* between baseline and 8 months at each level of the between-subjects independent variable, dog ownership status. Among participants in the control group, time spent at a *MVPA1 level (in bouts)* did not differ between baseline ($M = 172.13$, $SD = 209.51$) and 8 months ($M = 165.90$, $SD = 204.59$), $F(1, 27) = 0.84$, $p = .774$, partial $\eta^2 = .003$. On the other hand, among participants in the acquired-dog group, there was a significant increase in time spent at a *MVPA1 level (in bouts)* from baseline ($M = 91.87$, $SD = 110.03$) to 8 months

($M = 170.07$, $SD = 180.39$), $F(1, 16) = 6.88$, $p = .018$, partial $\eta^2 = .301$.

Simple effects were then conducted for the between-subjects independent variable, dog ownership status, to test for mean differences in *MVPAI (in bouts)* between the control and acquired-dog groups at each level of the within-subjects independent variable, time 2. At baseline, participants in the control group ($M = 172.13$, $SD = 209.51$) did not differ in their *MVPAI (in bouts)* from those in the acquired-dog group ($M = 91.87$, $SD = 110.03$), $F(1, 43) = 2.13$, $p = .152$, partial $\eta^2 = .047$. Similarly, at 8 months, participants in the control group ($M = 165.90$, $SD = 204.59$) did not differ in their *MVPAI (in bouts)* from those in the acquired-dog group ($M = 170.07$, $SD = 180.39$), $F(1, 43) = 0.05$, $p = .945$, partial $\eta^2 = .000$. These results are displayed in Figure 3. Taken together, these findings indicate that participants who acquired a dog increased the amount of time they engaged in moderate- to vigorous-intensity physical activity weekly from baseline to 8 months, irrespective of whether or not they engaged in physical activity in 10-minute bouts.³⁴

³⁴Additional analyses were conducted to ascertain whether participants in the acquired-dog group experienced an increase in both their moderate- and vigorous-intensity physical activity over time. Results revealed that there was a significant increase in dog owners' moderate-intensity physical activity *without bouts* from baseline ($M = 171.19$, $SD = 121.41$) to 8 months ($M = 264.76$, $SD = 169.28$), $F(1, 16) = 12.37$, $p = .003$, partial $\eta^2 = .436$. As well, there was a significant increase in dog owners' moderate-intensity physical activity *in bouts* from baseline ($M = 64.51$, $SD = 85.25$) to 8 months ($M = 135.03$, $SD = 129.62$), $F(1, 16) = 7.58$, $p = .014$, partial $\eta^2 = .321$. However, there was not a significant increase in dog owners' vigorous-intensity physical activity *without bouts* from baseline ($M = 24.66$, $SD = 33.16$) to 8 months ($M = 28.18$, $SD = 39.73$), $F(1, 16) = 0.47$, $p = .501$, partial $\eta^2 = .029$. It was not possible to assess whether there was a significant increase in vigorous-intensity physical *in bouts* over time, given that 70.59% of the participants who acquired a dog did not engage in any vigorous-intensity physical activity *in bouts* at either baseline or 8 months.

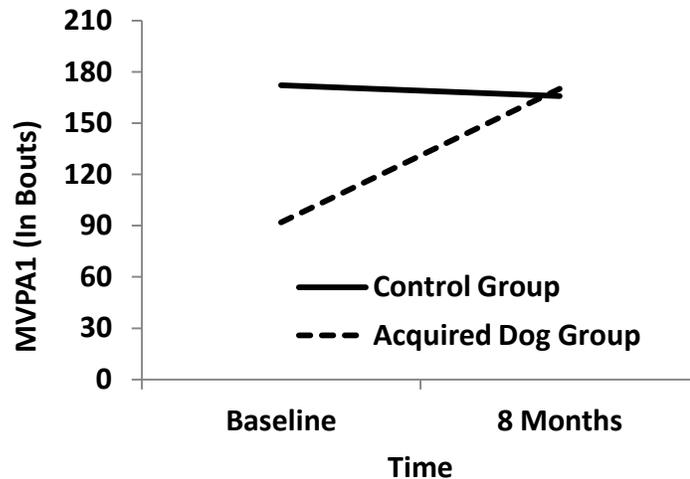


Figure 3. Mean MVPAI (in bouts) at baseline and 8 months by dog ownership status.

Meeting the physical activity guidelines. In the following section, I examine whether acquiring a dog affects the likelihood of achieving the 150- and 300-minute guidelines relative to a control group of non-dog owners. I also look at whether the 150-minute guideline is being met through 30 minutes of moderate- to vigorous-intensity physical activity on at least 5 days of the week by the control and acquired-dog groups. I then utilize the pedometer function of the accelerometer to determine the average number of steps taken daily by both groups. Finally, I examine the percentage of individuals in each group who achieve the benchmark of at least 10,000 steps daily.

Percentage of participants achieving the recommended guidelines. As may be seen from Table 45, at baseline a higher percentage of the participants in the control than the acquired-dog group achieved the 150-minute guideline in bouts, but both groups were similar at baseline when bouts were not included. Dog owners became more active over time; at 8 months 71% of the individuals in the acquired-dog group versus 57% of the individuals in the control group achieved the 150-minute guideline through MVPAI (no bouts). The acquired-dog group also increased their MVPAI (in bouts) from baseline to 8

months with the result that a relatively similar percentage of the acquired-dog group (41%) and control group (46%) achieved the 150-minute guideline at 8 months. With respect to the 300-minute guideline, at baseline a higher percentage of the participants in the control group than the acquired-dog group attained the 300-minute guideline without and with bouts. On the other hand, at 8 months a higher percentage of the participants in the acquired-dog group than the control group attained the 300-minute guideline without and with bouts.

Table 45

Percentage of Participants Attaining Weekly Physical Activity Criteria at Baseline and 8 Months by Dog Ownership Status

	Control group (%)		Acquired-dog group (%)	
	Baseline	8 Months	Baseline	8 Months
≥ 150 minutes of <i>MVPAI</i> (no bouts)	67.86	57.14	64.71	70.59
≥ 150 minutes of <i>MVPAI</i> (in bouts)	42.86	46.43	23.53	41.18
≥ 300 minutes of <i>MVPAI</i> (no bouts)	42.86	39.29	17.65	52.94
≥ 300 minutes of <i>MVPAI</i> (in bouts)	14.29	14.29	5.88	23.53

Odds of meeting the 150-minute guideline. Binary logistic regression analyses were conducted to examine the odds of participants in the acquired-dog group achieving the recommended 150-minute guideline relative to the control group at baseline and 8 months. I hypothesized that, at baseline, individuals in the acquired-dog group would not be more likely than those in the control group to achieve 150 minutes of moderate- to vigorous-intensity physical activity weekly, while at 8 months individuals in the acquired-dog group would be more likely to meet the guideline than those in the control group. The outcome variable was coded as follows: did not achieve the 150-minute

guideline = 0, achieved the 150-minute guideline = 1. The independent variable, dog ownership status, was coded as follows: control group = 0, acquired-dog group = 1.

Consistent with expectations, at baseline the odds of achieving the 150-minute guideline through *MVPAI (no bouts)* did not differ for those in the control versus acquired-dog group (*OR*, 0.87; 95% CI [0.24, 3.10], *p* = .828). Contrary to expectations, at 8 months the odds of achieving the 150-minute guideline through *MVPAI (no bouts)* also did not differ by dog ownership status (*OR*, 1.80; 95% CI [0.50, 6.50], *p* = .370). Similarly, the odds of achieving the 150-minute guideline through *MVPAI (in bouts)* did not differ for those in the control versus acquired-dog groups at either baseline (*OR*, 0.41; 95% CI [0.11, 1.58], *p* = .195) or 8 months (*OR*, 0.81; 95% CI [0.24, 2.73], *p* = .731).

Odds of meeting the 300-minute guideline. Binary logistic regression analyses were conducted to examine the odds of participants in the acquired-dog group achieving the recommended 300-minute guideline relative to the control group at baseline and 8 months. I hypothesized that, at baseline, individuals in the control and acquired-dog groups would not differ in their likelihood of achieving 300 minutes of moderate- to vigorous-intensity physical activity weekly. On the other hand, I hypothesized that, at 8 months, dog owners would be more likely to achieve the 300-minute guideline compared to those in the control group. The outcome variable was coded as follows: did not achieve the 300-minute guideline = 0, achieved the 300-minute guideline = 1. Consistent with expectations, at baseline the odds of achieving the 300-minute guideline through *MVPAI (no bouts)* did not differ for those in the control versus acquired-dog groups (*OR*, 0.29; 95% CI [0.07-1.22], *p* = .091). Contrary to expectations, at 8 months the odds of achieving the 300-minute guideline through *MVPAI (no bouts)* also did not differ

by dog ownership status (*OR*, 1.74; 95% CI [0.52-5.87], $p = .373$).³⁵

Attaining 30 minutes of MVPAI on 5 days. The percentage of participants who attained the recommended 150-minute guideline through 30 minutes of MVPAI on 5 days of the week without and with bouts was examined (Table 46).³⁶ At baseline, the percentage of individuals who achieved 30 minutes of MVPAI on 5 days of the week was fairly similar for individuals in the control and acquired-dog groups. On the other hand, at 8 months a higher percentage of the individuals in the acquired-dog group than in the control group achieved 30 minutes of MVPAI on 5 days of the week.

Table 46

Percentage of Participants Attaining 30 Minutes of MVPAI on 5 Days of the Week at Baseline and 8 Months by Dog Ownership Status

	Control group (%)		Acquired-dog group (%)	
	Baseline	8 Months	Baseline	8 Months
At least 30 minutes of MVPAI on at least 5 days (no bouts)	28.57	32.14	23.53	58.82
At least 30 minutes of MVPAI on at least 5 days (in bouts)	10.71	14.29	5.88	23.53

Step counts. Using the pedometer function of the accelerometer, I determined the average daily step count for the control and acquired dog groups over the course of the

³⁵Binary logistic regression analyses were not conducted to examine the likelihood of individuals in the acquired-dog group achieving the recommended 300 minutes of MVPAI (*in bouts*) relative to the control group at baseline and 8 months, given that the cell sizes were too small. Among the individuals in the acquired-dog group, only one participant at baseline and four participants at 8 months achieved 300 minutes of MVPAI (*in bouts*).

³⁶Binary logistic regression analyses were not conducted due to the small cell sizes.

study (Table 47). The control group had similar step counts at baseline and 8 months, while the acquired dog group increased their average daily step count from baseline to 8 months.

Table 47

Daily Step Count by Dog Ownership Status

	Baseline		8 Months	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Control group				
Average daily step count	8,779.34	4,073.85	8,626.49	4,276.80
Acquired dog group				
Average daily step count	7,530.29	3,036.50	9,893.56	3,991.84

Given that researchers have recommended that to be considered active individuals should accumulate at least 10,000 steps daily (Tudor-Locke & Bassett, 2004), I determined the percentage of individuals in the control and acquired-dog groups who achieved the 10,000 step guideline at both time periods (Table 48). At baseline, a considerably lower percentage of the individuals in the acquired dog group (12%) achieved the 10,000 step guideline compared to in the control group (32%). On the other hand, at 8 months the percentage of individuals in both groups who achieved the 10,000 step guideline was virtually identical (approximately 35%), which indicates that dog owners became more active over time.

I also looked at whether those participants who achieved 10,000 steps on average daily also achieved 150 minutes of *MVPAI* weekly without and with bouts. It is noteworthy that *all* of the participants in the control and acquired-dog groups who

achieved 10,000 steps on average daily also met the weekly 150-minute guideline when bouts were not taken into consideration. At 8 months, all of the participants in the control group and 83% of the participants in the acquired-dog group who attained 10,000 steps on average daily also met the weekly 150-minute guideline in 10-minute bouts.

Table 48

Percentage Attaining 10,000 Steps and Percentage Achieving 10,000 Steps and 150-Minute Guideline at Baseline and 8 Months by Dog Ownership Status

	Control group (%)		Acquired-dog group (%)	
	Baseline	8 Months	Baseline	8 Months
On average \geq 10,000 steps daily	32.14 (<i>n</i> = 9)	35.71 (<i>n</i> = 10)	11.76 (<i>n</i> = 2)	35.29 (<i>n</i> = 6)
Participants achieving average of 10,000 steps daily who also achieved \geq 150 minutes of <i>MVPAI</i> (<i>no bouts</i>) weekly	100.00 (<i>n</i> = 9)	100.00 (<i>n</i> = 10)	100.00 (<i>n</i> = 2)	100.00 (<i>n</i> = 6)
Participants achieving average of 10,000 steps daily who also achieved \geq 150 minutes of <i>MVPAI</i> (<i>in bouts</i>) weekly	88.89 (<i>n</i> = 8)	100.00 (<i>n</i> = 10)	50.00 (<i>n</i> = 1)	83.33 (<i>n</i> = 5)

Physical and psychological health. It will be recalled that I hypothesized that dog owners would increase their moderate- to vigorous-intensity physical activity over the course of the study and that this would result in dog owners having improved physical and psychological health over time. On the other hand, I hypothesized that the control group would not become more physically active over the course of the study and, therefore, would not experience changes in their health over time. Below, I present the three sets of analyses that I conducted to assess whether participants in the acquired-dog

and control groups differed in their health over time.

Physical health assessed at two time periods. A two-way mixed MANOVA was performed on two physical health dependent variables: the PILL and self-rated health. The between-subjects independent variable was dog ownership status (control group, acquired-dog group) and the within-subjects independent variable was time 2 (baseline, 8 months). As may be seen from Table 49, results revealed that neither the main effect for time 2 nor the main effect for dog ownership status were significant. These findings indicate that, first, participants did not experience a significant change over time on the combined physical health dependent variable and, second, participants in the control and acquired-dog groups did not differ significantly on the combined physical health dependent variable. Finally, the interaction between time 2 and dog ownership status was not significant.

The MANOVA was re-run controlling for the influence of social desirability, as social desirability was correlated with the PILL at both baseline and 8 months.³⁷ A two-way mixed MANCOVA revealed that social desirability was significantly associated with the combined physical health dependent variable, Wilks' $\lambda = .863$, $F(2, 41) = 3.27$, $p = .048$, partial $\eta^2 = .137$. As may be seen from Table 49, after controlling for the influence of socially desirable responding, both the main effect for time 2, the main effect for dog ownership status and the interaction between time 2 and dog ownership status continued to be non-significant.

³⁷Social desirability was not associated with self-rated health at either baseline or 8 months.

Table 49

MANOVA and MANCOVA Results for Physical Health

	<i>df</i>	Wilks' λ	<i>F</i>	Partial η^2
No covariate				
Time 2	2, 42	.998	0.05	.002
Dog ownership status	2, 42	.986	0.31	.014
Time 2 x dog ownership status	2, 42	.881	2.83	.119
Social desirability entered as covariate				
Time 2	2, 41	.982	0.38	.018
Dog ownership status	2, 41	.967	0.71	.033
Time 2 x dog ownership status	2, 41	.888	2.58	.112

Psychological health assessed at two time periods. A two-way mixed MANOVA was performed on three psychological health dependent variables: depression, self-esteem and life satisfaction. The between-subjects independent variable was dog ownership status (control group, acquired-dog group) and the within-subjects independent variable was time 2 (baseline, 8 months). As may be seen from Table 50, the main effect for time 2 was not significant; participants did not experience a significant change over time on the combined psychological health dependent variable. In addition, the main effect for dog ownership status was not significant; the control and acquired-dog groups did not differ significantly on the combined psychological health dependent variable. However, the time 2 by dog ownership status interaction was significant.

Given that social desirability was correlated with depression, self-esteem and life satisfaction at baseline and 8 months, the MANOVA was re-run with social desirability

entered as a covariate. Results from the two-way mixed MANCOVA revealed that social desirability was not associated with the combined psychological health dependent variable, Wilks' $\lambda = .836$, $F(3, 40) = 2.61$, $p = .065$, partial $\eta^2 = .164$. As may be seen from Table 50, the results from the model with social desirability entered as a covariate did not differ from the model without social desirability entered as a covariate (i.e., the main effects were not significant, while the interaction was significant). Given these findings, additional analyses were conducted without social desirability entered as a covariate.

Table 50

MANOVA and MANCOVA Results for Psychological Health

	<i>df</i>	Wilks' λ	<i>F</i>	Partial η^2
No covariate				
Time 2	3, 41	.913	1.30	.087
Dog ownership status	3, 41	.863	2.16	.137
Time 2 x dog ownership status	3, 41	.786	3.73*	.214
Social desirability entered as a covariate				
Time 2	3, 40	.987	0.18	.013
Dog ownership status	3, 40	.875	1.91	.125
Time 2 x dog ownership status	3, 40	.790	3.55*	.210

* $p < .05$.

To investigate the significant multivariate time 2 by dog ownership status interaction, follow-up two-way mixed ANOVAs were conducted separately for each of the psychological health dependent variables: depression, self-esteem and life satisfaction. As may be seen from Table 51, although none of the main effects were

significant, the time 2 by dog ownership status interaction was significant for life satisfaction.

Table 51

ANOVA Results and Means and Standard Deviations for Three Psychological Health

Measures at Baseline and 8 Months by Dog Ownership Status

	Control group		Acquired-dog group		<i>F</i> (1,43)	Partial η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Depression						
Baseline	0.82	0.56	0.79	0.63		
8 Months	0.88	0.59	0.69	0.54		
Time 2					0.10	.002
Dog ownership					0.46	.011
Time 2 x dog ownership					1.31	.030
Self-esteem						
Baseline	2.07	0.53	1.96	0.59		
8 Months	2.10	0.60	2.14	0.60		
Time 2					2.55	.056
Dog ownership					0.50	.001
Time 2 x dog ownership					1.27	.029
Life satisfaction						
Baseline	4.40	1.40	3.36	1.32		
8 Months	4.17	1.34	3.85	1.34		
Time 2					1.12	.025
Dog ownership					2.91	.063
Time 2 x dog ownership					8.32**	.162

Note. Dog ownership refers to whether participants were in the control or acquired-dog group.

** $p < .01$.

In order to interpret the significant interaction between time 2 and dog ownership status for life satisfaction, simple effects were conducted. To begin, simple effects were conducted for the within-subjects independent variable, time 2, to test for mean differences in life satisfaction between baseline and 8 months at each level of the between-subjects independent variable, dog ownership status, using a Bonferroni corrected alpha of .025. Among participants in the control group, life satisfaction did not differ between baseline ($M = 4.40$, $SD = 1.40$) and 8 months ($M = 4.17$, $SD = 1.34$), $F(1, 27) = 2.59$, $p = .119$, partial $\eta^2 = .088$. Similarly, among individuals in the acquired-dog group, life satisfaction did not differ over time (baseline: $M = 3.36$, $SD = 1.32$; 8 months: $M = 3.85$, $SD = 1.34$), $F(1, 16) = 5.00$, $p = .040$, partial $\eta^2 = .238$.

Simple effects were subsequently conducted for the between-subjects independent variable, dog ownership status, to test for mean differences in life satisfaction between the control and acquired-dog groups at each level of the within-subjects independent variable, time 2, using a Bonferroni corrected alpha of .025. At baseline, participants in the control group ($M = 4.40$, $SD = 1.40$) were significantly less satisfied with life compared to those in the acquired-dog group ($M = 3.36$, $SD = 1.32$), $F(1, 43) = 6.03$, $p = .018$, partial $\eta^2 = .123$. On the other hand, at 8 months, participants in the control group ($M = 4.17$, $SD = 1.34$) did not differ in their life satisfaction from those in the acquired-dog group ($M = 3.85$, $SD = 1.34$), $F(1, 43) = 0.62$, $p = .436$, partial $\eta^2 = .014$. These findings are displayed in Figure 4.

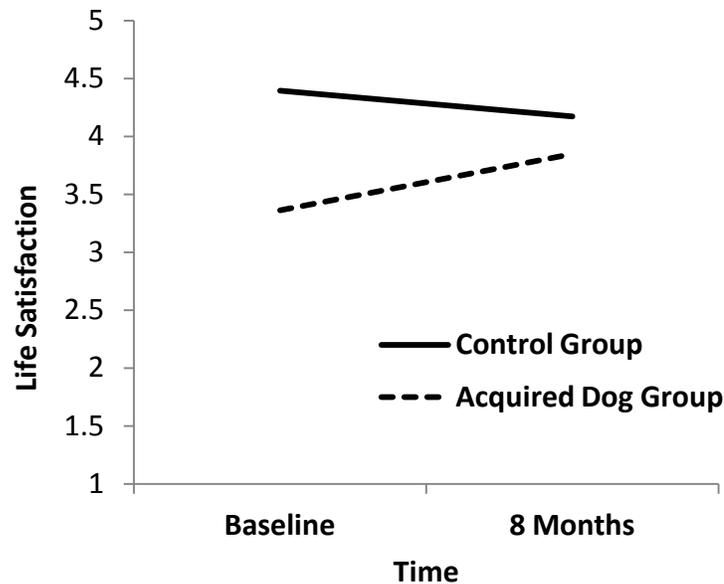


Figure 4. Mean life satisfaction scores at baseline and 8 months by dog ownership status.

Health assessed at three time periods. In order to obtain additional insight into the possible health changes that may result from dog owners increasing their moderate- to vigorous-intensity physical activity through time spent dog walking, participants completed a number of 1-item health measures (BMI, trouble sleeping and stress) at three time periods over the course of the study. Three separate 2 x 3 mixed ANOVAs were performed on BMI scores, trouble sleeping and stress. Dog ownership status was the between-subjects independent variable (control group, acquired-dog group) and time 3 was the within-subjects independent variable (baseline, 4 months, 8 months).³⁸ Social desirability was not entered as a covariate in these analyses, as it was unrelated to the three health measures at baseline, 4 months and 8 months.

³⁸Three separate mixed ANOVAs were conducted rather than a single mixed MANOVA, given that the three health variables were unrelated at baseline, only trouble sleeping and stress were associated at 4 months, $r(43) = .32$, and only BMI and stress were associated at 8 months, $r(43) = .33$.

Results for the mixed ANOVAs conducted on each of the dependent variables (BMI, trouble falling asleep and stress) revealed that neither the main effect for time 3, the main effect for dog ownership status nor the time 3 by dog ownership status interaction were significant. The ANOVA results and means and standard deviations are presented in Table 52.

Table 52

ANOVA Results and Means and Standard Deviations for Three Health Measures at Three Time Periods by Dog Ownership Status

	Control group		Acquired-dog group		<i>df</i>	<i>F</i>	Partial η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
BMI							
Baseline	27.46	5.84	26.15	4.03			
4 Months	27.26	5.71	25.87	4.35			
8 Months	27.21	5.62	26.21	4.41			
Time 3					2, 86	1.37	.031
Dog ownership					1, 43	0.60	.014
Time 3 x dog ownership					2, 86	0.97	.022
Trouble sleeping							
Baseline	2.61	1.10	2.76	1.15			
4 Months	2.57	1.00	2.29	0.92			
8 Months	2.64	1.16	2.59	0.87			
Time 3					2, 86	1.94	.043
Dog ownership					1, 43	0.04	.001
Time 3 x dog ownership					2, 86	1.34	.030
Stress							
Baseline	2.89	0.83	3.12	0.93			
4 Months	2.82	0.86	2.76	0.56			
8 Months	2.93	0.90	3.06	0.83			
Time 3					2, 86	1.95	.043
Dog ownership					1, 43	0.21	.005
Time 3 x dog ownership					2, 86	0.70	.016

Note. Dog ownership refers to whether participants were in the control or acquired-dog group.

Dog walking. In this section, I move from examining all of the physical activity obtained during waking hours to only the physical activity obtained through dog walking. I begin by examining the intensity level of the physical activity obtained dog walking. I then provide descriptive information for factors that may affect weekly time spent dog walking at a moderate- to vigorous-intensity level. Finally, I examine dog owners' perceptions of the ways that acquiring a dog and walking it may have affected their physical activity and health.

Physical activity obtained dog walking. The accelerometer data from the dog walks of the 17 individuals in the acquired-dog group were used to examine the physical activity obtained while dog walking at 8 months. I began by examining the weekly amount of time spent dog walking at each intensity level. More than half of the time spent dog walking was at a moderate- (49%) or vigorous- (6%) intensity level. The remaining time was spent either sedentary (7%) or at a light-intensity level (38%). Next, I examined the weekly amount of time spent dog walking at each intensity level and at a moderate- to vigorous-intensity level without and with bouts (Table 53). It is noteworthy that, on average, dog owners achieved the weekly 150-minute guideline through dog walking when *MVPAI* was not restricted to 10-minute bouts. Furthermore, when time spent dog walking was examined in 10-minute bouts, on average dog owners achieved more than 100 minutes of *MVPAI* weekly through dog walking alone.

Table 53

Descriptive Statistics for Weekly Time Spent Dog Walking by Intensity Level at 8 Months

Weekly time spent dog walking				
Intensity level	<i>M</i>	<i>SD</i>	Min	Max
Sedentary	19.97	14.57	2.03	57.19
Light	103.96	57.64	14.00	199.01
Moderate	133.40	132.10	4.69	415.31
Vigorous	17.43	33.34	0.00	133.00
Total ^a	274.77	195.99	50.05	717.43
<i>MVPA (no bouts)</i>	150.83	156.05	4.69	548.31
<i>MVPAI (in bouts)</i>	109.84	127.31	0.00	443.31

^aTime spent dog walking at all intensity levels.

The contribution that dog walking made to dog owners' overall weekly physical activity at each intensity level is reported in Table 54. Dog walking accounted for 50% of the physical activity that individuals in the acquired-dog group engaged in at a moderate-intensity level over the course of the week. In the case of vigorous-intensity physical activity, dog walking accounted for 62% of dog owners' weekly vigorous physical activity. The fact that dog walking was responsible for more than half of the dog owners' weekly *MVPAI* (51%) reflects the key role that dog walking plays in dog owners' overall physical activity engaged in at a *MVPAI*.

Table 54

Percentage of Weekly Time Spent at Each Intensity Level Achieved Through Dog Walking (No Bouts) at 8 Months

Group	% time at each intensity level				
	Sedentary	Light	Moderate	Vigorous	MVPAI
Acquired-dog group	0.52	7.89	50.39	61.86	51.49

Finally, I utilized the pedometer function of the accelerometer to determine the number of steps taken at 8 months. On average, participants in the acquired-dog group achieved 2,828.17 steps daily ($SD = 2,496.00$) through dog walking, with the number of steps taken daily ranging from 389.67 to 9,448.67. Only one dog owner came close to achieving the guideline of at least 10,000 steps daily through dog walking alone.

Factors that may affect time spent dog walking. In this section, I examine a number of possible factors that may affect time spent dog walking including: the characteristics of the dog, whether the dog was walked by other people, the season the dog was walked and whether the dog owner experienced problems with the dog misbehaving. Given the small sample of dog owners ($n = 17$), these statistics are presented solely for descriptive purposes.

Characteristics of the dog. In Table 55, the average weekly time spent dog walking is presented according to the dog's size, age and breed exercise requirement. Although the sample is small, the figures indicate that medium size dogs are walked for the most time weekly, while small dogs are walked for the least time. In addition, dogs who are more than 1 year of age are walked for more time weekly compared to those who are 1 year or less. Finally, dogs from a breed requiring a high level of exercise were

walked for more time weekly than dogs from a breed requiring a moderate level of exercise.

Table 55

Weekly Time Spent Dog Walking at 8 Months by Size, Age and Breed Exercise Requirement

Variable	<i>n</i>	<i>MVPAI (no bouts)</i>		<i>MVPAI (in bouts)</i>	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Size of dog					
Small	4	107.85	91.92	81.24	78.77
Medium	2	188.02	233.33	124.99	176.76
Large	11	159.70	172.86	117.48	143.21
Age of dog					
≤ 1 year	10	117.08	124.70	89.10	105.68
> 1 year	7	199.04	192.36	139.46	157.25
Breed exercise requirement ^a					
Low	0	0	0	0	0
Moderate	6	104.24	87.36	70.83	72.54
High	7	198.15	195.19	152.03	160.06

^aFour participants who had a mixed breed dog that was from breeds that required different levels of exercise were excluded.

Whether someone else walks the dog. To determine whether the dog owner was the only person who takes the dog for walks, dog owners were asked to indicate at 8 months whether someone else walks their dog instead of them some of the time. The majority of the dog owners, 88.24% ($n = 15$), indicated that someone else walks their dog without them some of the time. When these dog owners were asked to indicate who walks their dog without them, the most common response was that another family member (e.g., spouse, child) walks their dog, 60.0% ($n = 9$). Other people who walk the dog include boyfriends, 20.0% ($n = 3$), a professional dog walker, 13.33% ($n = 2$) and

friends, 13.33% ($n = 2$).³⁹

When time spent dog walking at a *MVPAI level (no bouts)* was examined according to whether someone else walks the dog some of the time, on average, those dog owners who had someone else walk their dog for them some of the time obtained 146.63 minutes weekly ($SD = 166.33$), while those who did not have someone else walk their dog some of the time obtained 182.35 minutes weekly ($SD = 6.14$). When the groups were compared on their average time spent dog walking at a *MVPAI level (in bouts)*, there was almost no difference between the groups: 110.15 minutes weekly ($SD = 136.09$) for those who had someone else walk the dog sometimes and 107.59 minutes weekly ($SD = 3.51$) for those who always walked the dog themselves.⁴⁰

Season the dog was walked. Table 56 presents the time spent dog walking according to the season that the data on dog walking were collected at 8 months. Although data were only collected from a small number of dog owners each season, from the figures it appears that dog owners walk their dog for less time in the winter relative to the other seasons. As well, it appears that dog owners spend the most time dog walking in the spring.

³⁹Some dog owners listed more than one individual who walks their dog.

⁴⁰The small standard deviations for time spent dog walking at a *MVPAI level (no bouts)* and *MVPAI level (in bouts)* among those who always walked their dog themselves reflects the fact that there were only two individuals in this group and these individuals spent a similar amount of time dog walking.

Table 56

Weekly Time Spent Dog Walking at 8 Months by Season Walked Dog

Season	<i>n</i>	<i>MVPAI (no bouts)</i>		<i>MVPAI (in bouts)</i>	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Winter	5	42.13	17.55	15.79	17.58
Spring	3	277.92	174.22	206.66	120.97
Summer	5	147.94	86.09	116.99	81.52
Fall	4	195.00	246.75	145.83	203.68

Experienced problems with dog misbehaving. At 8 months, dog owners were asked to indicate whether they had experienced any difficulties as a result of acquiring a dog in order to determine whether their dog had behavioural problems that could affect the time they spent dog walking. The 70.59% ($n = 12$) of dog owners who indicated that they had experienced difficulties with their dog were asked to describe the challenges. Half of the 12 dog owners listed more than one difficulty, with the most common difficulty being dog behavioural problems (75.00%, $n = 9$). The next most frequently mentioned difficulties were the responsibility/time needed to care for the dog (41.67%, $n = 5$) and unexpected dog health problems (25.00%, $n = 3$).

Time spent dog walking was examined according to whether the dog owner indicated that their dog had behavioural problems, as owners of dogs who misbehave may walk their dog for less time weekly compared to those whose dogs do not misbehave. When time spent dog walking weekly at a *MVPAI level (no bouts)* was examined, on average, dogs who had behavioural problems were walked for 117.56 minutes ($SD = 104.73$), while those without behavioural problems were walked for

188.26 minutes ($SD = 200.25$). Similarly, dogs with behavioural problems ($M = 71.54$, $SD = 77.80$) were walked for less time at a *MVPAI level (in bouts)* relative to those without behavioural problems ($M = 152.92$, $SD = 161.63$).

Questions about reasons for acquiring a dog and resulting changes. At baseline, in order to assess whether one of the main reasons for acquiring a dog was to obtain physical activity, participants in the acquired-dog group were asked to provide their top three reasons for acquiring a dog. Slightly more than half, 52.94% ($n = 9$), indicated that one of their top three reasons was to obtain exercise.⁴¹ In order to determine whether participants in the acquired-dog group perceived that one of the main benefits of dog ownership was the physical activity obtained through dog walking, at 8 months they were asked to describe the two main benefits of owning a dog. Half of the 16 dog owners who responded to this question, 50.00% ($n = 8$), indicated that one of the top two benefits of owning a dog was the exercise they obtained.⁴² It is noteworthy that of the nine dog owners who indicated that one of their main reasons for acquiring a dog was to obtain exercise, 66.67% ($n = 6$) reported that exercise was one of the main benefits that they received from acquiring a dog. Two dog owners who did *not* identify exercise as a reason for acquiring a dog did, however, report that exercise was a benefit of acquiring a dog.

Dog owners were asked a number of closed- and open-ended questions to determine whether they perceived that their physical activity and health had changed over

⁴¹The other top reasons for acquiring a dog included a love of dogs/animals (58.82%, $n = 10$) and for companionship (52.94%, $n = 9$).

⁴²The most frequently cited benefit of owning a dog was companionship (68.75%, $n = 11$). Exercise was the next most frequently cited benefit.

the course of the study. At 8 months, in response to a question asking how acquiring a dog had affected the amount of time they spend engaging in physical activities, the majority indicated that their physical activity level had increased after acquiring a dog; 70.59% ($n = 12$) exercised somewhat more and 23.53% ($n = 4$) considerably more. Only one participant (5.88%) indicated that they exercised considerably less.⁴³

At 8 months, in response to a question asking owners about the effect of acquiring a dog on their health, the overwhelming majority, 88.24% ($n = 15$), indicated that the dog had made a difference. When these dog owners were asked to explain how acquiring a dog had affected their health, nine of the 15 dog owners (60.00%) indicated that the dog resulted in them increasing their physical activity. Other health-related benefits mentioned by dog owners included losing weight, a healthier lifestyle, feeling less stressed and sleeping better. Dog owners were also asked to rate their current health at 8 months compared to their health at baseline. Almost half of the dog owners, 47.06% ($n = 8$), indicated that their health was somewhat better at 8 months compared to at baseline. The same percentage, 47.06% ($n = 8$), reported that their health had not changed, while one dog owner (5.88%) reported somewhat worse health.

Summary

The results from the 8-month longitudinal study revealed that individuals who acquired a dog became more physically active over the course of the 8-month study, while the control group did not differ in their physical activity level over time. On average, from baseline to 8 months participants who acquired a dog increased their moderate-to vigorous-intensity physical activity in 10-minute bouts by 97 minutes and by

⁴³For this question, no participants selected the following response options: somewhat less or the same.

70 minutes when bouts were not taken into consideration. Furthermore, while only 24% of the individuals in the acquired-dog group achieved the Canadian guideline of 150-minutes of moderate- to vigorous-intensity physical activity weekly in 10-minute bouts at baseline, a considerably higher percentage did so at 8 months, 42%.

The quantitative analyses revealed that individuals in the acquired-dog group did not experience any improvements in either their physical or psychological health over the course of the 8-month study relative to the control group. On the other hand, when dog owners' responses to the closed- and open-ended questions regarding their health were examined at 8 months, it was apparent that dog owners perceived that their health had improved as a result of acquiring a dog. The overwhelming majority, 88%, of dog owners indicated at 8 months that acquiring a dog had made a difference to their health and provided examples such as lost weight, less stressed and sleep better. Furthermore, nearly half of the dog owners, 47%, reported improvements in their health at 8 months relative to baseline.

When the physical activity obtained through dog walking was examined, more than half of the time spent dog walking at 8 months, 55%, was at a moderate- to vigorous-intensity level, which indicates that dog walking is one means of obtaining physical activity at the recommended intensity level for health benefits. When the contribution that dog walking made to dog owners' overall weekly physical activity was examined, dog walking accounted for 51% of the acquired-dog group's overall weekly moderate- to vigorous-intensity physical activity. Finally, the important role that dogs can play in obtaining physical activity was highlighted by the finding that, among the dog owners who indicated that one of their main reasons for acquiring a dog was to obtain

exercise, two-thirds reported that exercise was one of the main benefits that they received from acquiring a dog.

Discussion

The purpose of this dissertation was to obtain a greater understanding of the physical activity obtained through dog walking when physical activity was objectively assessed using accelerometers and to examine the possible short- and long-term health benefits from dog walking. The findings indicate that dog walking is an activity that can be engaged in to obtain physical activity at the recommended intensity level for health benefits. One of the factors affecting the length of time dog owners spend walking their dog, the size of the dog, is noteworthy as it is something that can be taken into consideration by individuals who are acquiring a dog. The finding that all of the regular dog walkers walked their dog for its well-being is important, as it indicates that dog walking is a purposeful physical activity and, therefore, more likely to promote long-term adherence. When the possible short- and long-term health benefits from dog walking were examined, the findings were mixed. Although dog owners experienced immediate psychological health benefits after walking their dog, the increase in physical activity that occurred after acquiring a dog did not translate into either physical or psychological health benefits over the course of the 8-month study.

I begin the discussion with the findings from my study of regular dog walkers (Study 1). I present information to show that dog walking is an effective way of obtaining the physical activity needed for health benefits and highlight the factors that affect dog owners' walking behaviour. Following this, I explore the finding that dog walking confers immediate psychological health benefits. I then move to the longitudinal

component of my dissertation (Study 2). I discuss the finding that individuals who acquired a dog became more physically active over time and examine the role that dog walking plays. Next, I provide possible explanations for the unexpected finding that individuals who acquired a dog and walked it did not experience improvements in their physical or psychological health over time relative to the control group. Finally, I present the strengths and limitations of this dissertation and provide suggestions for future research.

Understanding Dog Walking as a Form of Physical Activity

The accelerometer data from the study of regular dog walkers provides evidence that dog walking is an effective way of obtaining physical activity at the intensity level recommended for health benefits. A key finding was that dog walkers spent a considerable amount of time dog walking over the course of the week at a *MVPAI* level: 146 minutes (in bouts) and 210 minutes (no bouts). Furthermore, 38% of the dog walkers met the 150-minute Canadian physical activity guideline through dog walking alone, which is considerably higher than the 22% of Canadians who achieved the 150-minute guideline based on their overall weekly physical activity (Statistics Canada, 2015b).

In order to understand the physical activity obtained dog walking, it is necessary to determine the amount of time spent at each intensity level. This is important as dog walkers may reduce their pace or stop on account of either the needs of their dog (Gaunet et al., 2014) or the social interactions that occur on their dog walks (Lee et al., 2009). The most frequent intensity level was moderate (46%), while the least amount of time was spent at a vigorous-intensity level (6%). From these statistics, it can be seen that more than half of the time spent dog walking (52%) was at the *MVPAI* level called for in

the guidelines. Dog walkers spent the remaining time at a light-intensity level (34%) or were sedentary (14%). The finding that dog owners walked their dog at a light-intensity level one-third of the time is of interest, given that researchers have found that light-intensity physical activity provides some health benefits (Healy et al., 2007; Howard et al., 2015; Loprinzi, 2013).

While the results from the present study are positive for dog owners who walk their dog, researchers have found that a considerable percentage of dog owners do not walk their dog, with findings ranging from 20% to 59% (Bauman et al., 2001; Richards et al., 2013). Furthermore, non-dog walkers are less likely to meet recommended physical activity guidelines than dog walkers (Coleman et al., 2008; Lentino et al., 2012; Reeves et al., 2011). The finding from this dissertation that dog walking is a viable means of meeting the Canadian physical activity guideline highlights the need to identify ways of encouraging those dog owners who do not walk their dog to do so.

When possible factors affecting time spent dog walking weekly at a *MVPAI* level in 10-minute bouts were examined, there were five noteworthy factors. Three were *personal characteristics of the participant* (age, marital status and living alone) and two were *characteristics of the dog* (dog size and dog health). The factor size of the dog is important as individuals who are planning to acquire a dog can choose the size of their dog, although their choice may be limited by factors such as the size of their dwelling. Owners of small dogs spent less time weekly walking their dog compared to owners of both medium and large dogs. Interestingly, not all of the small dogs in the present study were from a breed that required a low level of exercise; however, in a qualitative study, Cutt et al. (2008c) found that dog owners perceive that small dogs require less exercise,

regardless of their actual exercise requirement.

In order to provide insight into dog walking as a means of increasing physical activity, participants were asked to complete a number of open-ended questions. Of particular interest was the finding that 33% of the dog walkers indicated that one of the main reasons they acquired a dog was to obtain exercise. A similar figure (36%) was obtained when Westgarth et al. (2015) examined the percentage of dog owners in their UK sample who acquired a dog for exercise. Individuals who are planning to acquire a dog in order to increase their physical activity need to be made aware that there are differences in dog exercise requirements according to not only the size but also the breed of the dog.

When dog walkers were asked through an open-ended question why they walked their dog, they all indicated that they did so for their dog's well-being. As an example, one dog walker stated that "*I walk my dog because he NEEDS and DESERVES it.*" If a dog owner's primary rationale for walking his/her dog is for its benefit, factors relating to the owner's relationship with their dog would merit particular attention when exploring what affects time spent dog walking. This suggestion is supported by qualitative and quantitative research findings that dog owners who report a greater sense of obligation/responsibility for their dog's well-being walk their dog more frequently (Brown & Rhodes, 2006; Cutt et al., 2008c).

Short-Term Health Benefits from Dog Walking

Although a number of researchers have conducted longitudinal studies to examine the possible long-term changes in health from dog walking (Johnson & Meadows, 2010; Serpell, 1991; Thorpe et al., 2006), there have been no quantitative studies examining the

possibility that dog owners may experience immediate psychological health benefits from walking their dog. I addressed the need for such a study by assessing dog walkers' psychological health before and after they walked their dog. Dog walkers' psychological health was ameliorated on six out of seven measures. Dog walkers felt less stressed after walking their dog and experienced an increase in their energy, self-esteem, social life satisfaction and overall life satisfaction as well as a more positive mood. These findings had large effect sizes (Cohen, 1988), which indicates that dog walkers experienced substantial improvements in their psychological health after walking their dog.

It may appear surprising that dog walking confers immediate psychological health benefits; however, this finding is consistent with previous research, which found that engaging in a single session of physical activity is associated with psychological health benefits (Daley & Welch, 2004; Landers & Petruzzello, 1994; North et al., 1990; Szabo, 2003). Further evidence that dog walkers experience immediate psychological health benefits from dog walking is provided by their responses to a question about the benefits, if any, that they receive from dog walking. Participants described various ways that their psychological health improved, such as by reducing their level of stress and improving their mood. Furthermore, this finding is consistent with the results from Knight and Edwards' (2008) qualitative study of dog walkers. A theme that emerged when they conducted 10 focus groups was that the dog owners felt better psychologically once they were out walking their dog.

Based on dog walkers' responses to closed- and open-ended questions, it appears that the changes in psychological health after dog walking may vary depending on a number of factors. One such factor is dog walkers' social interactions on their dog

walks.⁴⁴ Sandstrom and Dunn (2014) found that even brief social interactions, such as smiling, making eye contact and having a brief conversation with individuals with whom one has weak social ties, are beneficial for psychological health. In the present study, all but one dog walker typically engaged in social interactions with the people they encountered on their dog walks, either through exchanging brief greetings or conversing with the people they met. On average, dog walkers encountered someone on 67% of their dog walks.

Two ways that the social interactions that occur while dog walking may be beneficial for dog walkers' immediate psychological health have been suggested. Harris (2007) observed that, although the social ties among dog walkers were generally weak, this may be beneficial for dog walkers' psychological health as they tend to engage in light, casual conversations that focus on impersonal matters and, as a result, they do not dwell on stressful personal matters. According to Laurier, Maze, and Lundin (2006), dog walking provides dog owners with the opportunity to meet new people, which reduces feelings of loneliness and social isolation. In the present study, when dog walkers were asked about the main benefits of dog walking, 46% cited social interactions on their dog walks as one of the main benefits.

It is also possible that the environment in which the dog is walked affects the short-term health benefits obtained from dog walking. The term "green exercise" has been developed to describe physical activity, such as dog walking, that is engaged in while at the same time being exposed to nature (Pretty, Griffin, Sellens, & Pretty, 2003).

⁴⁴As noted earlier, according to Wood and Christian (2011), the social interactions that occur through dog walking fall on a continuum that ranges from subtle forms of acknowledgement (e.g., waving), conversing, dog walking together to the development of friendships.

A multitude of studies have found that engaging in green exercise is more salutary for people's mental health compared to exercising in a non-green environment (Bratman, Daily, Levy, & Gross, 2015; Focht, 2009; Harte & Eifert, 1995; Nisbet & Zelenski, 2011; Thompson Coon et al., 2011).

Support for the possible beneficial effects of dog walking in nature is provided by studies that assessed participants' mental health immediately before and after they engaged in green exercise. The studies revealed that participants experienced reduced levels of anxiety and stress, improved mood and increased self-esteem when they left a greenspace compared to when they arrived at it (Barton, Hine, & Pretty, 2009; Barton & Pretty, 2010; Mackay & Neill, 2010; Pretty et al., 2007; Rogerson, Brown, Sandercock, Wooller, & Barton, 2015). The dog walkers in the present study may have experienced greater psychological health benefits on those dog walks that occurred in a greenspace (50%) than in a non-greenspace. It is noteworthy that one-third of the dog walkers cited being in nature as a benefit of dog walking. Taken together, the findings from this dissertation highlight the need to explore in more depth the short-term psychological health benefits from dog walking and factors that may moderate this relationship.

Changes in Physical Activity After Acquiring a Dog

There is concern about the low percentage of Canadians who are sufficiently active and the negative ramifications for people's health (Statistics Canada, 2015b; Warburton et al., 2007). Given that 1 in 3 Canadian households have a dog (Canadian Animal Health Institute, 2015) and that dogs require regular exercise, dog walking has been identified as one means of obtaining physical activity. In the longitudinal component of this dissertation, I examined whether acquiring a dog does in fact lead to an

increase in physical activity. As hypothesized, participants in the acquired-dog and control groups differed in their physical activity levels from baseline to 8 months on both *MVPAI (in bouts)* and *MVPAI (no bouts)*. Participants in the acquired-dog group became more physically active over time, while participants in the control group did not differ in their physical activity level over the course of the study.

It is noteworthy that large effects were detected when the acquired-dog group was compared at baseline and 8 months on their *MVPAI* in 10-minute bouts (partial $\eta^2 = .301$) and their *MVPAI* without bouts (partial $\eta^2 = .417$) based on Cohen's (1998) conventions for interpreting the magnitude of effect sizes. On average, dog owners increased their weekly *MVPAI (in bouts)* by 1 hour and 18 minutes from baseline to 8 months and increased their weekly *MVPAI (no bouts)* by 1 hour and 37 minutes. These figures demonstrate that individuals who acquired a dog and walked it experienced a sizeable increase in their weekly *MVPAI*. Furthermore, participants perceived that they had become more active over the course of the study. At 8 months, 71% indicated that they exercised somewhat more and 24% that they exercised considerably more as a result of acquiring a dog.

The finding that at 8 months participants in the acquired-dog group did not differ from the control group in either their minutes of *MVPAI* or their likelihood of achieving the 150-minute guideline is not consistent with previous research. When earlier cross-sectional self-report studies (Duvall Antonacopoulos, 2009; Gretebeck et al., 2013; Lentino et al., 2012; Reeves et al., 2011; Shibata et al., 2012) and one accelerometer study (Coleman et al., 2008) compared the physical activity levels of dog walkers and non-dog owners, they found that dog walkers were more physically active relative to non-

dog owners. Furthermore, previous cross-sectional studies have found that dog walkers are more likely to meet the physical activity guidelines compared to non-dog owners (Coleman et al., 2008; Reeves et al., 2011; Shibata et al., 2012).

In order to explore possible reasons for the non-significant difference between the control and acquired-dog groups at 8 months, the physical activity levels of the participants in the present study were compared to those of Canadian adults. According to the latest figures from Statistics Canada (2015b), adults in the general population achieved an average of 12 minutes of *MVPAI (in bouts)* daily and 22% achieved the 150-minute weekly guideline in bouts. In the present study, I anticipated that individuals in the acquired-dog group would be more active relative to the Canadian population 8 months after acquiring a dog. On the other hand, I anticipated that at baseline (before they acquired a dog) they would be similar. When physical activity figures were examined at baseline, the acquired-dog group had virtually identical figures to those from Statistics Canada; on average they achieved 13 minutes daily of *MVPAI (in bouts)* and 24% achieved 150 minutes weekly of *MVPAI (in bouts)*.

In the case of the control group, I anticipated that over the course of the study they would have similar physical activity figures to those from Statistics Canada (2015b). However, at baseline and 8 months the control group's figures were higher relative to those from Statistics Canada. On average daily, individuals in the control group engaged in 25 minutes of *MVPAI (in bouts)* at baseline and 24 minutes at 8 months. With respect to the percentage meeting the 150-minute guideline in bouts, 43% did so at baseline and 46% at 8 months. From these figures, it appears that the fact that the control group was more physically active relative to the population as a whole may have contributed to the

finding that the acquired-dog and control groups did not differ at 8 months.

The fact that the control group was more active over the course of the 8-month study relative to Canadians as a whole may be due to the recruitment method that was used for this group. Participants in the control group were recruited from the volunteer section of Kijiji and Craigslist and invited to take part in a physical activity and health study. It is possible that individuals in the volunteer section who were more physically active were more inclined to sign-up for a study that involved wearing an accelerometer. In the case of the acquired-dog group, given the challenge of finding a sufficient number of participants, additional methods were used. The figures for the dog group may be closer to the national figures, given that one of the additional methods involved the use of online-panels of individuals from across Canada. Furthermore, individuals who signed-up for this study likely focused on the pet-related eligibility requirement (i.e., they had to be planning to acquire a dog within the next 3 months), rather than on the fact that it was a physical activity study.

An important component of the longitudinal study was the determination of the role that dog walking played in the physical activity obtained by the participants who acquired a dog. This was achieved by examining the accelerometer data for the time that individuals who acquired a dog spent dog walking at 8 months. Over the course of a week, dog owners accumulated a considerable amount of *MVPAI* through dog walking: 110 minutes (in bouts) and 151 minutes (no bouts). When the contribution that dog walking made to participants' overall weekly moderate- and vigorous-intensity physical activity was examined, dog walking accounted for 50% of dog owners' moderate-intensity physical activity and 62% of their vigorous-intensity physical activity. These

figures emphasize the important role that dog walking can play with respect to dog owners' *MVPAI*.

Dog owners' responses to the open-ended questions in the longitudinal study suggest that they were aware of the potential exercise-related benefits that dogs may confer. At baseline, 53% of the individuals in the acquired-dog group indicated that one of their main reasons for acquiring a dog was to obtain physical activity. Furthermore, when these individuals were asked at 8 months about the main benefits of dog ownership, 67% cited exercise. Thus, it appears that not only does dog walking make a major contribution to participants achieving physical activity at the recommended intensity level, but that a sizeable percentage of dog owners consider the physical activity benefits when acquiring a dog.

Long-Term Changes in Health After Acquiring a Dog

I expected that individuals who acquired a dog would become more physically active and, as a result, would experience improvements in their health over the 8-month study, given the link between physical activity and health (U.S. Department of Health and Human Services, 2008; Warburton et al., 2007). Therefore, I hypothesized that participants who acquired a dog would experience improvements in their physical and psychological health over the course of the study, while participants in the control group would not experience changes in their health over time. Surprisingly, although participants who acquired a dog became more physically active over the course of the study, they did not experience improvements in either their physical or psychological health over time compared to the control group.

Although the quantitative findings indicated that dog owners' health did not

improve over the course of the study as a result of acquiring a dog and walking it, based on dog owners' responses to closed- and open-ended questions it is apparent that many dog owners perceived that their health improved as a result of acquiring a dog. The overwhelming majority (88%) of dog owners perceived that acquiring a dog had made a difference to their health and cited the following health benefits: more active, lost weight, healthier lifestyle, less stressed and sleep better. Furthermore, nearly half (47%) perceived that their health had improved at 8 months compared to baseline. A possible explanation for these seemingly contradictory findings is provided by Herzog's (2011) suggestion that, as a result of extensive media coverage on the benefits of pet ownership, it has become widely accepted by the general public that pet ownership is beneficial for health, even though there are mixed findings. Therefore, participants in the present study may have believed that they should have experienced health benefits as a result of acquiring a dog. However, given that dog owners reported a number of different health benefits at 8 months, a more likely explanation is that the small sample size of the present study made it difficult to detect health effects.

A drawback of the types of physical health measures (minor health problems, self-reported health, BMI) used in this longitudinal study is that they do not assess the main chronic health diseases including coronary heart disease, stroke, high blood pressure, adverse blood lipid profile, type 2 diabetes, metabolic syndrome, and colon and breast cancer that have been strongly linked to physical inactivity (U.S. Department of Health and Human Services, 2008). Of the studies conducted to date examining the possible physical health benefits from dog walking, only one study conducted in the general population by Lentino et al. (2012) examined whether dog walkers and non-dog owners

differed in their likelihood of having a physical inactivity-related chronic disease.

Lentino et al. (2012) found that compared to non-dog owners, dog walkers were less likely to report having been diagnosed by a doctor in the past year with diabetes or hypertension (i.e., high blood pressure). This suggests that that some of the physical health benefits from acquiring a dog may not have been captured in the current study.

With respect to psychological health, it is possible that the challenges associated with being a new dog owner contributed to individuals who acquired a dog not experiencing improvements in their psychological health over time relative to the control group. Support for this possibility is provided by the fact that when dog owners were asked at 8 months whether they had experienced any difficulties as a result of acquiring a dog, 71% responded positively. Furthermore, the most commonly experienced problem was dog behavioural problems (75%). If dogs misbehaved on their walks, it is unlikely that the owners would have experienced improvements in their psychological health as these may have been offset by the stress experienced as both the dog and owner adapted to dog walking.

Another possible explanation for the non-significant health findings relates to the time frame of the study. It is possible that a period longer than 8 months is necessary to detect changes in health from dog walking. Dog walking is a unique activity, in that dog owners must ensure that their dog is trained to walk with them before they can go on lengthy walks. Although the majority of dog owners (94%) indicated that they began walking their dog within the first month of acquiring it, at 8 months 59% of the sample had a dog who was one year of age or less. This indicates that a sizeable percentage of the sample acquired a puppy. The UK Kennel Club (2015b) cautions that, since puppies

tire more easily than adult dogs, they need to be taken on shorter walks. As an example, at 3 to 4 months puppies should be walked for a maximum of 15 to 20 minutes daily split into two walks. Once the dog becomes an adult, it can then be walked at the amount of time recommended for the breed, which according to the UK Kennel Club (2015a) varies from up to 30 minutes to more than 2 hours daily. This suggests that the dog owners in the present study who acquired puppies may have spent less time walking for a considerable portion of the study and that these walks may not have been at the *MVPAI* level recommended for health benefits.

Strengths and Limitations of the Current Research

A major strength of the study of regular dog walkers was the use of accelerometers, rather than a self-report measure, to assess time spent dog walking. Having objective information about the time spent at each intensity level while dog walking is important, given that the results revealed that dog owners spent a considerable amount of time at a sedentary- or light-intensity level (48%) on their dog walks over the course of a week. One limitation is the fact that the findings from this study cannot be generalized to all dog walkers, given that the sample was restricted to dog owners who walked their dog at least three times a week for periods that typically lasted at least 10 minutes. Yet another limitation stems from the fact that the overwhelming majority of the data (80%) were collected during one season, summer.

The component of this dissertation that examined whether there were immediate psychological health benefits from dog walking had two limitations. First, the dog walkers may have discerned that the researcher was examining whether there were changes in their psychological health immediately after walking their dog, which could

have affected the manner in which they responded. However, the fact that the dog walkers provided this information as part of the dog-walking log that was completed before and after every dog walk over the course of a week means that this was less likely to occur. Second, a drawback of the 1-item visual analogue scales used in the present study was the fact that it was readily apparent to dog walkers what aspect of their psychological health was being assessed. For example, depression was assessed by asking participants to indicate "How depressed do you feel at the moment?" One way of addressing this limitation would be to use indirect multi-item measures, such as the short form of the Profile of Mood States that has been used to assess pre-post changes in mental health from green exercise (Barton & Pretty, 2010).

For the longitudinal component of this dissertation, it was not possible to randomly assign participants to a group that either did or did not acquire a dog. As a result, it was necessary to utilize a quasi-experimental longitudinal design in which individuals who were actively seeking to acquire a dog and those who were not planning to do so were recruited. Given the challenge of finding individuals who were planning to acquire a dog and then actually adopted a dog, the sample was comprised of only 17 dog owners, which limits the generalizability of the findings. Another limitation was that it was not possible to include a group of non-dog walkers due to the small sample size.

An important strength of the physical activity component of the longitudinal study was the use of an objective measure of physical activity, however a limitation of the health component was the use of self-report measures. While, ideally, physical health would be assessed using objective measures (e.g., cholesterol level), it was not feasible to do so in the present study. The self-report physical health measures were selected

because they are commonly used in other studies assessing the possible benefits of dog walking for physical health. For example, numerous studies have compared dog walkers and non-dog owners' self-reported BMIs (Coleman et al., 2008; Gretebeck et al., 2013; Lentino et al., 2012; Shibata et al., 2012) and self-reported health (Lentino et al., 2012; Shibata et al., 2012). As well, in Serpell's (1991) longitudinal study of adults who acquired a dog, physical health was assessed through a self-report checklist of 20 minor health complaints (e.g., colds and flu, a bad back).

A different type of limitation stems from the attrition rate for the longitudinal study. Of the individuals who completed the baseline component of the study, 63% also completed the 4 and 8 month components of the study (i.e., an attrition rate of 37%). When attrition analyses were conducted comparing completers and non-completers on dog ownership status, demographic variables, physical activity dependent variables and health dependent variables, the groups differed on only two variables.⁴⁵ First, non-completers had poorer self-rated health relative to the completer group. However, the groups did not differ on the 54-item PILL on which higher scores are associated with more physician visits, more use of aspirin and more sick days (Pennebaker, 1982). Second, a higher percentage of the completers had at least one university degree (58%) compared to the non-completers (36%). Given that the longitudinal study was onerous involving the completion of a lengthy survey and wearing an accelerometer for a week at

⁴⁵As noted earlier, the chi-square test that was conducted to determine whether there was an association between completing all components of the longitudinal study and dog ownership status approached significance; a lower percentage of the participants who planned to acquire a dog completed all aspects of the study compared to the control group. This result likely reflects the fact that, while some of the individuals in the planned-to-acquire-a-dog group decided not to continue participating in the study, others were unable to do so as they did not acquire a dog.

two different time periods, only those participants with higher levels of education who might have more appreciation for the importance of research may have been willing to comply with the demands of the study. Therefore, additional research is needed in order to ensure that the findings hold for Canadians with all levels of education.

A limitation that arises when using accelerometers is the researcher's lack of control over the use of the accelerometers. As a result, there is a risk that some of the participants may not have followed the study instructions for wearing the accelerometer. For example, participants may have worn the device incorrectly, which could have resulted in inaccurate physical activity information. However, given that participants were provided with a detailed diagram showing how the device should be worn and were contacted to ensure they did not have any questions, it is unlikely that this was a major problem.

A final limitation of the dissertation was the fact that information was not collected regarding the ethnicity of the participants. The findings from two American studies suggest that ethnicity affects not only whether the dog is walked, but the amount of time that is spent dog walking. In the first study, Coleman et al. (2008) found that dog walkers were more likely to be white compared to both non-dog walkers and non-dog owners. In the second study, when Richards (2015) utilized data from the 2009 National Health Travel Survey to examine the sociodemographic characteristics of dog walkers in the United States, she found that African Americans, Asians and Hispanics were less likely to accumulate at least 30 minutes in 10-minute bouts in one day through dog walking compared to Caucasians. These findings highlight the need for future Canadian studies to consider the potential role of ethnicity.

Future Research

Based on the findings from the study of regular dog walkers, an area that merits further attention is the possible short-term health benefits from dog walking. Given that this dissertation focused solely on comparing dog walkers' psychological health immediately before and after they walked their dog, there is a need for researchers to examine the possible short-term effects of dog walking on dog owners' physical health. This could be achieved by assessing risk indicators for chronic diseases that are associated with physical inactivity, such as blood pressure (Thompson et al., 2001).

An area that merits further attention is how individual differences in conscientiousness influence dog walking behaviour. In the present study, the sample of regular dog walkers had high levels of conscientiousness; on a scale ranging from 1 to 7 dog walkers had a mean score of 6.07. Research is needed to determine whether those dog owners who regularly walk their dog are more conscientious compared to those who do not regularly walk their dog and those who never walk their dog. If those dog owners who regularly walk their dog are more conscientious relative to the other two groups, this information would be important when exploring ways to encourage those dog owners who walk their dog minimally or not at all to walk their dog regularly.

The potential role of the canine-human bond is an important factor that should be taken into consideration in future studies, given that it is unclear from the research conducted to date whether dog owners' level of attachment to their dog affects their walking behaviour. While studies conducted in Australia (Hoerster et al., 2011) and the United States (Cutt et al., 2008a) found that dog walkers and non-dog walkers had similar levels of attachment to their dog, a Japanese study found that dog walkers were more

highly attached to their dog compared to those who did not walk their dog (Oka & Shibata, 2012). When the relationship between dog owners' attachment level and walking behaviour was examined, Schneider et al. (2015) did not find evidence that dog owners' level of attachment to their dog was associated with either the number of times or the number of minutes the dog was walked weekly. On the other hand, Headey et al. (2008) found that, among a sample comprised of female dog owners, those who had higher levels of attachment to their dog exercised more frequently over the course of a week. Taken together, these findings highlight the need for researchers to further explore through both quantitative and qualitative studies whether dog owners' attachment level is a dog walking correlate.

The finding that all of the regular dog walkers indicated that one of the main reasons they walked their dog was for its well-being provides evidence that dog walking is a purposeful physical activity, which is important given that such activities are more likely to promote long-term adherence than activities that are only engaged in for the purpose of obtaining exercise (Morgan, 2001). This suggests that the promotion of dog walking for the dog's benefit may be an effective way of encouraging physical activity among dog owners. Support for this approach is provided by a recent Canadian pilot study conducted over a 12-week period, which found that providing dog owners who did not walk their dog regularly with written material on the benefits of canine exercise resulted in a significantly higher step count at 12 weeks relative to the control group of dog owners who did not receive written material (Rhodes, Murray, Temple, Tuokko, & Wharf Higgins, 2012). Additional research is needed to determine the most effective way of communicating to dog owners the need to walk their dog for its well-being (e.g.,

through veterinarians or the provision of written material through avenues such as pet stores).

There is concern about not only the increase in the number of overweight and obese adults, but also the increase in the number of overweight and obese canines (Sandøe, Palmer, Corr, Astrup, & Bjørnvad, 2014). Approximately 69% of Americans adults were overweight or obese in 2011-2012 (National Center for Health Statistics, 2015), while approximately 53% of American dogs were overweight or obese in 2014 (Association for Pet Obesity Prevention, 2015). There is evidence that dog walking is beneficial in terms of weight loss for both dog owners and their dogs (e.g., Kushner, Blatner, Jewell, & Rudloff, 2006). This emphasizes the important role that veterinarians can play in promoting physical activity both directly for the health of the dog and indirectly for the health of the dog owner. The interrelationship between canine and human health is the focus of the *One Health Initiative*, which is described in its vision statement as being "dedicated to improving the lives of all species—human and animal—through the integration of human medicine, veterinary medicine and environmental science" (One Health Initiative, 2015).

The results from the study of regular dog walkers indicate that there is a need for researchers to explore how the immediate psychological health benefits from dog walking affect dog walkers after the walk has ended. The fact that researchers have found that the psychological health benefits from engaging in a single episode of physical activity extend from 1 to 24 hours (Cox et al., 2001; Daley & Welch, 2004; Maroulakis & Zervas, 1993; Sibold & Berg, 2010) suggests that the psychological health benefits from dog walking may extend for a period after the dog walk. As well as determining how long the

psychological health benefits last, there is a need to examine how the immediate psychological health benefits affect other areas of the dog walkers' lives, such as their interactions with others after the dog walk. As an example, given that dog walkers were in a better mood, more satisfied with life and less stressed after walking their dog, this may translate into more positive interactions with family, friends and/or co-workers.

In the longitudinal component of this dissertation, the possible physical activity-related health benefits from dog walking were examined separately for physical and psychological health. However, future studies need to take into account the fact that physical and psychological health are not independent. According to the Canadian Mental Health Association Ontario (2015), the two are fundamentally linked; poor mental health increases the risk for chronic diseases, while individuals with chronic diseases have an increased risk of developing mental health problems. Furthermore, according to the WHO (2004b), the importance of mental health in maintaining good physical health, and vice versa, is well substantiated. The Canadian Mental Health Association Ontario (2015) notes that one way of preventing both poor physical and psychological health is through physical activity. Given that the findings from this dissertation revealed that individuals who acquired a dog became more physically active over time, future longitudinal studies examining the possible health benefits arising from dog walkers increased physical activity levels need to take into consideration the interrelationship between physical and psychological health.

Given that the findings from the present study provide evidence that acquiring a dog leads to an increase in moderate- to vigorous-intensity physical activity over the course of an 8-month period, future studies should consider utilizing the Transtheoretical

Model (Prochaska, Redding, Evers, 2008) to explore the stages of change that individuals who acquire a dog move through. For example, if we were to consider the data from the current study through the lens of the Transtheoretical Model, we can see that at baseline, 47% of the individuals in the acquired-dog group did not identify exercise as one of their reasons for seeking to acquire a dog and, therefore, were in the first stage, *precontemplation*. Similarly, the remaining 53% of the individuals in the acquired-dog group were in the next stage, *contemplation*, as they indicated that one of the reasons they were planning to acquire a dog was for exercise. By 8 months, all of the individuals in the acquired-dog group were obtaining physical activity through dog walking and had been doing so for more than 6 months. Therefore, the individuals in the acquired-dog group were in the final stage of change, *maintenance*. Research is needed to determine what factors are associated with individuals who plan to acquire a dog moving from the *precontemplation* to the *maintenance* stage of dog walking.

The fact that a considerable percentage of the dog owners in the longitudinal study acquired either a puppy and/or a dog with behavioural problems may have resulted in dog owners being unable to take their dog on long walks for a considerable period after acquiring it. Therefore, although the individuals who acquired a dog were obtaining a high level of physical activity at a *MVPAI* level at 8 months through dog walking, it is not known how much time they spent dog walking over the first 7 months of the study. When examining the effect of dog walking on health, future longitudinal studies should take into consideration how much time is spent dog walking at a *MVPAI* level over the course of the study.

The findings from this dissertation highlight the considerable difference when the

average time spent dog walking at a *MVPAI* level is assessed with and without 10-minute bouts taken into consideration. In the study of regular dog walkers, when weekly time spent dog walking at a *MVPAI* level was examined, time spent dog walking dropped by 64 minutes when only 10-minute bouts were included (from 210 minutes without bouts to 146 minutes in bouts). Similarly, in the longitudinal study, time spent dog walking weekly at 8 months dropped by 41 minutes when only 10-minute bouts were included (from 151 minutes without bouts to 110 minutes in bouts). It is noteworthy that the latest Australian guidelines no longer call for physical activity to be engaged in at a *MVPAI* level in 10-minute bouts (Australian Government Department of Health, 2014). Research is needed to determine whether physical activity needs to be carried out at a *MVPAI* level for periods lasting at least 10 minutes to provide health benefits, as is currently the requirement in the Canadian physical activity guidelines (Canadian Society for Exercise Physiology, 2011). This issue is particularly important in the case of dog walking, given that the nature of dog walking is such that a considerable amount of the time spent dog walking is not in bouts.

Conclusions

The fact that less than one-quarter of Canadians are sufficiently active is of concern in light of the negative health consequences associated with insufficient physical activity (Statistics Canada, 2015b; Warburton et al., 2007). Given the popularity of dogs as household pets and their need for exercise, dog walking has been suggested as one way to obtain physical activity (Bauman et al., 2001). Although this may seem like a logical conclusion, it was first necessary to objectively determine how much of the physical activity obtained dog walking is done at the moderate- to vigorous-intensity level

recommended for health benefits. Results from the week-long study of regular dog walkers revealed that more than half of the time spent dog walking was at a moderate- to vigorous-intensity level. Furthermore, approximately 2 in 5 of the regular dog walkers achieved the recommended 150-minute guideline in 10-minute bouts through dog walking alone, while 3 out of 5 did so when bouts were not taken into consideration.

A new area that was explored in this dissertation was the possible change in dog walkers' psychological health immediately after they walked their dog. The finding that dog walkers experienced considerable improvement in their psychological health immediately after walking their dog suggests that an area that warrants attention is the short-term physical health benefits from dog walking. Future research also needs to explore the possible immediate effect on dog walkers' psychological health of dog walk-related factors, such as the dog walkers' social interactions on the dog walk and the environment in which the dog is walked.

The longitudinal component of this dissertation examined whether acquiring a dog leads to an increase in physical activity. Results revealed that individuals who acquired a dog increased their physical activity level from baseline to 8 months. Further support for the exercise-related benefits from acquiring a dog comes from the finding that 67% of the individuals who identified exercise as a main reason for acquiring a dog indicated at 8 months that obtaining exercise was a major benefit of owning a dog.

Contrary to expectations, participants who acquired a dog and walked it and the control group of non-dog owners did not differ in their physical or psychological health over the course of the study. A number of possible explanations were suggested, such as the small sample, the time frame and the types of measures used to assess health.

Although the quantitative component of this dissertation did not provide evidence that becoming more physically active after acquiring a dog was beneficial for health, a sizeable percentage of the dog owners perceived that their health had improved 8 months after becoming a dog owner. This highlights the need for additional research to explore further the possible physical activity-related health benefits from dog walking.

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Appendix A: Online Survey for Study 1

In order to complete the following survey, you need to enter the unique code that was e-mailed to you along with the link to this survey:

Enter Code:

If you have misplaced your code, please contact Nikolina at ndantona@connect.carleton.ca and it will be sent to you again.

Section 1 (Screening Questions)

Indicate the date that you are completing this survey:

Date: _____ Month: _____ Year: _____

Country in which currently live (tick one):

Canada

Other Please specify: _____

Indicate whether you live in (tick one):

City or town

Rural area/farm

Indicate whether you are (tick one):

under 18 years of age

18 years of age or older

→ If you are at least 18 years of age, indicate your age: _____

Do you currently own more than 1 dog? (circle) Yes / No

On average, how many days a week do you walk your dog? (*Note: In this study, whenever there is a reference to walking with your dog this includes jogging with your dog*)

_____ 3 or more days a week

_____ less than 3 days a week

When you take your dog out for a walk, how long does it usually last? (tick one)

_____ Less than 10 minutes

_____ 10 or more minutes

Are you a professional dog walker? (circle) Yes / No

Next

Section 2

1) Sex (tick one):

_____ Male

_____ Female

→ If female, are you pregnant? (circle) Yes / No

2) Marital status (tick one):

_____ Single

_____ Cohabiting (lived with partner for less than 1 year)

_____ Common-law (lived with partner for 1 or more years)

_____ Married

Separated

Divorced

Widowed

3) What is your highest level of education (tick one):

Elementary school

Some high school

Finished high school

Some college

College degree

Some university

One university degree

Two or more university degrees

4) What is your annual family household income before tax? (tick one)

\$19,999 or less

\$20,000 to \$39,999

\$40,000 to \$59,999

\$60,000 to \$79,999

\$80,000 to \$99,999

\$100,000 to \$119,999

\$120,000 to \$139,999

\$140,000 or more

5) Do you live alone? (circle) Yes / No

6) Do you have children under 18 years of age living at home?

_____ Yes

_____ No

→ If yes, provide their ages: _____

7) What is your height (in either):

_____ or _____
Centimeters Feet Inches

8) What is your weight (in either):

_____ or _____
Kilograms Pounds

Next

Section 3

1) Do you have a fenced backyard where you can let your dog out? (circle) Yes / No

2) What breed(s) is your dog (if your dog is a mixed breed, indicate the main breed if you can): _____

3) Indicate the size of your dog (tick one):

_____ Small (e.g., Dachshund, Chihuahua, Toy Poodle)

_____ Medium (e.g., Bulldog, Cocker Spaniel, Beagle)

_____ Large (e.g., Husky, Labrador Retriever, Standard Poodle)

_____ I am unsure of the size of my dog

4) Indicate your dog's height from the floor to its shoulder (in either):

 or
Centimeters Feet Inches

5) Indicate your dog's weight (in either):

 or
Kilograms Pounds

6) Indicate the age of your dog (tick one):

- 1 year or less
- 2 years
- 3 years
- 4 years
- 5 years
- 6 years
- 7 years
- 8 years
- 9 years
- 10 years
- 11 years
- 12 years or more

7) In a typical week, does someone else walk your dog without you? (circle) Yes / No

If Yes, indicate who walks your dog without you (e.g., spouse, child, professional dog walker):

If Yes, indicate in a typical week how often someone else walks your dog without you:

- _____ 1 day a week
- _____ 2 days a week
- _____ 3 days a week
- _____ 4 days a week
- _____ 5 days a week
- _____ 6 days a week
- _____ 7 days a week

8) In a typical week, are there other dog owners with whom you walk on some of your dog walks? (tick one)

- yes
- no

→ *If Yes*, indicate how often you walk with the other dog owners (tick one):

- _____ Always
- _____ Often
- _____ Occasionally
- _____ Rarely

9) Which of the following statements describes your typical social interactions with the people you encounter on your dog walks? (tick one)

- _____ I do not interact with the people I encounter
- _____ I only exchange brief greetings (e.g., hello) with the people I encounter
- _____ I converse with the people I encounter

Next

Section 4**Ten-Item Personality Inventory (TIPI)**

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

- 1 = Disagree strongly**
- 2 = Disagree moderately**
- 3 = Disagree a little**
- 4 = Neither agree nor disagree**
- 5 = Agree a little**
- 6 = Agree moderately**
- 7 = Agree strongly**

I see myself as:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.

Next

Section 5

1) Do you have any health conditions that affect the length of time you can walk your dog? (tick one)

yes
 no

→ *If Yes*, please describe the condition(s).

2) Does your dog have any health conditions that affect the length of time it can be walked? (tick one)

yes
 no

→ *If Yes*, please describe the condition(s).

Next

Section 6

Describe your reasons for getting a dog.

Describe why you walk your dog.

Next

Thank you for taking part in the first part of our study!

For the next part of our study, we would like you to wear a physical activity monitoring device on all of your dog walks over the course of a week and complete a dog-walking log and a brief survey.

If you do so, you will receive:

- a \$10 gift card from a choice of six stores
- a personalized profile of your dog walking physical activity.

To participate in the next part of our study, please e-mail Nikolina at ndantona@connect.carleton.ca and state that you would like to participate in **Part 2: Dog Walking Study.**

In your e-mail, include the following:

- your name, phone number and mailing address
- the code that was included in the e-mail that was sent to you containing the survey link

Once you e-mail Nikolina, she will be in touch with you shortly by e-mail to let you know when you will be mailed a package containing a physical activity monitoring device and the dog-walking log and brief survey.

Appendix B: Cover Letter and Instructions (Drop Off Version) for Study 1

Dear Participant,

Welcome to the second part of our dog walking study! This is your opportunity to help us understand dog walking as a form of physical activity.

The package that you received contains the following:

- this **booklet**, which has questions about your dog walks
- a **physical activity monitoring device** and **waist band**

Don't be intimidated by the length of this booklet. It looks long because it contains forms for all of your possible dog walks over the course of a week. However, **it takes less than a minute** to complete each set of dog walking questions.

To assist you in remembering to wear the physical activity monitoring device on all of your dog walks, we suggest that you keep this booklet and the physical activity monitoring device in the **same place as your dog's leash**.

To make it easier for you, we have put a plastic tie on this booklet and on the bag containing the physical activity monitoring device, so you can hang these materials with your dog's leash.

Do not let anyone else wear the physical activity monitoring device, even if they walk your dog without you.

Please ensure that the study materials are stored in a location where your dog cannot mistake the physical activity monitoring device for a snack!

Thank you,

Nikolina Duvall Antonacopoulos
Ph.D. Candidate, Carleton University

Dr. Timothy Pychyl
Faculty Sponsor, Carleton University

What do I need to do?

Day 1 to Day 7

- Begin this study on the day **after** you received the envelope containing the physical activity monitoring device and this booklet. **If you are going to be away some of the time during the next 7 days, contact Nikolina about a new date to start wearing the physical activity monitor, as we would like you to wear the physical activity monitoring device for 7 consecutive days.**
- For the **next 7 days**, wear the physical activity monitoring device on all of your dog walks and complete the questions in the section of this booklet entitled “*Dog-Walking Log*.”

Before every dog walk...

Step 1: Complete the pre-dog walk questions in the “*Dog-Walking Log*.”

Step 2: Put on the physical activity monitoring device and then put on your dog’s leash.

Step 3: Begin your dog walk.

After every dog walk....

Step 1: As soon as you return from your dog walk, remove your dog’s leash and the physical activity monitoring device.

Step 2: Immediately after, complete the post-dog walk questions in the “*Dog-Walking Log*.”

Day 8

- Complete the section of this booklet entitled “*Additional Questions*.”
- Contact Nikolina to let her know that you have finished participating in the study. She will arrange to pick up the study materials (i.e., this booklet, the physical activity monitoring device and the waist band).

If you have any questions about the instructions for this study, please contact Nikolina at ndantona@connect.carleton.ca



Instructions for Wearing the Physical Activity Monitoring Device

Please read the following instructions carefully:

- The physical activity monitoring device should be attached to the waist band and worn around your waist. The monitoring device should be located above your **RIGHT** hip.
- When the physical activity monitoring device is positioned correctly, **the device should be right side up so that the word “ActiCal” appears at the bottom of the device (towards your feet) and is parallel to the ground.**



- You can wear the physical activity monitoring device either below or above your clothing (whichever is more comfortable).
- The physical activity monitoring device should be worn close to your body. **It should not move when you walk.**
- If it rains, you should still wear the physical activity monitoring device as it is waterproof. However, do not submerge the device in water as this will destroy it.
- The physical activity monitoring device does not have a start or stop button. It will start working as soon as you put it on and stop once you take it off.

Appendix C: Dog-Walking Log (Drop Off Version) for Study 1**Dog-Walking Log****INSTRUCTIONS**

This section contains questions to be completed **before** and **after** EACH of your dog walks over the next 7 days. Dog walks include any time spent walking or jogging with your dog.

Just before you put on the physical activity monitoring device, complete the pre-dog walk questions.

Once you return from your dog walk, remove the physical activity monitoring device and then complete the post-dog walk questions.

There are forms for up to 3 dog walks a day. The first form for each day is on a yellow sheet. You should only fill in the forms for the number of dog walks that you go on each day. **If you go on more than 3 dog walks on any day, you need to provide information about the additional dog walks on the green sheet at the end of this section entitled “Additional Dog Walks.”**

For any days that you do not walk your dog, record the date at the top of the page for that day and then put a line through the rest of the page.

If you have any questions about wearing the physical activity monitoring device or completing the dog-walking log, contact Nikolina at

ndantona@connect.carleton.ca



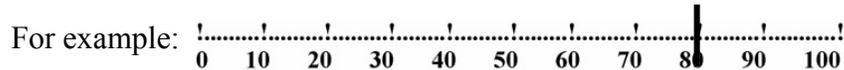
DATE: _____
 day month year

It is very important that you provide accurate information about the start and end time of your dog walks.

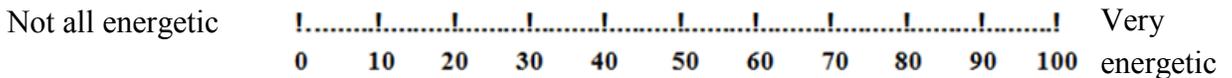
Questions to be completed BEFORE dog walk 1:

Indicate the start time of your dog walk: _____ (circle am / pm)

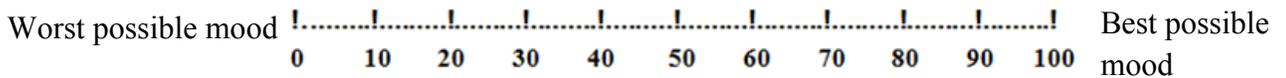
Instructions: For each of the following statements, place a vertical line on the continuum to indicate where you fall.



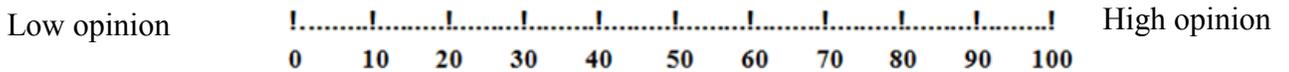
How energetic do you feel at the moment?



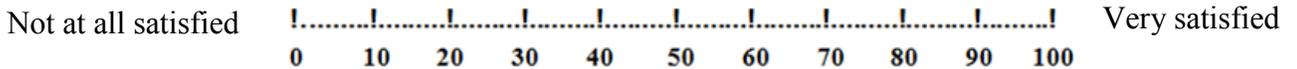
Indicate your current mood:



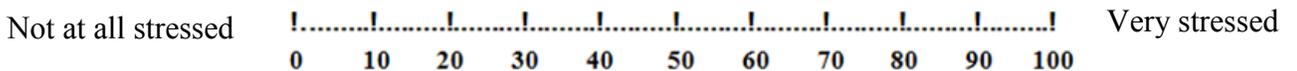
What is your opinion of yourself at the moment?



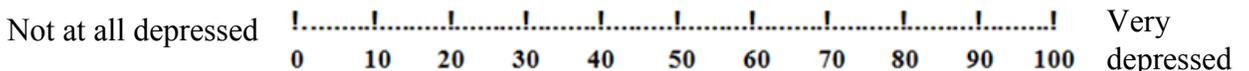
How satisfied are you with your social life at the moment?



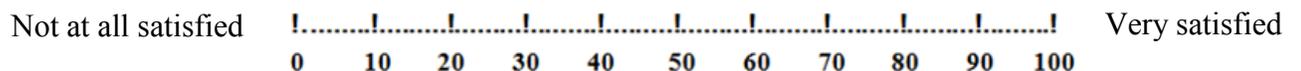
Indicate your current stress level:



How depressed do you feel at the moment?



How satisfied are you with your life at the moment?



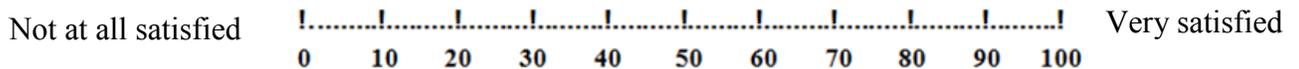
Questions to be completed **after** your dog walk are on the reverse side of this page. →

Questions to be completed AFTER dog walk 1:

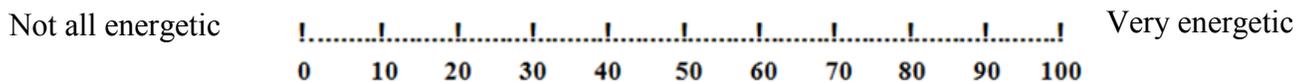
Indicate the time you <u>finished</u> your dog walk:	Did you wear the physical activity device on your dog walk?	Indicate the area in which you walked or jogged with your dog:	What was the weather like on your dog walk?	Did you take your dog to a dog park (a park where dogs can play OFF LEASH)?	Did someone from your household accompany you on the dog walk?	Did you encounter anyone on your dog walk?
Time: _____ Circle one : am / pm	Circle: yes / no	Circle one of the following: A) Only walked or jogged on streets B) Walked or jogged to a park C) Drove to a park D) Walked or jogged to another location <i>Specify: (e.g., beach)</i> _____ E) Drove to another location: <i>Specify:</i> _____	Circle one : A) Miserable B) Fair C) Good D) Gorgeous	Circle: yes / no	Circle: yes / no <i>If Yes,</i> indicate who (e.g., child) _____	Circle: yes / no <i>If Yes,</i> indicate the number of people you talked to: _____

Instructions: For each of the following statements, place a vertical line on the continuum to indicate where you fall.

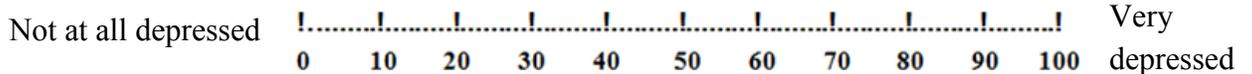
How satisfied are you with your life at the moment?



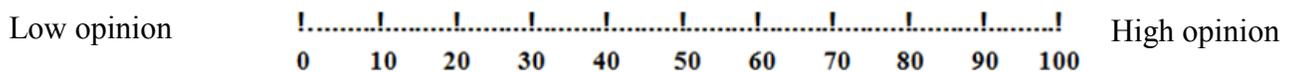
How energetic do you feel at the moment?



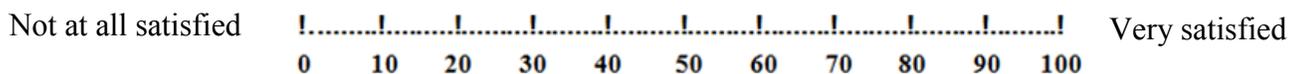
How depressed do you feel at the moment?



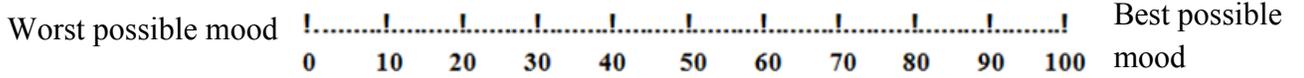
What is your opinion of yourself at the moment?



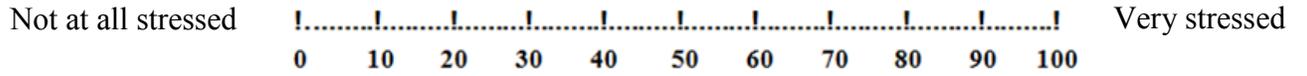
How satisfied are you with your social life at the moment?



Indicate your current mood:



Indicate your current stress level:



Did you experience any stressful situations such as your dog misbehaving or problems with another dog? (Circle: yes / no)

If Yes, please explain:

DAY 1: Dog Walk 2

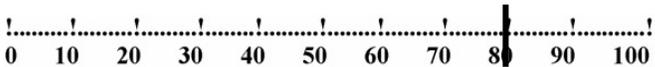
It is very important that you provide accurate information about the start and end time of your dog walks.

DATE: _____ _____ _____
 day month year

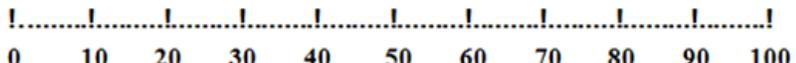
Questions to be completed BEFORE dog walk 2:

Indicate the start time of your dog walk: _____ (circle am / pm)

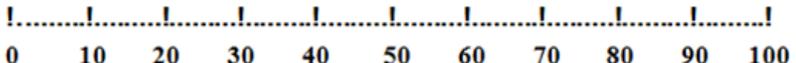
Instructions: For each of the following statements, place a vertical line on the continuum to indicate where you fall.

For example: 

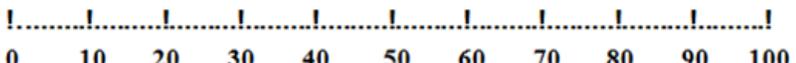
How energetic do you feel at the moment?

Not all energetic  Very energetic

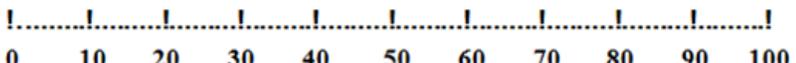
Indicate your current mood:

Worst possible mood  Best possible mood

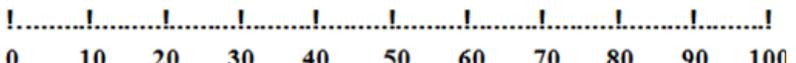
What is your opinion of yourself at the moment?

Low opinion  High opinion

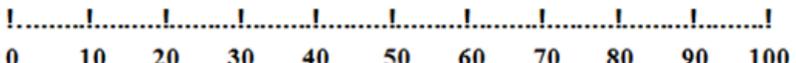
How satisfied are you with your social life at the moment?

Not at all satisfied  Very satisfied

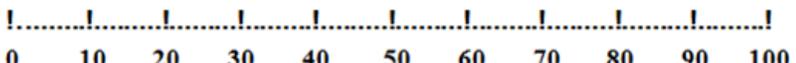
Indicate your current stress level:

Not at all stressed  Very stressed

How depressed do you feel at the moment?

Not at all depressed  Very depressed

How satisfied are you with your life at the moment?

Not at all satisfied  Very satisfied

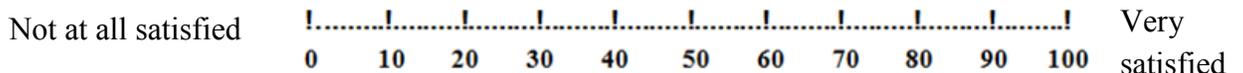
Questions to be completed **after** your dog walk are on the reverse side of this page. 

Questions to be completed AFTER dog walk 2:

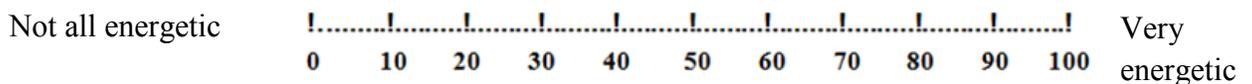
Indicate the time you <u>finished</u> your dog walk:	Did you wear the physical activity device on your dog walk?	Indicate the area in which you walked or jogged with your dog:	What was the weather like on your dog walk?	Did you take your dog to a dog park (a park where dogs can play OFF LEASH)?	Did someone from your household accompany you on the dog walk?	Did you encounter anyone on your dog walk?
Time: _____	Circle: yes / no	Circle one of the following: A) Only walked or jogged on streets B) Walked or jogged to a park C) Drove to a park D) Walked or jogged to another location <i>Specify: (e.g., beach)</i> _____ E) Drove to another location: <i>Specify:</i> _____	Circle one : A) Miserable B) Fair C) Good D) Gorgeous	Circle: yes / no	Circle: yes / no <i>If Yes,</i> indicate who (e.g., child) _____	Circle: yes / no <i>If Yes,</i> indicate the number of people you talked to: _____

Instructions: For each of the following statements, place a vertical line on the continuum to indicate where you fall.

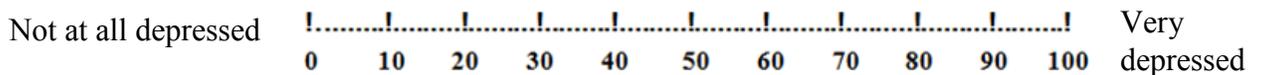
How satisfied are you with your life at the moment?



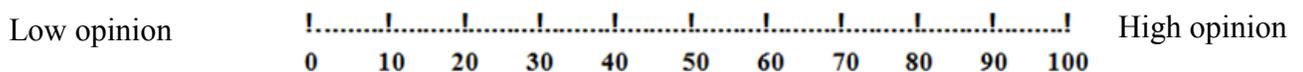
How energetic do you feel at the moment?



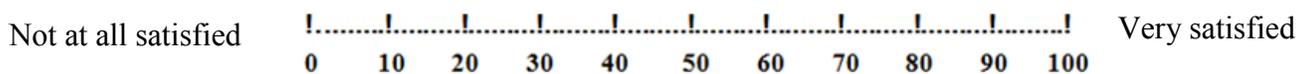
How depressed do you feel at the moment?



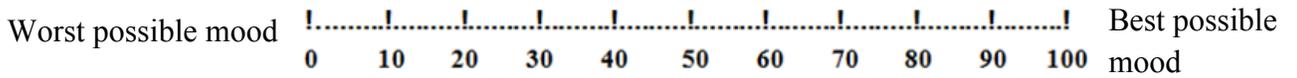
What is your opinion of yourself at the moment?



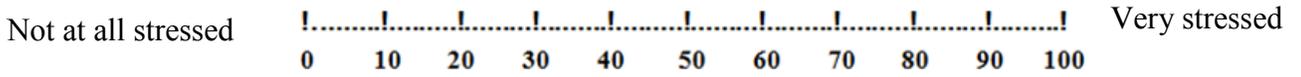
How satisfied are you with your social life at the moment?



Indicate your current mood:



Indicate your current stress level:



Did you experience any stressful situations such as your dog misbehaving or problems with another dog? (Circle: yes / no)

If Yes, please explain:

Appendix D: Day 8 Paper Survey for Study 1**Additional Questions****INSTRUCTIONS**

This section contains additional questions to be completed once you have:

- worn the physical activity monitoring device on your dog walks over the course of **7 days**
- filled out the dog-walking log

On the **eighth day** participating in this study, you should complete this section, which includes questions relating to the week you wore the physical activity monitoring device and your experience dog walking.

The last page of this section explains how to obtain your \$10 gift card and a personalized profile of your dog walking physical activity.

It is very important that you complete this section promptly, it only takes a few minutes.

DAY 8

Please answer the following questions on the day after you have finished wearing the physical activity monitoring device on your dog walks:

During the week you wore the physical activity monitoring device were there any days when you did not walk your dog? (tick one)

Yes
 No

→ ***If Yes***, complete the following table:

Date(s) did not walk dog	Did other people walk your dog? (e.g., spouse, child, professional dog walker)
Date: _____	Circle one of the following: Yes / No <i>If Yes</i> , specify who walked your dog: _____
Date: _____	Circle one of the following: Yes / No <i>If Yes</i> , specify who walked your dog: _____
Date: _____	Circle one of the following: Yes / No <i>If Yes</i> , specify who walked your dog: _____
Date: _____	Circle one of the following: Yes / No <i>If Yes</i> , specify who walked your dog: _____

Was the week you wore the physical activity monitoring device a typical week in terms of the amount of time you normally spend walking your dog? (circle) Yes / No

If No, did you spend more or less time than usual dog walking? (tick one)

_____ More

_____ Less

If No, explain why the week you wore the physical activity monitoring device was not a typical week in terms of the amount of time you spent dog walking:

During the week you wore the physical activity monitoring device, did you work:

_____ full time

_____ part time

_____ not at all

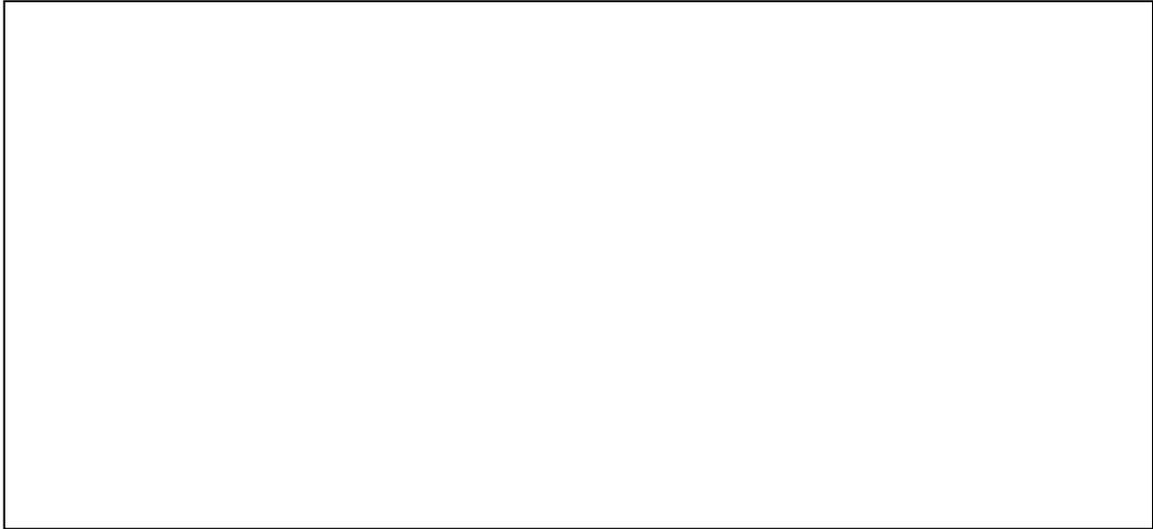
Was one of the reasons you acquired a dog to obtain more exercise?

_____ yes

_____ no

In the box below, describe what affects the amount of time you spend dog walking.

In the box below, describe the benefits that you receive from walking your dog, if any.

A large, empty rectangular box with a thin black border, intended for the respondent to write their answer to the question above.

In the box below, describe how owning a dog affects the amount of exercise you obtain.

A large, empty rectangular box with a thin black border, intended for the respondent to write their answer to the question above.

If you have any additional comments, please provide them in the box below or e-mail them to ndantona@connect.carleton.ca

Thank you for taking the time to participate in this study!

You should now contact Nikolina at ndantona@connect.carleton.ca to let her know that you have finished participating in the study. She will arrange a time to pick up the study materials (i.e., this booklet, the physical activity monitoring device and the waist band).

When you contact Nikolina, please indicate from which of the following stores you would like at a \$10 gift card:

- Pet Smart
- Chapters
- Walmart
- Starbucks
- Michaels
- Canadian Tire

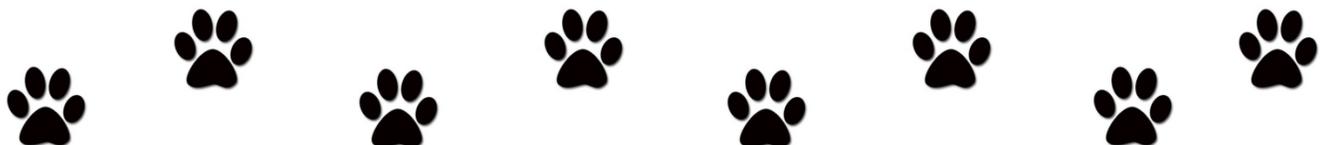
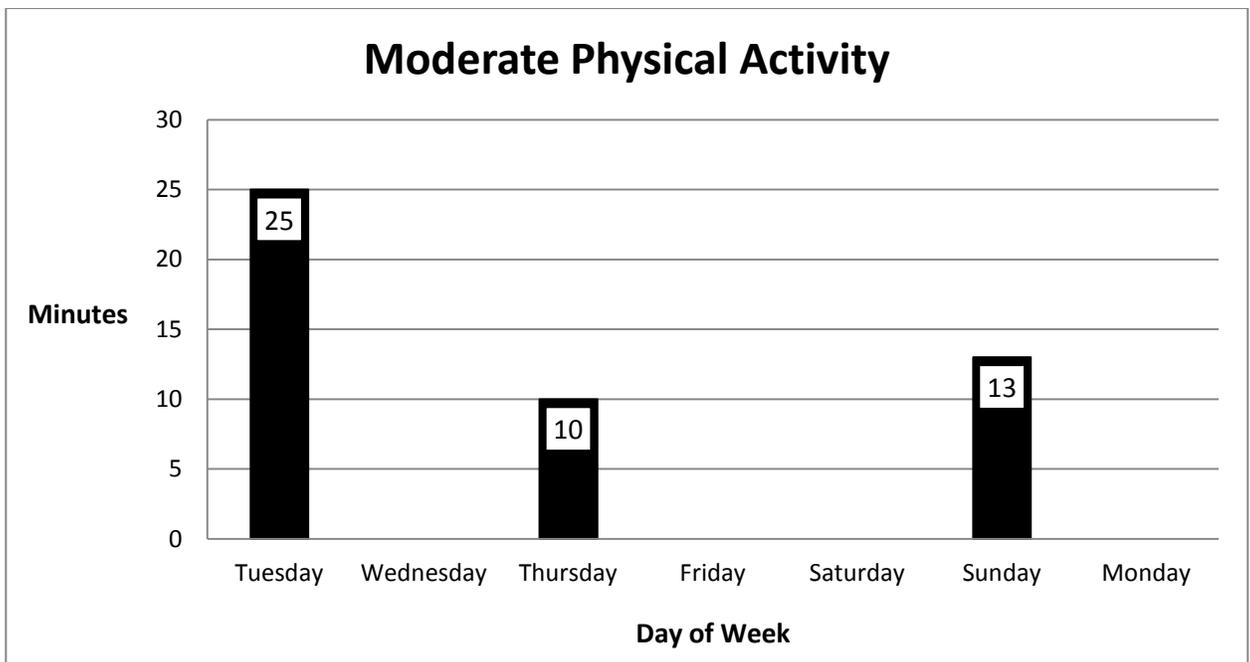
When Nikolina picks up your study materials, she will give you your gift card and a debriefing form explaining the purpose of the study. Once Nikolina has had a chance to prepare your dog walking physical activity profile, she will send it to you separately.

Appendix E: Dog Walking Physical Activity Profile for Study 1

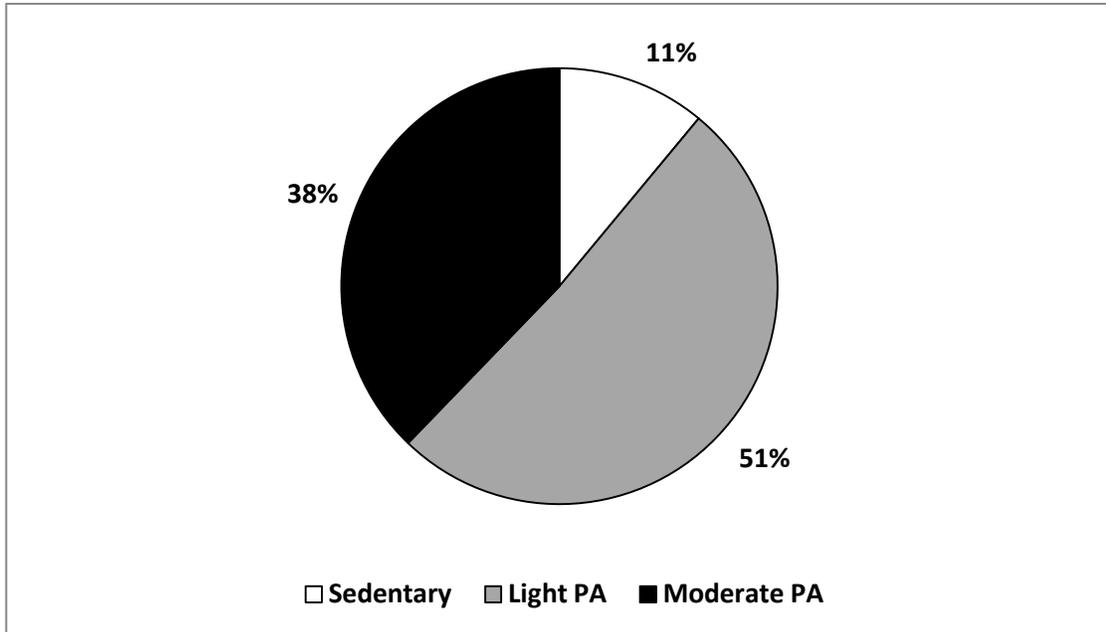
Dear X,

To thank you for participating in my dog walking study, I have prepared a personalized dog walking physical activity profile for you based on the week you wore the physical activity monitoring device.

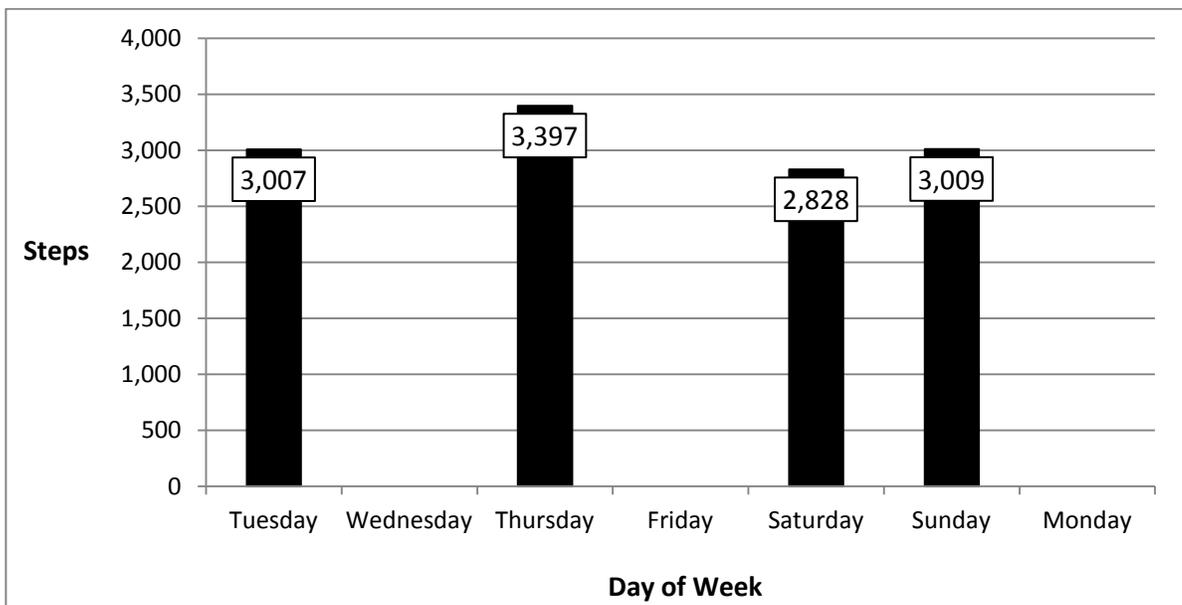
According to the Canadian physical activity guidelines, adults 18 years of age or older should accumulate at least 150 minutes of moderate- to vigorous-intensity physical activity weekly. The figure below shows how many minutes of moderate-intensity physical activity you accumulated each day through walking your dog while wearing the physical activity monitoring device (none of your dog walking physical activity was at a vigorous-intensity level). For example, on Day 1 (Tuesday), through dog walking you were moderately active for 25 minutes. Over the course of the week, you achieved **48 minutes** of moderate-intensity physical activity through dog walking alone.



The pie chart below shows your weekly dog walking physical activity broken down by intensity level. On your dog walks over the course of the week, **38% of the time you were moderately active, 51% of the time lightly active and 11% of the time sedentary or inactive.**



Another way to examine physical activity is through the number of steps taken daily. It is recommended that adults achieve **at least 10,000 steps daily**. The figure below displays the number of steps that you achieved each day through dog walking.



Please note that your individual physical activity profile will not be used in any way other than as feedback to you. When presenting the results from this study your data will be combined with that of other participants, so you cannot be identified.

Appendix F: Baseline Survey (Completed by Both Groups) for Study 2

In order to complete the following survey, you need to enter the unique code that was e-mailed to you along with the link to this survey:

Enter Code:

If you have misplaced your code, please contact Nikolina at ndantona@connect.carleton.ca and it will be sent to you again.

Indicate the date that you are completing this survey:

Day: _____ Month: _____ Year: _____

Screening Questions

Country in which currently live (tick one):

_____ Canada

_____ Other

Indicate whether you live in (tick one):

_____ City or Town

_____ Rural area/farm

Indicate whether you are (tick one):

_____ 18 years of age or older

_____ under 18 years of age

Do you currently own a dog(s)? (tick one)

- No
 Yes

Are you a professional dog walker? (tick one)

- No
 Yes

Note: Participants who lived in a country other than Canada, lived on a farm or in a rural area, were less than 18 years of age, owned a dog or were a professional dog walker were directed to a page at the end of the survey and informed that they did not satisfy the screening requirements and, therefore, were not eligible to participate in the study. They were also provided with contact information, in case they had any questions or concerns.

Next

Background Questions

Sex (circle): Male / Female

Current age: _____ years old

Marital status (tick one):

- Single
 Cohabiting (lived with partner for less than 1 year)
 Common-law (lived with partner for 1 or more years)
 Married
 Separated
 Divorced
 Widowed

Do you live alone (tick one):

Yes

No

What is your highest level of education (tick one):

Elementary school

Some high school

Finished high school

Some college

College degree

Some university

One university degree

Two or more university degrees

What is your annual family income before tax? (tick one)

\$19,999 or less

\$20,000 to \$39,999

\$40,000 to \$59,999

\$60,000 to \$79,999

\$80,000 to \$99,999

\$100,000 to \$119,999

\$120,000 to \$139,999

\$140,000 and over

Next

Pet Ownership

Do you currently own a cat? (tick one)

Yes

No

Have you ever owned a dog? (tick one)

Yes

No

→ *If Yes*, indicate how long ago you owned a dog. Be sure to specify whether you are referring to YEARS or MONTHS: _____

Are you planning to acquire a dog within the next 3 months? (circle) Yes / No

If Yes, indicate how soon you anticipate acquiring a dog (tick one):

within 1 month

within 2 months

within 3 months

If Yes, provide your top three reasons for acquiring a dog:

1) _____

2) _____

3) _____

Next

BMI

1. What is your height (in either):

Centimeters or Feet Inches

2. What is your weight (in either):

_____ or _____
Kilograms Pounds

3. *If female*, are you pregnant? (circle) Yes / No

4. In general, would you say that your health is (circle):

Poor Fair Good Very Good Excellent

5. In the past month, how often did you have trouble falling asleep? (tick one)

- _____ Never
_____ Rarely (1 time a month)
_____ Sometimes (2-4 times a month)
_____ Often (5-15 times a month)
_____ Almost always (16-30 times a month)

6. Thinking about the amount of stress in your life, would you say that most days are (tick one):

- _____ not at all stressful
_____ not very stressful
_____ a bit stressful
_____ quite a bit stressful
_____ extremely stressful

Next

The Pennebaker Inventory of Limbic Languidness (PILL)

This section contains a list of common symptoms and bodily sensations that most people have experienced at one time or another. For each, please circle the number that best describes how often you have experienced the symptom, using the following scale:

1	2	3	4	5
Have never or almost never experienced the symptom	Less than 3 or 4 times per year	Every month or so	Every week or so	More than once every week

<u>Symptom or bodily sensation</u>	<u>Answer (circle the best number)</u>				
1. Eyes water	1	2	3	4	5
2. Itching or painful eye(s)	1	2	3	4	5
3. Ringing in ears	1	2	3	4	5
4. Temporary deafness or hard of hearing	1	2	3	4	5
5. Lump in throat	1	2	3	4	5
6. Choking sensations	1	2	3	4	5
7. Sneezing spells	1	2	3	4	5
8. Running nose	1	2	3	4	5
9. Congested nose	1	2	3	4	5
10. Bleeding nose	1	2	3	4	5
11. Asthma or wheezing	1	2	3	4	5
12. Coughing	1	2	3	4	5

1	2	3	4	5
Have never or almost never experienced the symptom	Less than 3 or 4 times per year	Every month or so	Every week or so	More than once every week

<u>Symptom or bodily sensation</u>	<u>Answer (circle the best number)</u>
---	---

13. Out of breath	1	2	3	4	5
14. Swollen ankles	1	2	3	4	5
15. Chest pains	1	2	3	4	5
16. Racing heart	1	2	3	4	5
17. Cold hands or feet even in hot weather	1	2	3	4	5
18. Leg cramps	1	2	3	4	5
19. Insomnia	1	2	3	4	5
20. Toothaches	1	2	3	4	5
21. Upset stomach	1	2	3	4	5
22. Indigestion	1	2	3	4	5
23. Heartburn	1	2	3	4	5
24. Severe pains or cramps in stomach	1	2	3	4	5
25. Diarrhea	1	2	3	4	5
26. Constipation	1	2	3	4	5
27. Hemorrhoids	1	2	3	4	5
28. Swollen joints	1	2	3	4	5

1	2	3	4	5
Have never or almost never experienced the symptom	Less than 3 or 4 times per year	Every month or so	Every week or so	More than once every week

<u>Symptom or bodily sensation</u>	<u>Answer (circle the best number)</u>
---	---

29. Stiff muscles	1	2	3	4	5
30. Back pains	1	2	3	4	5
31. Sensitive or tender skin	1	2	3	4	5
32. Face flushing	1	2	3	4	5
33. Severe itching	1	2	3	4	5
34. Skin breaking out in a rash	1	2	3	4	5
35. Acne or pimples on the face	1	2	3	4	5
36. Acne or pimples on places other than face	1	2	3	4	5
37. Boils	1	2	3	4	5
38. Sweat even in cold weather	1	2	3	4	5
39. Strong reactions to insect bites	1	2	3	4	5
40. Headaches	1	2	3	4	5
41. Sensation of pressure in head	1	2	3	4	5
42. Hot flashes	1	2	3	4	5
43. Chills	1	2	3	4	5
44. Dizziness	1	2	3	4	5

1	2	3	4	5
Have never or almost never experienced the symptom	Less than 3 or 4 times per year	Every month or so	Every week or so	More than once every week

<u>Symptom or bodily sensation</u>	<u>Answer (circle the best number)</u>
---	---

45. Feel faint	1	2	3	4	5
46. Numbness or tingling in any part of the body	1	2	3	4	5
47. Twitching of eyelid	1	2	3	4	5
48. Twitching other than eyelid	1	2	3	4	5
49. Hands tremble or shake	1	2	3	4	5
50. Stiff joints	1	2	3	4	5
51. Sore muscles	1	2	3	4	5
52. Sore throat	1	2	3	4	5
53. Sunburn	1	2	3	4	5
54. Nausea	1	2	3	4	5

Next

Center for Epidemiologic Studies-Depression Scale (CES-D)

Below is a list of the ways you might have felt or behaved. Please indicate how often you have felt or behaved this way **during the past week**:

0 = Rarely or none of the time (Less than 1 day a week)

1 = Some or a little of the time (1-2 days a week)

2 = Occasionally or a moderate amount of time (3-4 days a week)

3 = Most or all of the time (5-7 days a week)

	<u>During the past week</u>	<u>Answer (circle)</u>			
1. I was bothered by things that usually don't bother me.	0	1	2	3	
2. I did not feel like eating; my appetite was poor.	0	1	2	3	
3. I felt that I could not shake off the blues even with help from my family or friends.	0	1	2	3	
4. I felt that I was just as good as other people.	0	1	2	3	
5. I had trouble keeping my mind on what I was doing.	0	1	2	3	
6. I felt depressed.	0	1	2	3	
7. I felt that everything I did was an effort.	0	1	2	3	
8. I felt hopeful about the future.	0	1	2	3	
9. I thought my life had been a failure.	0	1	2	3	
10. I felt fearful.	0	1	2	3	
11. My sleep was restless.	0	1	2	3	
12. I was happy.	0	1	2	3	

As stated on the previous page, indicate how often you have felt or behaved this way **during the past week:**

0 = Rarely or none of the time (Less than 1 day a week)

1 = Some or a little of the time (1-2 days a week)

2 = Occasionally or a moderate amount of time (3-4 days a week)

3 = Most or all of the time (5-7 days a week)

<u>During the past week</u>	<u>Answer (circle)</u>			
13. I talked less than usual.	0	1	2	3
14. I felt lonely.	0	1	2	3
15. People were unfriendly.	0	1	2	3
16. I enjoyed life.	0	1	2	3
17. I had crying spells.	0	1	2	3
18. I felt sad.	0	1	2	3
19. I felt that people disliked me.	0	1	2	3
20. I could not get “going.”	0	1	2	3

Next

Rosenberg Self-Esteem Scale (SES)

Below is a list of statements dealing with your general feelings about yourself. If you **strongly agree**, select **SA**. If you **agree** with the statement, select **A**. If you **disagree**, select **D**. If you **strongly disagree**, select **SD**.

- | | | | | |
|---|----|---|---|----|
| 1. On the whole, I am satisfied with myself. | SA | A | D | SD |
| 2. At times, I think I am no good at all. | SA | A | D | SD |
| 3. I feel that I have a number of good qualities. | SA | A | D | SD |
| 4. I am able to do things as well as most other people. | SA | A | D | SD |
| 5. I feel I do not have much to be proud of. | SA | A | D | SD |
| 6. I certainly feel useless at times. | SA | A | D | SD |
| 7. I feel that I'm a person of worth, at least on an equal plane with others. | SA | A | D | SD |
| 8. I wish I could have more respect for myself. | SA | A | D | SD |
| 9. All in all, I am inclined to feel that I am a failure. | SA | A | D | SD |
| 10. I take a positive attitude toward myself. | SA | A | D | SD |

Next

The Satisfaction with Life Scale (SWLS)

Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number in the line preceding that item. Please be open and honest in your responding.

1 = Strongly Disagree

2 = Disagree

3 = Slightly Disagree

4 = Neither Agree or Disagree

5 = Slightly Agree

6 = Agree

7 = Strongly Agree

_____ In most ways my life is close to my ideal.

_____ The conditions of my life are excellent.

_____ I am satisfied with life.

_____ So far I have gotten the important things I want in life.

_____ If I could live my life over, I would change almost nothing.

Next

The Positive and Negative Affect Scales (PANAS)

Listed below are a number of words that describe different feelings and emotions. For each, please pick a number from the following scale to indicate the extent to which you feel this way, **IN GENERAL**. That is, how you feel on average.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely
	_____ interested		_____ irritable	
	_____ distressed		_____ alert	
	_____ excited		_____ ashamed	
	_____ upset		_____ inspired	
	_____ strong		_____ nervous	
	_____ guilty		_____ determined	
	_____ scared		_____ attentive	
	_____ hostile		_____ jittery	
	_____ enthusiastic		_____ active	
	_____ proud		_____ afraid	

Next

Marlowe-Crowne Social Desirability Scale (M-C SDS)

Listed below are a number of statements concerning personal attitudes and traits. Please read each item and decide whether the statement is true or false as it applies to you.

For each item, please select **TRUE** or **FALSE**.

- | | <u>Answer (circle)</u> |
|---|-------------------------------|
| 1. It is sometimes hard for me to go on with my work if I am not encouraged. | True False |
| 2. I sometimes feel resentful when I don't get my way. | True False |
| 3. On a few occasions, I have given up doing something because I thought too little of my ability. | True False |
| 4. There have been times when I felt like rebelling against people in authority even though I knew they were right. | True False |
| 5. No matter who I'm talking to, I'm always a good listener. | True False |
| 6. There have been occasions when I took advantage of someone. | True False |
| 7. I'm always willing to admit to it when I make a mistake. | True False |
| 8. I sometimes try to get even rather than forgive and forget. | True False |
| 9. I am always courteous, even to people who are disagreeable. | True False |
| 10. I have never been irked when people expressed ideas very different from my own. | True False |
| 11. There have been times when I was quite jealous of the good fortune of others. | True False |
| 12. I am sometimes irritated by people who ask favors of me. | True False |
| 13. I have never deliberately said something that hurt someone's feelings. | True False |

Next

Thank you for completing the online survey!

We would now like you to wear a physical activity monitoring device during all of your waking hours over the course of a week and complete a physical activity monitor booklet (Note: it should take you less than a minute to complete the booklet each day).

If you do so, you will receive:

- a \$10 gift card from a choice of six stores

To obtain a physical activity monitoring device and physical activity monitor booklet, please e-mail Nikolina at ndantona@connect.carleton.ca and state that the following: **"I am ready for you to provide me with a physical activity monitoring device."** In your e-mail, include the following:

- your name, phone number and mailing address
- the code that was included in the e-mail that was sent to you containing the survey link

Once you e-mail Nikolina, she will be in touch with you shortly by e-mail to let you know when you will be mailed or hand delivered a package containing a physical activity monitoring device and the physical activity monitor booklet.

This page was only included in the baseline survey for individuals in the planned-to-acquire-a-dog group.

I am also interested in examining the physical activity and health of individuals who **do not own a dog and are not planning to acquire a dog**. Therefore, I would be grateful if you could suggest any friends and/or relatives whom you think would be interested in participating in this study. I have provided space for you to provide the name and e-mail address for up to 3 people. In order to be eligible to participate, the individuals must live in a city or town, be at least 18 years of age and *NOT* own a dog.

Name 1: _____ e-mail: _____

Name 2: _____ e-mail: _____

Name 3: _____ e-mail: _____

Appendix G: 4-Month Survey (Completed by Both Groups) for Study 2

In order to complete the following survey, you need to enter the unique code that was e-mailed to you along with the link to this survey:

Enter Code:

If you have misplaced your code, please contact Nikolina at ndantona@connect.carleton.ca and it will be sent to you again.

Indicate the date that you are completing this survey:

Day: _____ Month: _____ Year: _____

Do you own a dog? (tick one)

Yes

No

In the past month, how often did you have trouble falling asleep? (tick one)

Never

Rarely (1 time a month)

Sometimes (2-4 times a month)

Often (5-15 times a month)

Almost always (16-30 times a month)

Thinking about the amount of stress in your life, would you say that most days are (tick one):

_____ not at all stressful

_____ not very stressful

_____ a bit stressful

_____ quite a bit stressful

_____ extremely stressful

What is your weight (in either):

_____ or _____
Kilograms Pounds

Appendix H: 8-Month Survey (Control Group) for Study 2

In order to complete the following survey, you need to enter the unique code that was e-mailed to you along with the link to this survey:

Enter Code:

If you have misplaced your code, please contact Nikolina at ndantona@connect.carleton.ca and it will be sent to you again.

Next

Indicate the date that you are completing this survey:

Day: _____ Month: _____ Year: _____

Background Questions

Marital status (tick one):

- Single
- Cohabiting (lived with partner for less than 1 year)
- Common-law (lived with partner for 1 or more years)
- Married
- Separated
- Divorced
- Widowed

Do you live alone (tick one):

- Yes
- No

Next

Pet Ownership

Do you currently own a cat? (tick one)

 Yes No

Do you currently own a dog(s)? (tick one)

 Yes No*If No*, did you own a dog at any point during the last year? (tick one) Yes No

Next

What is your height (in either):

<input type="text"/>	or	<input type="text"/>	<input type="text"/>
Centimeters		Feet	Inches

What is your weight (in either):

<input type="text"/>	or	<input type="text"/>
Kilograms		Pounds

If female, are you pregnant? (circle) Yes / No

In general, would you say that your health is (circle):

Poor	Fair	Good	Very Good	Excellent
------	------	------	-----------	-----------

In the past month, how often did you have trouble falling asleep? (tick one)

- Never
- Rarely (1 time a month)
- Sometimes (2-4 times a month)
- Often (5-15 times a month)
- Almost always (16-30 times a month)

Thinking about the amount of stress in your life, would you say that most days are (tick one):

- not at all stressful
- not very stressful
- a bit stressful
- quite a bit stressful
- extremely stressful

Next

The following scales (which are shown in the baseline survey) were also be included:

- The Pennebaker Inventory of Limbic Languidness
- Center for Epidemiologic Studies-Depression Scale
- Rosenberg Self-Esteem Scale
- The Satisfaction with Life Scale
- The Positive and Negative Affect Scales

Thank you for taking the time to complete the online survey!

We would now like you to wear a physical activity monitoring device during all of your waking hours over the course of a week and complete a physical activity monitor booklet (Note: it should take you less than one minute to complete the booklet each day).

If you do so, you will receive:

- a \$10 gift card from a selection of stores

To obtain a physical activity monitoring device and physical activity monitor booklet, please e-mail Nikolina at ndantona@connect.carleton.ca and state that the following: **"I am ready to wear the physical activity monitoring device for a second time."** In your e-mail, include the following:

- your name, phone number and mailing address
- the code that was included in the e-mail that was sent to you containing the survey link

Once you e-mail Nikolina, she will be in touch with you shortly by e-mail to let you know when you will be mailed or hand delivered a package containing a physical activity monitoring device and the physical activity monitor booklet.

Appendix I: 8-Month Survey (Individuals who Acquired a Dog) for Study 2

In order to complete the following survey, you need to enter the unique code that was e-mailed to you along with the link to this survey:

Enter Code:

If you have misplaced your code, please contact Nikolina at ndantona@connect.carleton.ca and it will be sent to you again.

Next

Indicate the date that you are completing this survey:

Day: _____ Month: _____ Year: _____

Verifying Eligibility

Do you currently own a dog(s)? (tick one)

Yes

No

Participants who did not own a dog at 8 months were directed to the end of the survey and informed that they were not eligible to participate in Part 2 of the study as they no longer owned a dog.

Next

Background Questions

Marital status (tick one):

Single

Cohabiting (lived with partner for less than 1 year)

Common-law (lived with partner for 1 or more years)

Married

Separated

Divorced

Widowed

Do you live alone (tick one):

Yes

No

Next

Pet Ownership

Do you currently own a cat? (tick one)

Yes

No

Do you own more than one dog? (tick one)

Yes

No

Depending on their response to this question, participants were directed to either the section entitled "1 dog" or "2 or more dogs"

1 dog

What breed(s) is your dog: _____

Indicate the size of your dog (tick one):

Small (e.g., Dachshund, Chihuahua, Toy Poodle)

Medium (e.g., Bulldog, Cocker Spaniel, Beagle)

Large (e.g., Husky, Labrador Retriever, Standard Poodle)

I am unsure of the size of my dog

Indicate your dog's height from the floor to its shoulder (in either):

_____ or _____
Centimeters Feet Inches

Indicate dog's weight (in either):

_____ or _____
Kilograms Pounds

Age of dog (tick one):

- 1 year or less
- 2 years
- 3 years
- 4 years
- 5 years
- 6 years
- 7 years
- 8 years
- 9 years
- 10 years
- 11 years
- 12 years or more

Do you walk your dog? (tick one)

- Yes
- No

← Participants who indicated that they did not walk their dog were re-directed to a page containing questions for those who did not walk their dog. Those who walked their dog proceeded to the next page of this survey.

Next

How soon after acquiring your dog, did you begin walking it? (tick one)

Less than 1 month

One month or more (indicate the number of months: _____)

Do other people walk the dog instead of you some of the time? (tick one)

Yes

No

→ *If Yes*, indicate who walks your dog (e.g., spouse, child, friend, professional dog walker): _____

When you take your dog for a walk, how long does it usually last? (tick one)

Less than 10 minutes

10 or more minutes

→ Explain your reasons for usually walking your dog for periods lasting less than 10 minutes:

Next

2 or more dogs

How many dogs do you own? _____

For the following questions, if you own 2 dogs fill out the sections entitled **Dog#1 and Dog#2**. If you own a third dog, you should also fill out the section entitled **Dog #3**.

Dog #1:

What breed(s) is dog #1: _____

Indicate the size of dog #1 (tick one):

- Small (e.g., Dachshund, Chihuahua, Toy Poodle)
- Medium (e.g., Bulldog, Cocker Spaniel, Beagle)
- Large (e.g., Husky, Labrador Retriever, Standard Poodle)
- I am unsure of the size of my dog

Indicate dog #1's height from the floor to its shoulder (in either):

_____ or _____ _____
Centimeters Feet Inches

Indicate dog #1's weight (in either):

_____ or _____
Kilograms Pounds

Age of dog #1 (tick one):

- 1 year or less
- 2 years
- 3 years
- 4 years
- 5 years
- 6 years
- 7 years
- 8 years
- 9 years
- 10 years
- 11 years
- 12 years or more

The Dog #1 questions were repeated for Dog#2 and Dog#3.

Indicate whether you walk (tick one):

- more than 1 of your dogs
- one dog
- none of your dogs



Participants who indicated that they did not walk any of their dogs were re-directed to a page containing questions for those who did not walk their dogs. Participants who walked at least one of their dogs completed the questions provided below.

Next

Do you walk dog #1? (tick one)

- Yes
- No

How soon after acquiring dog#1, did you begin walking it? (tick one)

- Less than 1 month
- One month or more (indicate the number of months: _____)

Do you walk dog #2? (tick one)

- Yes
- No

How soon after acquiring dog#2, did you begin walking it? (tick one)

- Less than 1 month
- One month or more (indicate the number of months: _____)

Do you walk dog #3? (tick one)

- Yes
- No

How soon after acquiring dog#3, did you begin walking it? (tick one)

Less than 1 month

One month or more (indicate the number of months: _____)

Do other people walk your dog(s) instead of you some of the time? (tick one)

Yes

No

→ *If Yes*, indicate who walks your dog(s) (e.g., spouse, child, friend, professional dog walker): _____

When you take your dog(s) out for a walk, how long does it usually last? (tick one)

Less than 10 minutes

10 or more minutes

→ Explain your reasons for usually walking your dog(s) for bouts lasting less than 10 minutes:

Next

The following page was only completed by dog owners who did not walk their dog(s)

Explain why you do not walk your dog(s):

Did you begin walking your dog(s) at some point during the past 8 months and then stop? (tick one)

Yes
 No

→ **If Yes**, did you walk your dog(s) for (tick one):

- Less than 1 month
- 1 month to 2 months
- 3 months to 4 months
- 5 months to 6 months
- 6 months to 7 months
- 7 months to 8 months
- 9 months to 10 months

If Yes, explain why you stopped walking your dog(s):

Next

Questions completed by all dog owners

What is your height (in either):

 or
 Centimeters Feet Inches

What is your weight (in either):

 or
 Kilograms Pounds

If female, are you pregnant? (circle) Yes / No

In general, would you say that your health is (circle):

Poor Fair Good Very Good Excellent

In the past month, how often did you have trouble falling asleep? (tick one)

- Never
- Rarely (1 time a month)
- Sometimes (2-4 times a month)
- Often (5-15 times a month)
- Almost always (16-30 times a month)

Thinking about the amount of stress in your life, would you say that most days are (tick one):

- not at all stressful
- not very stressful
- a bit stressful
- quite a bit stressful
- extremely stressful

Next

The following scales (which are shown in the baseline survey) will also be included:

- The Pennebaker Inventory of Limbic Languidness
- Center for Epidemiologic Studies-Depression Scale
- Rosenberg Self-Esteem Scale
- The Satisfaction with Life Scale
- The Positive and Negative Affect Scales

Next

What are the two main benefits of owning a dog?

Have you experienced any difficulties as a result of acquiring a dog? (tick one)

Yes
 No

→ *If Yes*, describe the difficulties that have resulted from acquiring a dog:

Compared to before you acquired a dog, is the total amount of time you now spend engaging in physical activities (tick one):

considerably less
 somewhat less
 the same
 somewhat more
 considerably more

Do you think that acquiring a dog made a difference to your health? (tick one)

Yes
 No

→ *If Yes*, describe how acquiring a dog has affected your health:

Compared to 8 months ago, how would you say your health is now?

- much better now than 8 months ago
 somewhat better now than 8 months ago
 about the same as 8 months ago
 somewhat worse than 8 months ago
 much worse now than 8 months ago

Next

If you have any additional comments relating to your experience with your dog,
please provide them in the box below

Next

Thank you for taking the time to complete the online survey!

We would now like you to wear a physical activity monitoring device during all of your waking hours over the course of a week and complete a physical activity monitor booklet (Note: it should take you less than one minute to complete the booklet each day).

If you do so, you will receive:

- a \$10 gift card from a selection of stores

To obtain a physical activity monitoring device and physical activity monitor booklet, please e-mail Nikolina at ndantona@connect.carleton.ca and state that the following: **"I am ready to wear a physical activity monitoring device for the second time."** In your e-mail, include the following:

- your name, phone number and mailing address
- the code that was included in the e-mail that was sent to you containing the survey link

Once you e-mail Nikolina, she will be in touch with you shortly by e-mail to let you know when you will be mailed or hand delivered a package containing a physical activity monitoring device and the physical activity monitor booklet.

Appendix J: Baseline Physical Activity Booklet for Study 2

Dear Participant,

Welcome to the next part of our physical activity and health study!

The package that you have received contains the following:

- this **physical activity monitor booklet**
- a **physical activity monitoring device** and **waist band**
- a **pre-paid envelope** to return the study materials (if the package was mailed to you)

Although this booklet contains a number of sheets, you only have to complete one sheet each day and it will take you **less than a minute** to complete the sheet.

To assist you in remembering to wear the physical activity monitoring device during all of your waking hours, we suggest that you keep this booklet and the physical activity monitoring device **in a spot where you will see them when you wake up.**

During the 7 days that you wear the physical activity monitoring device, you should **continue with your normal physical activities. If you do not normally engage in physical activity, this is fine.**

Do **not** let anyone else wear the physical activity monitoring device.

Please ensure that the physical activity monitoring device is kept in a safe place when you are not wearing it, as the device is expensive!

Thank you,

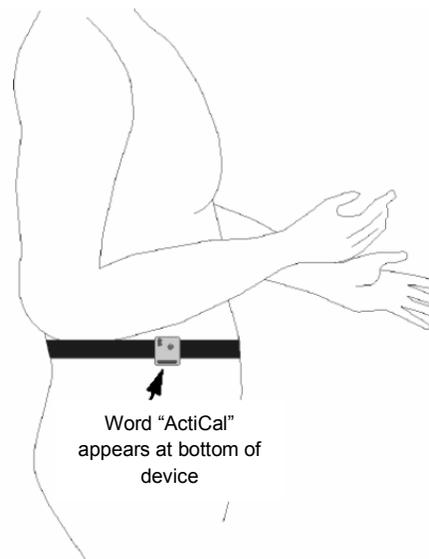
Nikolina Duvall Antonacopoulos
Ph.D. Candidate, Carleton University

Dr. Timothy Pychyl
Faculty Sponsor, Carleton University

Instructions for Wearing the Physical Activity Monitoring Device

Please read the following instructions carefully:

- The physical activity monitoring device should be attached to the waist band and worn around your waist. The monitoring device should be located above your **RIGHT** hip.
- When the physical activity monitoring device is positioned correctly, **the device should be right side up so that the word “ActiCal” appears at the bottom of the device (towards your feet) and is parallel to the ground.**



- You can wear the physical activity monitoring device either below or above your clothing (whichever is more comfortable).
- The physical activity monitoring device should be worn close to your body. **It should not move when you walk.**
- If it rains, you should still wear the physical activity monitoring device as **it is splashproof**. However, **do not submerge the device in water** as this will destroy it.
- The physical activity monitoring device does not have a start or stop button. It will start working as soon as you put it on and stop once you take it off.

STUDY INSTRUCTIONS

Day 1 to Day 7

- Begin this study on the day **after** you received the envelope containing the physical activity monitoring device and this booklet.

If you are going to be away some of the time during the next 7 days, contact Nikolina to pick a new date to start wearing the physical activity monitoring device, as we would like you to wear it for 7 consecutive days.

- Wear the physical activity monitoring device during ***all of your waking hours (except when bathing, showering and swimming)***. This booklet contains one sheet for each day that you wear the physical activity monitoring device.
 - **As soon as you wake up**, you should put on the physical activity monitoring device and indicate the time in this booklet.
 - **Right before you go to bed**, you should take off the physical activity monitoring device and indicate the time in this booklet.
 - If you **take the device off for any reason during the day (e.g., to shower, bath or swim)**, indicate the time you take off and put back on the physical activity monitoring device in this booklet.
 - If you spend any time **swimming and/or biking (including time on a stationary bike)**, indicate the time in this booklet.

Day 8

- If the study materials (i.e., this booklet, the physical activity monitoring device and the waist band) were delivered to your home, contact Nikolina and let her know that you have finished participating in the study. She will then arrange to pick up the study materials.
- If the study materials were mailed to you, return them in the pre-paid envelope that was sent to you.

If you have any questions about the instructions for this study, please contact Nikolina at ndantona@connect.carleton.ca

Unique code
entered here

DAY 1

DATE: _____
 day month year

Please be as precise as possible when reporting times.

Question to be completed in the MORNING:

Time put physical activity monitor ON in the morning: _____ (circle am / pm)

Question to be completed in the EVENING:

Time took physical activity monitor OFF in the evening: _____ (circle am / pm)

Questions to be completed if you remove the physical activity monitor during Day 1:

Time took off during day: off: _____ (circle am / pm) back on: _____ (circle am / pm)
Reason: _____

Time took off during day: off: _____ (circle am / pm) back on: _____ (circle am / pm)
Reason: _____

If you spend time *swimming and/or biking* on Day 1, specify the start and end time:

Indicate activity (i.e., swam or bicycled)	Start Time (specify am or pm)	End Time (specify am or pm)

Appendix K: 8-Month Physical Activity Booklet for Study 2

Dear Participant,

Welcome to the final part of our physical activity and health study!

The package that you have received contains the following:

- this **physical activity monitor booklet**
- a **physical activity monitoring device and waist band**
- a **pre-paid envelope** to return the study materials (if the package was mailed to you)

Given that you are now a dog owner, you will be asked to provide the start and end time for your dog walks. If you do not walk your dog(s), this is not a problem.

Although this booklet contains a number of sheets, you only have to complete one sheet each day and it will take you **less than a minute** to complete the sheet.

To assist you in remembering to wear the physical activity monitoring device during all of your waking hours, we suggest that you keep this booklet and the physical activity monitoring device **in a spot where you will see them when you wake up.**

During the 7 days that you wear the physical activity monitoring device, you should **continue with your normal physical activities. If you do not normally engage in physical activity, this is fine.**

Do **not** let anyone else wear the physical activity monitoring device.

Please ensure that the physical activity monitoring device is kept in a safe place when you are not wearing it, as the device is expensive!

Thank you,

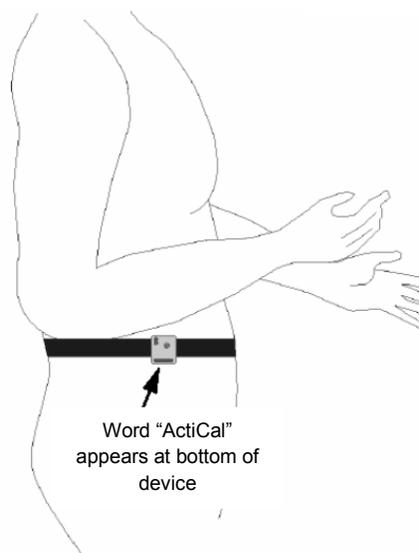
Nikolina Duvall Antonacopoulos
Ph.D. Candidate, Carleton University

Dr. Timothy Pychyl
Faculty Sponsor, Carleton University

Instructions for Wearing the Physical Activity Monitoring Device

Please read the following instructions carefully:

- The physical activity monitoring device should be attached to the waist band and worn around your waist. The monitoring device should be located above your **RIGHT** hip.
- When the physical activity monitoring device is positioned correctly, **the device should be right side up so that the word “ActiCal” appears at the bottom of the device (towards your feet) and is parallel to the ground.**



- You can wear the physical activity monitoring device either below or above your clothing (whichever is more comfortable).
- The physical activity monitoring device should be worn close to your body. **It should not move when you walk.**
- If it rains, you should still wear the physical activity monitoring device as **it is splashproof**. However, **do not submerge the device in water** as this will destroy it.
- The physical activity monitoring device does not have a start or stop button. It will start working as soon as you put it on and stop once you take it off.

STUDY INSTRUCTIONS

Day 1 to Day 7

- Begin this study on the day **after** you received the envelope containing the physical activity monitoring device and this booklet.

If you are going to be away some of the time during the next 7 days, contact Nikolina to pick a new date to start wearing the physical activity monitoring device, as we would like you to wear it for ***7 consecutive days***.

- Wear the physical activity monitoring device during ***all of your waking hours (except when bathing, showering and swimming)***. This booklet contains one sheet for each day that you wear the physical activity monitoring device.
 - **As soon as you wake up**, you should put on the physical activity monitoring device and indicate the time in this booklet.
 - **Right before you go to bed**, you should take off the physical activity monitoring device and indicate the time in this booklet.
 - If you **take the device off for any reason during the day (e.g., to shower, bath or swim)**, indicate the time you take off and put back on the physical activity monitoring device in this booklet.
 - Record the time that you spend **walking and/or jogging with your dog(s)** in this booklet.
 - If you spend any time **swimming and/or biking (including time on a stationary bike)**, indicate the time in this booklet.

Day 8

- If the study materials (i.e., this booklet, the physical activity monitoring device and the waist band) were delivered to your home, contact Nikolina and let her know that you have finished participating in the study. She will then arrange to pick up the study materials.
- If the study materials were mailed to you, return them in the pre-paid envelope that was sent to you.

If you have any questions about the instructions for this study, please contact Nikolina at ndantona@connect.carleton.ca

Unique code
entered here

DAY 1

DATE: _____
 day month year

Please be as precise as possible when reporting times.

Question to be completed in the MORNING:

Time put physical activity monitor ON in the morning: _____ (circle am / pm)

Question to be completed in the EVENING:

Time took physical activity monitor OFF in the evening: _____ (circle am / pm)

Questions to be completed if you remove the physical activity monitor during Day 1:

Time took off during day: off: _____ (circle am / pm) back on: _____ (circle am / pm)
Reason: _____

Time took off during day: off: _____ (circle am / pm) back on: _____ (circle am / pm)
Reason: _____

If you walk and/or jog with your dog on Day 1, indicate when you start and end each walk:

Start Time (specify am or pm)	End Time (specify am or pm)

Be sure to include all of your dog walks on Day 1.

If you spend time swimming and/or biking on Day 1, specify the start and end time:

Indicate activity (i.e., swam or bicycled)	Start Time (specify am or pm)	End Time (specify am or pm)

Thank you for taking the time to participate in this study!

You should now contact Nikolina at ndantona@connect.carleton.ca to let her know that you have finished participating in the study. When you contact Nikolina, please indicate from which of the following participating retailers you would like a \$12 gift card:

- PetSmart
- Tim Hortons
- Future Shop
- Starbucks
- Chapters
- Harveys
- Home Depot
- Walmart
- Canadian Tire
- Michaels

If the materials were delivered to your home, when Nikolina picks up your study materials, she will bring you your gift card.

If the materials were mailed to your home, you will need to mail back the study materials using the pre-paid envelope that was sent to you along with the study materials. Once Nikolina receives the study materials, she will then mail you your gift card.

Please note that along with your gift card, you will be provided with a debriefing that explains the purpose of this study.