

An Examination of the Possible Physical Activity and Short-Term Health Benefits Associated With Dog Walking

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The purpose of this study was to examine whether dog walking is beneficial for dog owners' health by providing sufficient physical activity for health benefits and improving their psychological health immediately after dog walking. The sample was comprised of 61 dog walkers who wore an accelerometer for one week on all of their dog walks and completed seven visual analogue scales assessing their psychological health before and after each of their dog walks. Slightly more than half of the time spent dog walking was at the moderate- to vigorous-intensity level recommended for health benefits. Furthermore, through dog walking alone, approximately two in five dog walkers met Canada's 150-minute physical activity guideline for health benefits. Analyses comparing dog walkers' psychological health before and after their dog walks revealed an improvement on six out of seven psychological health 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. Taken together, these findings provide objective evidence that dog walking is a viable means of attaining the physical activity needed for health benefits and highlight the need to further explore the short-term health benefits of dog walking.

Keywords: dog; dog walking; physical activity guidelines; health

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There is growing concern about the increasing rates of physical inactivity worldwide (World Health Organization [WHO], 2014), given the importance of physical activity for health. Strong evidence exists that regular physical activity lowers the risk of the following non-communicable diseases: 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). 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.

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, Katzmarzyk, Rhodes, & Shephard, 2007). Researchers have also found some evidence that physical activity may be beneficial in terms of reducing stress and anxiety (Gilmour, 2007; Rahl, 2010) 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, Ghanghro, Johnson, & Kidwai, 2011; Warburton et al., 2007).

The recognition that physical activity is important for health has resulted in the WHO (2010) and a number of countries developing physical activity guidelines, which outline the amount of physical activity

recommended for health benefits. The latest physical activity guidelines released 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) call for adults to accumulate at least 150 minutes of moderate- to vigorous-intensity physical activity weekly. The guidelines also specify that the physical activity should be accumulated in bouts lasting at least 10 minutes.

A number of countries such as Canada (Gilmour, 2007), the United States (Centers for Disease Control and Prevention, 2008) and the United Kingdom (Craig, Mindell, & Hirani, 2009) have conducted national studies to measure physical activity levels among adults. Recently researchers in a number of countries have begun using accelerometers in order to objectively assess physical activity rather than relying upon self-report techniques, the most commonly used method (D. Dale, Welk, & Matthews, 2002). Findings have revealed that there is a considerable discrepancy between the two types of measures. For example, 55% of Canadians self-reported achieving the recommended 150 minutes of moderate- to vigorous-intensity physical activity in 10-minute bouts (L. P. Dale et al., 2016), while only 22% met this guideline when physical activity was assessed using accelerometers (Statistics Canada, 2015). Researchers in the United States found a similar discrepancy with 60% of Americans achieving the 150-minute guideline through self-reported physical activity versus only 8% based on accelerometer-measured physical activity (Tucker, Welk, & Beyler, 2011).

Dog walking has been proposed as one means of obtaining the physical activity recommended for health benefits (Bauman,

Russell, Furber, & Dobson, 2001; Epping, 2011).

Dogs are a common household pet—approximately one in three American and Canadian households have a dog (American Veterinary Medical Association, 2015; Canadian Animal Health Institute, 2015)—and dogs are unique in that, unlike other household pets, they require exercise. 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.

A limitation of previous dog walking studies is that they have relied upon self-report measures to determine the amount of time dog owners spend walking their dog over the course of a week (e.g., Coleman et al., 2008; Reeves, Rafferty, Miller, & Lyon-Callo, 2011). Furthermore, many of the studies did not take into consideration whether the dog walking was done in bouts lasting at least 10 minutes (e.g., Cutt, Giles-Corti, & Knuiiman, 2008; Lentino, Visek, McDonnell, & DiPietro, 2012). 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. Dog walking studies that use self-report measures may also experience the limitations that have been noted by researchers studying physical activity levels. For example, researchers have suggested that self-report data may be affected by response bias resulting from social desirability concerns and recall issues, such as inaccurate memory (Colley et al., 2011; Prince et al., 2008).

Researchers have examined the possible long-term changes in physical and psychological health that may occur as a result of the physical activity obtained

through dog walking (Johnson & Meadows, 2010; Serpell, 1991; Thorpe et al., 2006). To-date there have been no quantitative studies examining the possibility that dog owners may experience immediate health benefits from walking their dog. However, there is evidence that engaging in a single bout of physical activity confers physical and psychological health benefits. For example, from a review of the literature, Thompson et al. (2001) noted that a single episode of physical activity lowers triglycerides and blood pressure, increases high-density lipoprotein cholesterol and reduces insulin resistance. Examples of improvements in psychological health following a single episode of physical activity include an increase in positive well-being and a decrease in psychological distress (Cox, Thomas, & Davis, 2001), improved mood (Sibold & Berg, 2010), reduced anxiety (Landers & Petruzzello, 1994) and decreased depression (North, McCullagh, & Tran, 1990).

The findings from two qualitative studies suggest that dog walking may confer immediate health benefits. First, a common theme that emerged from Knight and Edwards' (2008) focus groups with dog walkers was that the dogs motivated their owners to take them for a walk and they felt better physically and psychologically once they were outside walking their dog. Second, through interviews and participatory analysis sessions, Campbell, Smith, Tumilty, Cameron, and Treharne (2016) found that dog walking enhanced dog walkers' psychological health by reducing their level of stress and promoting feelings of calmness and relaxation.

Study Purpose

This purpose of this study was to examine whether dog walking provides sufficient physical activity for health benefits and whether dog walking provides health benefits in the form of improved

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psychological health immediately after the completion of the walk. To begin, this study explored whether dog walking is an effective means of obtaining the 150 minutes of moderate- to vigorous-intensity physical activity recommended for health benefits when time spent dog walking is objectively assessed using accelerometers. Next, this study explored whether dog walkers experience an improvement in their psychological health immediately after walking their dog¹ when psychological health is assessed using 1-item visual analogue scales.

Method

Participants

The sample was comprised of 61 dog walkers who went on 630 dog walks over the course of a week. Participants were eligible to participate in the study if they lived in Ottawa (Ontario, Canada), were at least 18 years of age, only owned one dog, typically walked their dog at least three times per week,² usually walked their dog for periods lasting at least 10 minutes and were not a professional dog walker. Participants were recruited through a variety of methods: (1) a sheet containing a description of the study was distributed to dog walkers at numerous dog parks in Ottawa; (2) copies of the sheet describing the study were made available at various locations (e.g., veterinarians' offices and animal hospitals); (3) participants were recruited through websites for classified ads, including Craigslist and Kijiji, and dog-related Internet websites, such as Ottawa Dog

Blog; (4) ads were placed on Ottawa Facebook dog groups; and (5) posters were placed in various locations in the community (e.g., libraries and community centers).

Materials

The accelerometer utilized in the present study was an Actical accelerometer (*Bio-Lynx Scientific Equipment, Montreal, Quebec*), which was set to record data in 1-minute intervals (epochs), resulting in a count value per minute. The cut-points that were applied to interpret the raw accelerometer data were those utilized by Statistics Canada when assessing Canadians' physical activity levels using the Actical accelerometer (Colley et al., 2011). 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. At the end of the study, participants were given a \$10 gift card and a personalized profile of their dog walking physical activity.

Demographic measures. In the online survey participants were asked to provide information about their sex, age, marital status, level of education, family household income before tax, whether they had children under 18 years living at home and whether they lived alone.

Measures for time spent dog walking. Data for the physical activity measures assessing time spent dog walking were collected by

¹The possible immediate changes in physical health from dog walking were not assessed, 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).

²In the American physical activity guidelines, it is stated that aerobic physical activity (e.g., dog walking) should be engaged in at least three days a week to confer health benefits (U.S. Department of Health and Human Services, 2008).

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having participants wear an accelerometer on their dog walks over the course of a week.

Intensity level. The amount of time spent dog walking at a sedentary-, light-, moderate- and vigorous-intensity level was determined by summing participants' total number of minutes dog walking at each intensity level over the course of the 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 *MVPA (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; Tucker et al., 2011). Second, time spent dog walking was also examined without taking bouts into consideration, given that dog owners may slow their pace or stop on account of the needs of their dog (Gaunet, Pari-Perrin, & Bernardin, 2014). The variable, *MVPA (no bouts)*, was created by summing any time spent dog walking at a moderate- or vigorous-intensity level over the course of the week.

Meeting guideline. Participants were classified according to whether they achieved the recommended guideline of at least 150 minutes of *MVPA* weekly through dog walking: *sufficient* (≥ 150 minutes) or *insufficient* (< 150 minutes). This was done for both *MVPA (in bouts)* and *MVPA (no bouts)*.

Measures for psychological health. Data for the psychological health measures were collected through a 7 day dog-walking log and an open-ended question that was completed on day 8 of the study.

Psychological health independent variable. The 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 on each of the following dependent variables:

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).

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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.

Overall 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 Canadian Community Health Survey (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 also asked to indicate whether they had experienced any stressful situations on their dog walk and, if so, to describe the stressful situations.

Open-ended question about benefits of dog walking. At the end of the 7 day dog-walking log there was an additional open-ended question to be completed on day 8. Participants were asked to describe the benefits, if any, that they receive from walking their dog. They were provided a textbox with sufficient space to provide more

than one benefit, if desired. This information was used to determine whether participants perceived that they received psychological health benefits from walking their dog.

Procedure

Participants began by completing an on-line survey on Survey Monkey (<https://www.surveymonkey.com/>), which contained questions about study eligibility and demographic characteristics. Participants were then either hand delivered or mailed a package containing a booklet, an accelerometer, a waistband and a postage paid return envelope (if the package was mailed to participants). The booklet consisted of three components. First, there was a cover letter and instructions for wearing the accelerometer. Participants were instructed to wear the accelerometer over their right hip on all of their dog walks for one week, beginning the day after they received the accelerometer. Second, there was a paper dog-walking log that included a series of questions that participants were instructed to complete immediately before and after walking their dog. This included the start and end time of their dog walks and seven visual analogue scales assessing their psychological health. Third, there was a sheet containing an open-ended question about possible benefits from dog walking that participants were instructed to complete on day 8. This study was approved by the Carleton University Psychology Research Ethics Board.

Data Analysis

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS). In order to explore dog walking as a means of meeting the recommended physical activity guidelines for health benefits, descriptive statistics were utilized. First, using the accelerometer data from the dog walks of each participant over the course of a

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week, the amount of time spent dog walking weekly at a sedentary-, light-, moderate- and vigorous-intensity level was calculated. Second, the weekly time spent dog walking at a *MVPA* was calculated. Third, the percentage of participants achieving the 150-minute guideline for health benefits through dog walking was determined. For the second and third calculations time spent dog walking was examined both with and without taking into consideration whether dog owners walked their dog in bouts lasting at least 10 minutes.

In order to determine whether dog walkers experience an improvement in their psychological health after dog walking, a repeated measures design was utilized. Data from each participant's dog walks over the course of the week were used to calculate a mean pre- and post-dog walk score for each of the following psychological health measures: energy, mood, self-esteem, depression, social life satisfaction, overall life satisfaction and stress. Seven one-way repeated measures ANOVAs were then conducted to compare dog walkers' psychological health immediately before and after their dog walks. As well, an eighth one-way repeated measures ANOVA was conducted to examine pre- and post-dog walk stress levels when those dog walks on which participants reported experiencing a stressful event were excluded.

Results

Demographic Characteristics

The sample was comprised of 61 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 1, 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.

Dog Walking and Physical Activity for Health Benefits

The mean amount of time spent dog walking at each intensity level is presented in Table 2 and the percentage of time spent dog walking weekly at each intensity level is shown in Figure 1. Participants most frequently walked their dog at a moderate-intensity level (187 minutes weekly or 46% of the time spent dog walking weekly). The next most common intensity level was light, with participants engaging in 138 minutes of dog walking weekly (34% of the time). Considerably less time was spent at the next most common intensity level, sedentary (58 minutes weekly or 14% of the time spent dog walking weekly). The least amount of time was spent at a vigorous-intensity level; participants only engaged in 23 minutes of vigorous-intensity physical activity on their dog walks over the course of the week (6% of the time). Table 2 also provides information on the mean amount of time spent dog walking weekly at the recommended *MVPA* level with and without 10-minute bouts. There was a notable difference (64 minutes) in weekly time spent dog walking at a *MVPA level (no bouts)* compared to *MVPA level (in bouts)*.

The percentage of participants achieving the 150 minutes of *MVPA* recommended for health benefits was examined. When bouts were not taken into consideration, 59.02% of the participants achieved the 150-minute guideline through dog walking. On the other hand, a considerably lower percentage, 37.70%, achieved the 150-minute guideline in 10-minute bouts through dog walking.

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Table 1
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		
Yes	12	20.34
No	47	79.66
Children under 18 living at home		
Yes	12	19.67
No	49	80.33

^aParticipants' 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).

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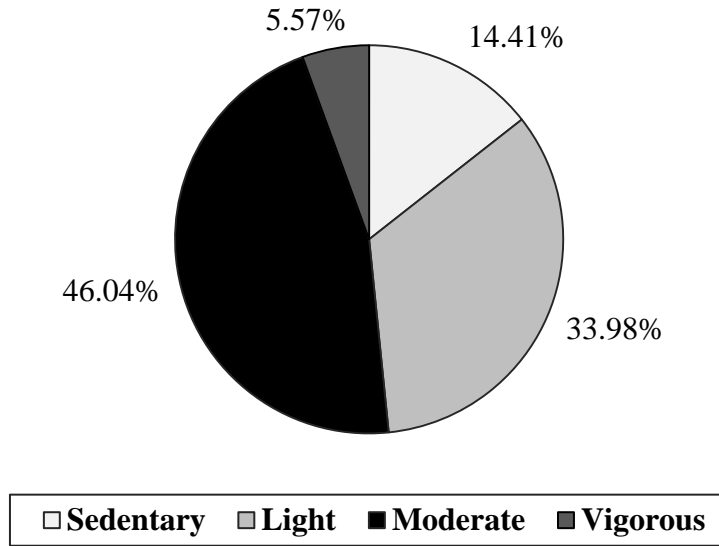


Figure 1. Percentage of time spent dog walking weekly at each intensity level (no bouts).

Table 2
Descriptive Statistics for Time Spent Dog Walking Weekly by Intensity Level and at a MVPA

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
MVPA (no bouts)	61	209.57	139.01	14.00	703.00
MVPA (in bouts)	61	146.07	123.10	0.00	620.00

Note. Information for the four intensity levels is presented without taking bouts into consideration.

^aTime spent dog walking at all intensity levels.

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Dog Walking and Short-Term Psychological Health

To begin, the associations between the psychological health dependent variables were examined for each of the two time periods: pre-dog walk and post-dog walk (see

Table 3). All of the pre-dog walk psychological health dependent variables were associated except for the relation between energy and depression. All of the post-dog walk psychological health dependent variables were correlated.

Table 3
Correlations Between Psychological Health Dependent Variables Pre- and Post-Dog Walk

Pre-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							-
Post-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							-

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

One-way repeated measures ANOVAs were then conducted to compare participants' psychological health immediately before and after their dog walks. As noted earlier, the psychological health data from the 630 dog walks were used to calculate mean pre- and post-dog walk scores on each of the psychological health measures

for each participant over the course of the week. Tests were conducted to assess changes in energy, mood, self-esteem, depression, social life satisfaction, overall life satisfaction, stress (including the walks on which a stressful event occurred) and stress (excluding the walks on which a stressful event occurred). In order to control

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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 4, 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 appeared to be 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, $F(1, 60) = 6.35, p = .014, \text{partial } \eta^2 = .096$.

After each dog walk, participants were asked to indicate whether they had experienced a stressful event while walking their dog. Participants reported experiencing a stressful event on 9.42% ($n = 59$) of their 626 dog walks (4 participants did not respond to this

question).³ The 59 stressful events included: dog misbehaved (57.63%), a dog or cat acted aggressively toward the participant's dog (15.25%), stress from family member walked with (8.47%), the weather (5.08%), stressful actions by others, such as bike rider/skateboarder (5.08%), illness of dog or participant (5.08%) and other stressors, such as dogs no longer allowed off leash (3.39%).

For the dependent variable stress, the analysis was also conducted with the 59 dog walks on which participants experienced a stressful event excluded when calculating mean pre- and post-dog walk stress levels. As may be seen from Table 4, 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 (partial $\eta^2 = .464$) compared to when all of their dog walks were included (partial $\eta^2 = .435$).

Table 4
ANOVA Results and Means and Standard Deviations for Psychological Health Dependent Variables Pre- and Post-Dog Walk

Dependent Variable	Pre-dog walk		Post-dog walk		$F(1, 60)$	p	Partial η^2
	M	SD	M	SD			
Energy	61.86	13.08	72.38	10.78	77.59	< .001	.564
Mood	69.43	11.13	76.04	9.52	42.19	< .001	.413
Self-esteem	71.82	12.89	76.56	11.48	28.34	< .001	.321
Social life satisfaction	72.00	13.56	75.86	13.20	17.83	< .001	.229
Overall life satisfaction	73.41	11.44	78.05	9.97	25.18	< .001	.296
Stress	25.54	15.87	20.49	15.75	46.25	< .001	.435
Stress (excluding 59 walks with stressful event)	25.30	15.54	19.25	15.81	51.88	< .001	.464

³Slightly 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.

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Through an open-ended question on day 8 of the study, participants were asked to describe the benefits, if any, that they receive from dog walking. The overwhelming majority of those who responded to this question ($n = 59$) identified more than one benefit (89.83%). More than half of the participants (55.93%) cited exercise for themselves as a benefit of dog walking. The next most frequently cited benefit was the social interactions that occurred while walking the dog (45.76%). Other benefits of dog walking identified by participants included: fresh air/being in nature (33.90%), stress release/relaxation (30.51%), interaction with neighbours/sense of community (25.42%), feel better/improved mood (23.73%) and time to reflect (10.17%).

Discussion

This study was conducted to provide insight into the possible health benefits of dog walking by examining whether dog walking provides the physical activity recommended for benefits and whether dog walking provides short-term psychological health benefits. When accelerometers were utilized to objectively assess the physical activity obtained dog walking, the results provided evidence that dog walking is an effective way of obtaining physical activity at the moderate- to vigorous-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 *MVPA* level: a mean of 146 minutes (in bouts) and 210 minutes (no bouts). Furthermore, 38% of the dog walkers achieved the Canadian physical activity guideline of 150 minutes of *MVPA* in 10-minute bouts through dog walking alone, which is considerably higher than the percentage of Canadians who met this guideline through all types of physical activity, 22% (Statistics Canada, 2015).

An examination of the time spent dog walking at each intensity level revealed that dog walkers spent more than half of their time (52%) at the *MVPA* level called for in the physical activity guidelines: 46% of the time at a moderate-intensity level and 6% at a vigorous-intensity level. Dog walkers spent the remaining time at a light-intensity level (34%) or were sedentary (14%). Although dog walkers spent one-third of their time dog walking at a light-intensity level, it is noteworthy that researchers have found that light-intensity physical activity provides some health benefits (Howard et al., 2015; Loprinzi, 2013).

This study examined for the first time whether the physical activity obtained dog walking confers immediate psychological health benefits. The results revealed that dog walkers' psychological health improved significantly on six out of seven measures and that these findings had large effect sizes (Cohen, 1988), which ranged from a partial η^2 of .229 to .564. The large effect sizes indicate that dog walkers experienced substantial improvements in their psychological health after walking their dog. Dog walkers felt less stressed and experienced an increase in their energy, self-esteem, social life satisfaction and overall life satisfaction as well as a more positive mood after walking their dog.

The finding that dog walking confers immediate psychological health benefits is consistent with previous research, which found that engaging in a single session of physical activity is associated with psychological health benefits (Cox et al., 2001; Landers & Petruzzello, 1994; North et al., 1990; Sibold & Berg, 2010). 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. This finding is consistent with the results from two qualitative studies (Campbell et al., 2016; Knight & Edwards, 2008), which found that dog walkers felt better psychologically when they were out walking their dog.

The immediate psychological health benefits from dog walking may be influenced by factors such as the dog walkers' social interactions on their dog walks. 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. Two ways that the social interactions that occur while dog walking may be beneficial for dog walkers' immediate psychological health have been suggested. First, 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. Second, according to Laurier, Maze, and Lundin (2006), dog walking provides dog walkers with the opportunity to meet new people, which they suggest may reduce feelings of loneliness and social isolation. However, it is noteworthy that Gilbey and Tani's (2015) systematic review of 21 studies found little support for the contention that companion animals help to reduce loneliness.

Another factor that may affect the short-term psychological health benefits from dog walking is the environment in which the dog is walked. 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). 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; Nisbet & Zelenski, 2011; Thompson Coon et al., 2011). The dog walkers in the present study may have experienced greater psychological health benefits on those dog walks that occurred in a greenspace rather 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.

The results from the present study of dog owners who walk their dog indicate that dog walking is a viable means of meeting the Canadian physical activity guidelines for health benefits and that dog walking provides immediate psychological health benefits. However, the fact that researchers have found that a sizeable percentage of dog owners (36%) do not walk their dog (Soares et al., 2015), highlights the need to identify ways of encouraging those dog owners who do not walk their dog to do so. It is noteworthy that the physical activity obtained dog walking is important not only for the owner but also the dog, as reflected by the fact that in 2016 approximately 54% of American dogs were overweight or obese (Association for Pet Obesity Prevention, 2017).

Strengths and Limitations/Future Research

A major strength of this study was the use of accelerometers, rather than a self-report measure, to assess dog walking as a means of achieving the recommended *MVPA* guidelines. Having objective information about the time spent at each intensity level while dog walking is important, given that the results revealed that dog walkers spent a considerable amount of time at a sedentary- or light-intensity level on their dog walks over the course of a week. One limitation of this study stems from the fact that the findings cannot be generalized to all dog walkers, given that the sample was restricted to dog walkers who walked their dog at least

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three times a week for periods that typically lasted at least 10 minutes, and because the sample characteristics do not reflect a wide cross-section of society (e.g., higher socioeconomic status).

The examination of the immediate psychological health benefits from dog walking had two limitations. First, the dog walkers may have discerned that the researchers were 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 was the fact that it was readily apparent to the 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 in future studies would be to use indirect multi-item measures (although these make compliance and continuation more challenging).

There is a need for future studies to explore how long the immediate psychological health benefits persist after the dog walk has ended, given 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). In addition, there is a need to examine whether the immediate psychological health benefits affect other areas of dog walkers' lives, such as their interactions with family, friends and/or co-workers after the dog walk. When designing future studies researchers should also consider including a control or

comparison condition, as this would enable them to compare the immediate changes in psychological health from walking with versus without a dog. Finally, given that this study 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 walkers' physical health.

Finally, research is needed to determine whether acquiring a dog and walking it leads to an increase in physical activity or whether physical activity levels remain the same before and after acquiring dog, if those individuals who choose to acquire a dog are already active. The results from a small longitudinal study that utilized accelerometers found that those who were and were not planning to acquire a dog did not differ in their moderate- to vigorous-intensity physical activity in 10-minute bouts at baseline (Duvall Antonacopoulos & Pychyl, 2017). While the group that acquired a dog and walked it became more physically active over the 8 month study, the control group of non-dog owners did not differ in their physical activity level over the course of the study. The finding that individuals who acquired a dog and walked it became more physically active needs to be explored further using both qualitative and longitudinal research designs in order to obtain a more in-depth understanding of how acquiring a dog affects dog owners' physical activity.

Conclusions

This study examined dog walking as a means of obtaining sufficient physical activity for health benefits and improving dog owners' short-term psychological health. The results provide objective evidence that dog walking is in fact one means of attaining the physical activity needed for health benefits. The results from the week-long study revealed that more than half of the time spent dog walking was at the moderate- to

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vigorous-intensity level recommended for health benefits and that, though dog walking alone, approximately two in five dog walkers achieved Canada's 150-minute guideline in 10-minute bouts. The results also revealed that there are short-term health benefits from dog walking, as reflected by the fact that dog owners experienced an improvement on six out of seven psychological health measures immediately after walking their dog. The large effect sizes for these results indicate that dog walkers experienced substantial improvements in their psychological health immediately after dog walking. In summary, these findings highlight the need for additional research to examine the ways in which dog walking can affect dog owners' health.

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