Dog Ownership and Physical Activity: A Review of the Evidence


Background: Dog walking is a strategy for increasing population levels of physical activity (PA). Numerous cross-sectional studies of the relationship between dog ownership and PA have been conducted. The purpose was to review studies comparing PA of dog owners (DO) to nondog owners (NDO), summarize the prevalence of dog walking, and provide recommendations for research. Methods: A review of published studies (1990–2010) examining DO and NDO PA and the prevalence of dog walking was conducted (N = 29). Studies estimating the relationship between dog ownership and PA were grouped to create a point-estimate using meta-analysis. Results: Most studies were conducted in the last 5 years, were cross-sectional, and sampled adults from Australia or the United States. Approximately 60% of DO walked their dog, with a median duration and frequency of 160 minutes/week and 4 walks/week, respectively. Meta-analysis showed DO engage in more walking and PA than NDO and the effect sizes are small to moderate (d = 0.26 and d = 0.16, respectively). Three studies provided evidence of a directional relationship between dog ownership and walking. Conclusions: Longitudinal and interventional studies would provide stronger causal evidence for the relationship between dog ownership and PA. Improved knowledge of factors associated with dog walking will guide intervention research.

Keywords: walking, dog, dog walking, recreational activity, meta-analysis

Regular physical activity (PA) is important in the prevention of chronic disease. Nevertheless, a significant proportion of youth and adults do not meet the recommended level of PA required for health benefits. Walking is a popular form of PA because it is considered easy and requires little skill or finances. Dog ownership may be associated with higher levels of PA. In many developed countries rates of dog ownership are high. For example, an estimated 39% of United States (US) and 40% of Australian households own at least 1 dog. This level of ownership illustrates the strong level of attachment that exists between humans and canines. Considering the large proportion of dog owners and that many dogs enjoy being walked, dog walking could provide a potentially viable strategy for increasing population levels of PA.

Research on this topic is growing rapidly and its potential as a PA intervention strategy is being recognized. Therefore, a review of the evidence is timely. This paper 1) reviews studies that compared PA of dog owners (DO) to nondog owners (NDO) and 2) summarizes the prevalence of dog walking from the scientific literature. Based on these findings, we discuss recommendations to help advance the field of dog walking research.

Methods

Search Strategy

Electronic databases were searched for relevant published articles (MEDLINE, PsychINFO, FAMILY: Australian Family and Society abstracts, ProQuest social science journals, ScienceDirect, Web of Science, and Academic Search Complete). Dog-related keywords (dog, dog walking, dog ownership, canine, pet, pet ownership, companion animal, human animal interaction) were crossed with PA-related keywords (walking, PA, leisure-time PA, leisure-time exercise, health, human health) for the search. The searches included only peer-reviewed studies published in the English language between
1990–2010. Reference lists from articles we included were also scanned and cross-referenced for additional potential studies.

**Eligibility Criteria**

Papers were excluded if the outcome measure was related to the health of the dog and not to humans (see Figure 1 in Appendix). Reviews, reports, case reports, qualitative studies, and abstracts only were excluded. Cross-sectional, surveillance, and cohort studies were included. Overall, 99 articles met the inclusion criteria. After excluding articles that did not report data comparing DO and NDO PA or the prevalence of dog walking by owners, 29 articles were included in the review. Among the cross-sectional studies, 11 studies reported on DO and NDO PA, 9 studies reported on the amount of dog walking by owners, and 6 studies reported on both DO and NDO PA and the prevalence of dog walking by owners. In addition, 3 studies reported longitudinal data on the relationship between dog ownership and PA.

**Meta-Analysis**

This systematic review provided the opportunity to conduct a meta-analysis and calculate a summary estimate of the 1) walking and 2) PA levels, of DO compared with NDO. Studies were included in the meta-analyses if they featured a relationship between a walking (n = 11; see Table 1) or PA (n = 6; see Table 1) variable and a dog ownership variable expressed in terms of an effect size (r, OR, or d). The referent was NDO and the dependent variable was minutes of walking or PA (when available). The meta value is subject to some variability because studies used different metrics to measure the dependent variable, however, this was overcome by using the standardized mean difference as the summary statistic. When multiple ORs were present due to subanalyses, only the total sample effect size was used. Along with the weighted average standardized mean difference, 95% confidence intervals (CI) were computed. Data were analyzed using Comprehensive Meta-analysis-2 software.15

The studies reviewed were grouped and analyzed using 3 main themes. First, a descriptive analysis and a meta-analysis of studies of dog owner and nondog owner walking and PA was undertaken. Second, a descriptive summary review of studies reporting the prevalence of dog walking was performed. Lastly, 3 longitudinal studies reporting data on the relationship between dog ownership were reviewed and summarized.

**Results**

**Physical Activity Levels of Dog Owners Versus Nondog Owners**

Studies were published between 1996–2010, the majority being in the last 5 years and either from Australia (n = 7) or the United States (n = 6). One study was conducted in Canada, 1 in Japan, and 2 in the United Kingdom. Across the 17 studies, the mean sample size was 4117 (range = 127–41,514) and median age of adult participants was 45 years (interquartile range (IQR: 40.0, 59.1). Three studies sampled older adults only16–18 and 2 studies sampled children (range = 5 to 12 years).19,20 Across studies, 32%–60% of adult samples were male, with 1 study of women only.21 Fourteen studies reported the prevalence of dog ownership among the study samples (median rate of dog ownership = 24%; range = 10%–57%). Generally, dog ownership was comparable to the estimated population rate of dog ownership within the country of study, with the highest levels in Australia (37%).

Overall, adult DO reported more minutes per week of PA (median: DO = 329; NDO = 277) and/or walking (median: DO = 129; NDO = 111) than NDO. Four of the fourteen studies reported differences between DO and NDO PA using objective measures (ie, accelerometer and/or pedometer). Among these studies, 2 sampled children,19,20 1 sampled older adults,18 and the other sampled adults,22 however, all showed that DO had significantly higher levels of objectively measured PA than NDO.

The point estimate for random effects meta-analysis was a standardized mean difference between DO and NDO of 0.26 (95% CI: 0.16, 0.35) for walking and 0.16 (95% CI: 0.03, 0.30) for PA. Thus, DO walked more than NDO and were more physically active than NDO. The effect can be categorized as a small to moderate yet meaningful difference.

**Prevalence of Dog Walking**

Table 2 summarizes 15 studies examining the amount of dog walking by DO (6 of these studies are also included in Table 1). Studies were conducted between 2001–2010, the majority either from Australia (n = 8) or the US (n = 6). Across the studies the mean sample size was 4251 (range = 24–47,731) and median age of adult participants was 45 years (IQR: 37.0, 55.3). Two of these studies sampled older, predominantly female adults.18,23 Moreover, 2 studies were conducted with the same sample of Australian children age 5–6 and 10–12 years20,24 and 3 studies sampled different subgroups from the same study.25–27 Across studies of middle-age adults, 22%–52% of the samples were male. Five studies included DO only and the remainder either reported a dog ownership rate comparable to the population rate of dog ownership within the country of the study (n = 7) or did not report the prevalence of dog ownership in their sample (n = 3). The median prevalence of dog walking among DO across all studies was 59% (range = 3%–80%). Ten studies provided descriptive data on duration and/or frequency of dog walking (3 studies provided both). Median duration and frequency of weekly dog walking among studies sampling adults were 160 minutes (IQR: 114.6, 210.0) and 4 walks (IQR: 2.4, 4.8), respectively; this equates to approximately 4 walks per week of 40 minutes each. Twelve percent of children age 5–6 years and 18% of children age 10–12 years walked their dog at least 3 times per week.24 Across both age groups children walked their dog on average 1.7 times per week (SD = 2.1).20
Table 1  Physical Activity of Dog Owner and Nondog Owners in Publication Date Order (1996–2010)

<table>
<thead>
<tr>
<th>Author, year of study, country of study</th>
<th>Sample characteristics: sample size, age, gender, % dog owners</th>
<th>Achieve recommended level of physical activity</th>
<th>Mean minutes/week of physical activity</th>
<th>Mean minutes/week of walking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dembicki &amp; Anderson*, 1996, United States&lt;sup&gt;17&lt;/sup&gt;</td>
<td>N = 127, 60+ years, 34.6% PO</td>
<td>Achieve recommended level of physical activity</td>
<td>Minutes/day: DO: 37.8 ± 27.8*; NO: 20.6 ± 23.2</td>
<td>Mean frequency: DO: 4.0 walks; NO: 2.5 walks</td>
</tr>
<tr>
<td>Headey, 1999, Australia&lt;sup&gt;40&lt;/sup&gt;</td>
<td>N = 1011, 16+ yrs (stratified by age &amp; gender), 40% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>DO: 210 (95% CI: 186–228); NO: 198 (95% CI: 174–216)</td>
<td>DO: 120 (95% CI: 108–132); NO: 102 (95% CI: 84–108)</td>
</tr>
<tr>
<td>Bauman et al#, 2001, Australia&lt;sup&gt;41&lt;/sup&gt;</td>
<td>N = 894, 44 yrs (mean), 45.6% male, 45.9% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>DO: 46.9%; NO: 47.3%</td>
<td>DO: 40.3**; NO 287.5</td>
</tr>
<tr>
<td>Giles-Corti &amp; Donovan*, 2003, Australia&lt;sup&gt;42&lt;/sup&gt;</td>
<td>N = 1773, 18–59 yrs, 31.8% male</td>
<td>Achieve recommended level of physical activity</td>
<td>Walk ≥ 180 min/wk vs. &lt; 179 min/wk: DO: OR = 1.58 (95% CI: 1.19–2.09); NO: OR = 1.00</td>
<td>Walking for leisure: DO: 114.9; NO: 108.2</td>
</tr>
<tr>
<td>Schofield et al*, 2005, Australia&lt;sup&gt;43&lt;/sup&gt;</td>
<td>N = 1237, 18+ years (stratified by age &amp; gender), 57.2% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>DO: 334.8; NO: 346.4</td>
<td>DO: 300.2**; NO 168.4</td>
</tr>
<tr>
<td>Brown &amp; Rhodes&lt;sup&gt;#&lt;/sup&gt;, 2006, Canada&lt;sup&gt;36&lt;/sup&gt;</td>
<td>N = 351, 56 yrs (mean for men), 50.4% male, 19.9% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>E: 99.2; NPE: 64.4</td>
<td>Exercise walking: DO: 75.4; NO: 57.8</td>
</tr>
<tr>
<td>Thorpe et al*, 2006, United States&lt;sup&gt;16&lt;/sup&gt;</td>
<td>N = 2533, 70–79 yrs, 48.3% male, 12.9% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>Any physical activity: DO: 67.2%; NO: 56.6%; NPE: 64.0%; DO: OR = 1.32 (95% CI: 1.1–1.76); NO: OR = 0.57 (95% CI: 0.4–0.82); NPE: OR = 1.00</td>
<td>Nonexercise walking: DO: 67.9*; NO: 32.1</td>
</tr>
<tr>
<td>Ball et al*, 2007, Australia&lt;sup&gt;21&lt;/sup&gt;</td>
<td>N = 1282, 42 yrs (mean), 100% female, 40% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>Any walking for leisure: DO: 73%*, NO: 61%</td>
<td>Exercise walking: DO: 75.4; NO: 57.8</td>
</tr>
<tr>
<td>Moudon et al*, 2007, United States&lt;sup&gt;44&lt;/sup&gt;</td>
<td>N = 608, 45–54 yrs, 49% male, 18% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>Walk ≥ 150 min/wk vs. &lt; 149 min/wk: DO: OR = 1.99 (95% CI: 1.21–3.26); NO: OR = 1.00</td>
<td>Accelerometer MVPA min/day: DW: 35 ± 24*; NDW: 27 ± 21; NO: 33 ± 24</td>
</tr>
<tr>
<td>Coleman et al, 2008, United States&lt;sup&gt;22&lt;/sup&gt;</td>
<td>N = 2199, 45 yrs (mean), 52% male, 28% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>DW: 53%; NDW: 33%; NO: 46%</td>
<td>DO: 322.4***; NO: 267.1</td>
</tr>
<tr>
<td>Cutt et al#, 2008, Australia&lt;sup&gt;26&lt;/sup&gt;</td>
<td>N = 1813, 40 yrs (mean), 40.5% male, 44% DO</td>
<td>Achieve recommended level of physical activity</td>
<td>DO: OR = 1.57** (95% CI: 1.14–2.16); NO: OR = 1.00; Walk ≥ 150 min/wk: DO: OR = 1.59* (95% CI: 1.08–2.36); NO: OR = 1.00</td>
<td>DO: 150.3***; NO: 110.9</td>
</tr>
</tbody>
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(continued)
### Table 1 (continued)

<table>
<thead>
<tr>
<th>Author, year of study, country of study</th>
<th>Sample characteristics: sample size, age, gender, % dog owners</th>
<th>Achieve recommended level of physical activity</th>
<th>Mean minutes/week of physical activity</th>
<th>Mean minutes/week of walking</th>
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<tbody>
<tr>
<td>Yabroff+, 2008, United States&lt;sup&gt;45&lt;/sup&gt;</td>
<td>N = 41,514, 65.4% 18–49 yrs, 49% male, 17.7% DO</td>
<td>Any walking for transportation: DO: OR = 0.91 (95% CI: 0.85–0.99); NPO: OR = 1.00; Any walking for leisure: DO: OR = 1.60 (95% CI: 1.50–1.80); NPO: OR = 1.00</td>
<td>DO: 129.3*; NPO: 119.7</td>
<td></td>
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<tr>
<td>Harris et al, 2009, United Kingdom&lt;sup&gt;18&lt;/sup&gt;</td>
<td>N = 240, ≥ 65 yrs, 52.1% male</td>
<td></td>
<td>DW 1670 more pedometer steps/day than NDW</td>
<td></td>
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<tr>
<td>Oka &amp; Shibata&lt;sup#+4&lt;/sup&gt;, 2009, Japan&lt;sup&gt;46&lt;/sup&gt;</td>
<td>N = 5177, 50% ≤ 39 yrs, 50% male, 18% DO</td>
<td>DO: 32.9%; NO: 26.4%; NPO: 25.0%; DO: OR = 1.54* (95% CI: 1.3–1.82); NO: OR = 1.11 (95% CI: 0.93–1.33); NPO: OR = 1.00</td>
<td>DO: 17.0***; NO: 10.9; NPO: 11.7</td>
<td>(MET-hr/wk): DO: 12.4*; NO: 10.5; NPO: 9.8</td>
</tr>
<tr>
<td>Gillum &amp; Obisesan, 2010, United States&lt;sup&gt;47&lt;/sup&gt;</td>
<td>N = 5903, ≥ 40 yrs, 46% male, 21% of 70–89 yr-olds were DO</td>
<td>Frequency: DO: 25% (8 times/wk)* (95% CI: 21–31); 15% (0 times/wk)* (95% CI: 13–18)</td>
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<tr>
<td>Owen et al, 2010, United Kingdom&lt;sup&gt;19&lt;/sup&gt;</td>
<td>N = 2065, 9–10 yrs, 10% DO</td>
<td>Accelerometer: MVPA min/day: DO: 72 (95% CI: 68–75); NO: 69 (95% CI: 66–71); Counts/min: DO: 511 (95% CI: 492–530)**; NO: 486 (95% CI: 478–495)</td>
<td></td>
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<tr>
<td>Salmon et al, 2010, Australia&lt;sup&gt;20&lt;/sup&gt;</td>
<td>N = 294 (5–6 yrs), N = 926 (10–12 yrs), 47.4% boys, 44% DO (5-6 yrs), 56% DO (10–12 yrs), N = 1152 mothers, N = 957 fathers, 40 yrs (mean), 53% DO</td>
<td>NO vs. DO (total sample): β = –0.04 (95% CI: –0.45 to 0.38); 5–6 yrs girls: DO = 29.3 min/day more accelerometer measured MVPA (95% CI: 5.5–53.1) than NO</td>
<td>NO vs. DO (total sample): β = –0.35 (95% CI: 0.17–0.56)**; 10–12 yrs girls: DO = 1.5 sessions/week more than NO</td>
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*Indicates 11 studies included in the walking meta-analysis; * Indicates 6 studies included in the PA meta-analysis.

Abbreviations: DO, dog owner; NO, Nondog owner; DW, dog walker; NDW, nondog walker; PO, pet owner; NPO, nonpet owner; MVPA, moderate-to-vigorous physical activity; METs-h/wk, Metabolic equivalents hours/week; N, sample size; OR, odds ratio; 95% CI, 95% confidence interval; β, linear regression β coefficient.

* P < 0.05; ** P < 0.01; *** P < 0.001.
<table>
<thead>
<tr>
<th>Author, year of study, country of study</th>
<th>Sample characteristics: sample size, age, gender, % dog owners</th>
<th>Prevalence of dog walking (%)</th>
<th>Minutes/week of dog walking</th>
<th>Frequency/week of dog walking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauman et al, 2001, Australia(^{41})</td>
<td>N = 894, 44 yrs (mean), 45.6% male, 45.9% DO</td>
<td>41.0</td>
<td>57 (mean)</td>
<td>3 (median)</td>
</tr>
<tr>
<td>Johnson &amp; Meadows, 2002, United States(^{23})</td>
<td>N = 24, 66 yrs (mean), 16.7% male, 100% DO</td>
<td>45.8</td>
<td></td>
<td>4 (mean)</td>
</tr>
<tr>
<td>Schofield et al, 2005, Australia(^{43})</td>
<td>N = 1237; 57.2% DO</td>
<td>By a household member: 60</td>
<td></td>
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</tr>
<tr>
<td>Suminski et al, 2005, United States(^{48})</td>
<td>N = 474, 37 yrs (mean), 43.9% male, 45.4% DO</td>
<td>27.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ham &amp; Epping, 2006, United States(^{49})</td>
<td>N = 1282, 55.4% ≥ 45 yrs, 41% male, 100% DO</td>
<td>Daily dog walking of at least 10 mins: 80.2</td>
<td>42.3% ≥ 30 min/day</td>
<td></td>
</tr>
<tr>
<td>Coleman et al, 2008, United States(^{22})</td>
<td>N = 2199, 45 yrs (mean), 52% male, 28% DO</td>
<td>70</td>
<td>Of those who walked: 180 ± 186 (mean)</td>
<td></td>
</tr>
<tr>
<td>Cutt et al, 2008, Australia(^{26})</td>
<td>N = 1813, 40 yrs (mean), 40.5% male, 44% DO</td>
<td>78</td>
<td></td>
<td>2.6 (mean)</td>
</tr>
<tr>
<td>Cutt et al, 2008, Australia(^{25})</td>
<td>N = 629, 18+ yrs, 100% DO</td>
<td>77</td>
<td>133.8 (mean) (SD: 112.8)</td>
<td>4 (mean) (SD: 2.8)</td>
</tr>
<tr>
<td>Timperio et al, 2008, Australia(^{24})</td>
<td>N = 281 (5–6 yrs); N = 864 (10–12 yrs); 44.8% DO (5–6 yrs); 57.3% DO (10–12 yrs)</td>
<td>22.6 (5–6 yrs); 36.9 (10–12 yrs)</td>
<td></td>
<td>5–6 yrs: 1–2 times/wk = 10.6%; ≥ 3 times/wk = 12%; 10–12 yrs: 1–2 times/wk = 18.7%; ≥ 3 times/wk = 0.1%</td>
</tr>
<tr>
<td>Tudor-Locke &amp; Ham, 2008, United States(^{50})</td>
<td>N = 47,731 person-days, 31.9% 30–44 yrs, 43.5% male</td>
<td>2.6 (2.3–2.8) dog walked in a 24 hour period</td>
<td>Duration/day: 30 (median)</td>
<td></td>
</tr>
<tr>
<td>Harris et al, 2009, United Kingdom(^{18})</td>
<td>N = 240, ≥ 65 yrs, 52.1% male</td>
<td>21.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merom et al, 2009, Australia(^{51})</td>
<td>N = 3415, 30.7% 30–44 yrs, 43.9% male</td>
<td>Of those who walk: 13.2 (prompted response)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian (nee Cutt) et al, 2010, Australia(^{47})</td>
<td>N = 483, 18 yrs, 100% DO</td>
<td>100</td>
<td>Regular dog walkers: 192.9 (mean) (SD: 112.6)**; Irregular dog walkers: 48.0 (mean) (SD: 19.1)</td>
<td>Regular dog walkers: 5.3 (mean) (SD: 2.9)**; Irregular dog walkers: 2.1 (mean) (SD: 1.3)</td>
</tr>
<tr>
<td>Salmon et al, 2010, Australia(^{20})</td>
<td>N = 294 (5–6 yrs), N = 926 (10–12 yrs), 47.4% boys, 44% DO (5–6 yrs), 56% DO (10–12 yrs), N = 1152 mothers, N = 957 fathers, 40 yrs (mean), 53% DO</td>
<td>59.0</td>
<td>1.7 (mean) (SD: 2.1)</td>
<td></td>
</tr>
<tr>
<td>Hoerster et al, 2010, United States(^{17})</td>
<td>N = 984, 52 yrs (mean), 22.2% male, 100% DO</td>
<td>68.5</td>
<td>139.9 (mean) (SD: 181.3)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: DO, dog owner; N, sample size; SD, Standard Deviation.

* P < 0.05; ** P < 0.01; *** P < 0.001.
Longitudinal Evidence of Relationship Between Dog Ownership and Physical Activity

To date, 3 studies\textsuperscript{28–30} have examined the relationship between dog ownership and PA using a longitudinal design.

In 1991, Serpell conducted a 10-month longitudinal study to examine changes in behavior and health status of 71 adult subjects who recently acquired a pet from a UK animal shelter (47 dog owners and 24 cat owners).\textsuperscript{28} Dog owners increased their recreational walking more over a 10-month period compared with nonpet owners.

More recently, a US study by Thorpe and colleagues examined dog walking behavior of 394 DO and 2137 NDO and walking speed over 3 years in a sample of community-dwelling older adults (range 71–82 years).\textsuperscript{29} At follow-up, dog walkers were twice as likely as nondog walkers and NDO to achieve recommended walking levels, independent of demographic factors and health-related characteristics. While dog walkers and NDO showed similar declines in usual and rapid walking speed, dog walkers maintained their initial mobility advantage.\textsuperscript{29} Although dog ownership appeared to facilitate walking behavior, the prevalence of dog ownership was low (15.5%) and only a minority of older DO walked their dog (36%).

Finally, an Australian study by Cutt and colleagues in 2008\textsuperscript{30} examined changes in sociodemographic, environmental, and intrapersonal factors associated with dog acquisition in adult NDO at baseline to 12-months follow-up and the effect of dog acquisition on minutes per week of recreational walking. At 12 months follow-up 12% (n = 92) of baseline NDO had acquired a dog and 681 had remained NDO. After adjusting for baseline variables, the effect of dog acquisition on the increase in minutes of neighborhood recreational walking was 31 minutes/week (95% CI: 7.4, 54.2). However, this reduced to 22 minutes (95% CI: -1.5, 45.4) after further adjustment for change in baseline to follow-up variables. Increase in intention to walk mediated the effect of dog acquisition on recreational walking.\textsuperscript{30} Importantly, this study measured change in dog ownership status over time and adjusted for both baseline and change over time confounders.

Discussion

Overall, the results of this review indicate that dog ownership is consistently associated with higher levels of walking and PA compared with those who do not own dogs. Moreover, DO (and dog walkers) were more likely than NDO (and nondog walkers) to meet the recommended levels of PA.\textsuperscript{2} The results of the meta-analyses showed that DO walk more and are more physically active than NDO. These effects can be categorized as a small to moderate yet meaningful difference and are an important first step at summarizing this data. However, the analysis was limited due to variations in the metrics of the dependent variables and study samples.

These findings, primarily from cross-sectional studies, are further strengthened by longitudinal data; however, there is a paucity of longitudinal studies that contain measures of dog ownership, dog walking or any other dog-related characteristics. For example, if questions on dog ownership and dog walking behavior were regularly added to state and national PA and or health surveys it could provide a potential source of longitudinal data that would assist in determining the relationship between dog ownership, dog walking and PA. Further, more research is required to confirm that getting a dog does in fact cause people to walk more and whether the increase in walking as a result of acquiring and walking a dog is at the expense of other types of PA (eg, sport participation, transport-related trips).\textsuperscript{30} Specifically, does dog acquisition influence changes in total PA, recreational walking, transport-related walking, other moderate-intensity activity and high intensity activity over the short and long term? Moreover, what impact does the long-term commitment of dog ownership play in maintaining walking behavior?

The results of this review highlight a number of important methodological considerations for future dog walking studies. While the scientific rigor of the studies presented has improved over time, many studies do not adequately control for confounding factors. For example, sociodemographic characteristics such as age, gender, socioeconomic status, and ethnicity are known to be associated with health behaviors such as PA\textsuperscript{31,32} and are also associated with dog ownership\textsuperscript{33} and thus should be tested as potential confounders in analyses exploring associations between dog ownership and PA.

Another methodological limitation observed during this review is the inconsistent use of terminology. Regarding the definition of ownership, because increased PA of pet owners may be due to dog walking, studies should specifically measure dog ownership rather than pet ownership. Moreover, this review shows that many DO are not active with their dogs. Thus, those that walk their dog should be distinguished from those that own a dog but do not walk their dog. Furthermore, consistent terminology should be used to define different subgroups and it is recommended that researchers refer to dog owners (DO), nondog owners (NDO), dog walkers (DW), and those who do not walk with their dogs—nondog walkers (NDW), as appropriate and has been done in this paper. Finally, consistency in the outcome measures reported would allow study results to be compared. Researchers should attempt to report outcomes of total and leisure-time PA and walking in minutes per week, proportion meeting recommended level of PA\textsuperscript{2}, and for DO, prevalence of dog walking as well as minutes (and frequency) of dog walking per week.

Only 4 studies in this review used an objective measure of PA (ie, accelerometer or pedometer) to compare the PA level of DO and NDO.\textsuperscript{18–20,22} The results confirm our findings of studies using self-report measures of PA. Future studies should include objective outcome measures to supplement self-reported measures. In particular,
The following is recommended for future dog-walking research:

1. **Objectively measured PA** (ie, accelerometers or pedometers) in addition to self-report measures
2. **Use context-specific measures**
3. **Examine and adjust for confounders in analyses**
4. **Conduct more international studies**
5. **Conduct more studies involving children and adolescents, race/ethnicity, and socioeconomic groups**
6. **Conduct more longitudinal studies to elucidate determinants of dog walking behavior and mediators between dog ownership and walking**
7. **Implement controlled intervention-based research to increase dog walking among DO**
8. **Initiate interdisciplinary research and collaboration between researchers from the field of human and veterinary public health, animal behavior, and urban planning**
9. **Be informed of current activity in the area of dog walking research [become a member of the International Dog Walking Activity Group (ID-WAG)].**

**Conclusions**

This review summarizes studies comparing the PA behavior of DO and NDO and the prevalence of dog walking behavior. Overall, the findings suggest that dog walking research needs to move beyond cross-sectional analyses of the PA levels of DO and NDO, to study designs that will provide further evidence of the directional relationship between dog ownership and PA. While dog walking has significant potential to increase the proportion of the community who are physically active, either by encouraging those who do not walk their dog to do so, or by increasing the amount of walking owners do with their dog, more research is required to better understand the correlates, determinants, and mediators of dog walking behavior. Improved knowledge of the factors associated with dog walking behavior will help guide future dog walking intervention research. Moreover, significant progression of this field requires more rigorous and consistent methodology as well as an interdisciplinary approach.

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References


35. Rohlf VI, Toukhatsi S, Coleman GJ, Bennett PC. Dog obesity: can dog caregivers’ (owners’) feeding and exercise


Appendix

Search of electronic databases:
- MEDLINE
- PsychINFO
- FAMILY: Australian Family and Society abstracts
- ProQuest social science journals
- ScienceDirect
- Web of Science
- Academic Search Complete

Limits: English language, peer-reviewed, published 1990 - 2010

Key words AND combinations:

Result: 109 (duplicates removed)

Dog related:
- Dog
- Dog walking
- Dog ownership
- Canine
- Pet
- Pet ownership
- Companion animal
- Human-animal interaction

Physical activity related:
- Walking
- Physical activity
- Leisure-time physical activity
- Leisure-time exercise
- Health

109 titles and/or abstracts assessed for inclusion in full text review

20 Excluded
Reviews, reports, case reports, qualitative studies and abstracts

99 full text articles assessed for eligibility

70 Excluded
Articles that did not report: (52)
- DO and NDO PA and/or
- Prevalence of dog walking by owners
AND articles that did not report study design as: (18)
- Cross-sectional or
- Surveillance or
- Cohort

29 full text articles included in review

Final result:
11 articles reported data on DO and NDO PA
9 articles reported data on prevalence of dog walking by owners
6 articles reported data on DO and NDO PA AND prevalence of dog walking by owners
3 articles reported longitudinal data on DO and PA

Figure 1 — Literature search strategy.