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Dog Ownership and Physical Activity: A Review of the Evidence.

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Dog ownership and physical activity: A review of the evidence

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Abstract

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 non-dog 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 five 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.
Introduction

Regular physical activity (PA) is important in the prevention of chronic disease\textsuperscript{1,2}. Nevertheless, a significant proportion of youth and adults do not meet the recommended level of PA required for health benefits\textsuperscript{3-5}. Walking is a popular form of PA because it is considered easy and requires little skill or finances\textsuperscript{6,7}.

Dog ownership may be associated with higher levels of PA\textsuperscript{8-11}. In many developed countries rates of dog ownership are high. For example, an estimated 39% of United States (US)\textsuperscript{12} and 40% of Australian\textsuperscript{13} households own at least one 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\textsuperscript{14}. Therefore, a review of the evidence is timely. This paper (1) reviews studies that compared PA of dog owners (DO) to non-dog 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 and 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 (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, nine studies reported on the amount of dog walking by owners, and six studies reported on both DO and NDO PA and the prevalence of dog walking by owners. In addition, three 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 sub-analyses, 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 three main themes. First, a descriptive analysis and a meta-analysis of studies of dog owner and non-dog owner walking and PA was undertaken. Second, a descriptive summary review of studies reporting the prevalence of dog walking was performed. Lastly, three longitudinal studies reporting data on the relationship between dog ownership were reviewed and summarized.

**Results**

**Physical activity levels of dog owners versus non-dog owners**

Studies were published between 1996 and 2010, the majority being in the last five years and either from Australia (n=7) or the United States (n=6). One study was conducted in Canada, one in Japan, and two in the United Kingdom. Across the 17 studies, the mean sample size was 4117 (range=127-41514) and median age of adult participants was 45 years (interquartile range (IQR: 40.0, 59.1). Three studies sampled older adults only\(^{16-18}\) and two studies sampled children (range=5-12 years)\(^{19,20}\). Across studies 32-60% of adult samples were male, with one 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%).

Insert table 1 here
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 (i.e., accelerometer and/or pedometer). Among these studies, two sampled children, one sampled older adults, and the other sampled adults, 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 and 2010, the majority either from Australia (n=8) or the US (n=6). Across the studies the mean sample size was 4251 (range=24-47731) and median age of adult participants was 45 years (IQR: 37.0, 55.3). Two of these studies sampled older, predominantly female adults. Moreover, two studies were conducted with the same sample of Australian children aged 5-6 and 10-12 years and three studies sampled different sub-groups from the same study. 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 amongst DO across all studies was 59% (range=3-80%). Ten studies provided descriptive data on duration and/or frequency of dog walking (three studies provided both). Median duration and frequency of weekly dog walking amongst studies sampling adults were 160 minutes (IQR: 114.6, 210.0) and 4 walks (IQR: 2.4, 4.8), respectively; this equates to approximately four walks per week of 40 minutes each. Twelve percent of children aged 5-6 years and 18% of children aged 10-12 years walked their dog at least 3 times per week. Across both age groups children walked their dog on average 1.7 times per week (SD=2.1).

**Longitudinal evidence of relationship between dog ownership and physical activity**

To date, three studies have examined the relationship between dog ownership and PA using a longitudinal design.

In 1991, Serpell conducted a ten-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). Dog owners increased their recreational walking more over a 10-month period compared to non-pet owners.

More recently, a US study by Thorpe and colleagues examined dog walking behavior of 394 DO and 2137 NDO and walking speed over three years in a sample of community-dwelling older adults (range 71-82 years). At follow-up, dog walkers were twice as likely as non-
dog 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. 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 examined changes in socio-demographic, 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. 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 to those who do not own dogs. Moreover, DO (and dog walkers) were more likely than NDO (and non-dog walkers) to meet the recommended levels of PA. 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 summarising 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 (e.g., sport participation, transport-related trips)\(^{30}\). 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 rigour of the studies presented has improved over time, many studies do not adequately control for confounding factors. For example, socio-demographic characteristics such as age, gender, socioeconomic status, and ethnicity are known to be associated with health behaviors such as PA\(^{31,32}\) and are also associated with dog ownership\(^{33}\) 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 sub-groups and it is recommended that researchers refer to dog owners (DO), non-dog owners (NDO), dog walkers (DW), and those who do not walk with their dogs – non-dog 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\(^2\), and for DO, prevalence of dog walking as well as minutes (and frequency) of dog walking per week.

Only four studies in this review used an objective measure of PA (i.e., accelerometer or pedometer) to compare the PA level of DO and NDO\(^{18,20,22}\). 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, a reliable and valid measure of the amount of walking DO engage in with and without their dog is required. Studies have used self-report measures of minutes and frequency of walking with a dog. However, time actually spent being physically active with a dog may vary widely from standing in a park whilst the dog investigates off lead, to ten mile jogs on lead. A recent study of dog behavior on walks suggests that a significant proportion of the dog’s walking time is actually spent sniffing\(^{34}\), which may result in many stationary and very slow walking speeds for owners and may also vary according to whether the dog is on or off-leash. Thus, it is recommended that
future dog walking research objectively measures the duration, frequency, intensity and patterns of walking done with a dog, the contribution this makes to their overall PA level, and how the behavior of the dog (e.g., sniffing, chasing a ball, on/off leash) influences the intensity and amount of walking that owners perform.

The results of this review stress the need for further dog walking studies to be conducted in other countries. The majority of studies were from the US and Australia, one each from Canada and Japan and although two studies were from the UK they did not examine a general adult population. To our knowledge, no dog walking studies have been conducted in developing countries and these studies may be important because the culture of dog-keeping is likely to be different from populations examined so far. Furthermore, the results of this review indicate that further studies of the relationship between dog ownership, dog walking and PA needs to be conducted in children and adolescents, and in diverse ethno-racial and socio-economic groups.

Despite shortcomings of the research to date, there is consistent correlational evidence for the positive association between dog ownership and PA. To enable public health practitioners to promote walking with the dog as an effective intervention tool to promote PA more research is needed to understand the correlates, determinants and mediators of dog walking behavior. Only five studies have examined the correlates of dog walking behavior. While it appears that owner’s perceived motivation, obligation and social support provided by the dog to walk are the most important factors associated with both not walking with a dog as well as regularly walking with a dog, further studies are warranted. The results of this review showed that on average about half of all DO don’t walk with their dog. Only one study to date has examined the factors associated with not walking with a dog. Thus, in order to
develop successful interventions, we need a better understanding of why these dog owners (DO) don’t walk their dog and how we can encourage them to do so. Finally, context-specific measures of the correlates as well as the behavior being examined are necessary in order to identify effective strategies for intervention.\(^{38,39}\)

**Summary of recommendations for future dog walking research:**

- Consistently define and use dependent variables (mean minutes of PA, walking and walking with dog, sufficient PA) and independent variables (DO; NDO; dog walker (DW); and non-dog walker (NDW))
- Objectively measured PA (i.e., accelerometers or pedometers) in addition to self-report measures
- Use context-specific measures
- Examine and adjust for confounders in analyses
- Conduct more international studies
- Conduct more studies involving children and adolescents, race/ethnicity and socio-economic groups
- Conduct more longitudinal studies to elucidate determinants of dog walking behavior and mediators between dog ownership and walking
- Implement controlled intervention-based research to increase dog walking amongst DO
- Initiate inter-disciplinary research and collaboration between researchers from the field of human and veterinary public health, animal behavior, and urban planning.
- Be informed of current activity in the area of dog walking research (Become a member of the International Dog Walking Activity Group (ID-WAG))\(^1\).

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\(^1\) To become a member of ID-WAG contact Jackie Epping (jge5@cdc.gov)
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.

Author’s contributions

All authors contributed to the study conception and design, revised the manuscript critically for intellectual content and approved the final version to be published. HC also analyzed the data, interpreted the data, results and implications of the study and drafted the manuscript revising it critically for important intellectual content at each stage. CW assisted with identifying studies for inclusion, checked and interpreted the data, and substantially contributed to drafting and revision of the manuscript. AB was involved with conceptualizing the review, conducting the initial draft and reading and reviewing all manuscript drafts. LR...
created the initial results tables and edited all versions of the manuscript. RR coordinated the
literature search, conducted the meta analyses and interpreted the findings and reviewed
manuscript drafts. KE assisted with identifying studies to be included in the paper and
critically reviewed manuscript drafts. JM contributed to the conceptualization of the
manuscript content, literature search and editing of manuscript drafts. RJT assisted with
identifying studies for inclusion, interpreted the results, and reviewed and edited drafts for
content.

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Australia) for their administrative assistance.

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References


<table>
<thead>
<tr>
<th>Author</th>
<th>Year of study</th>
<th>Country of study</th>
<th>Sample characteristics:</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>Dembicki &amp; Anderson</td>
<td>1996</td>
<td>United States</td>
<td>N=127, 60+ yrs, 34.6% PO</td>
<td></td>
<td></td>
<td>Minutes/day: DO:37.8±27.8*, NO: 20.6±23.2</td>
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<tr>
<td>Headey</td>
<td>1999</td>
<td>Australia</td>
<td>N=1011, 16+ yrs (stratified by age &amp; gender), 40% DO</td>
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<td>Mean frequency: DO: 4.0 walks, NO: 2.5 walks</td>
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<tr>
<td>Bauman et al.</td>
<td>2001</td>
<td>Australia</td>
<td>N=894, 44 yrs (mean), 45.6% male, 45.9% DO</td>
<td>DO: 46.9%, NO: 47.3%</td>
<td>DO: 210 (95% CI: 186-228), NO: 198 (95% CI: 174-216)</td>
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<td>Giles-Corti &amp; Donovan</td>
<td>2003</td>
<td>Australia</td>
<td>N=1773, 18-59 yrs, 31.8% male</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>DO: 120 (95% CI: 108-132), NO: 102 (95% CI: 84-108)</td>
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<tr>
<td>Study</td>
<td>Year</td>
<td>Location</td>
<td>Sample Size</td>
<td>Age (Mean ± SD)</td>
<td>Gender</td>
<td>DO (%)</td>
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<td>Schofield et al.</td>
<td>2005</td>
<td>Australia</td>
<td>1237</td>
<td>18+ yrs</td>
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<td>51.5</td>
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<td>Brown &amp; Rhodes</td>
<td>2006</td>
<td>Canada</td>
<td>351</td>
<td>56 yrs</td>
<td>50.4</td>
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<td>Thorpe et al.</td>
<td>2006</td>
<td>United States</td>
<td>2533</td>
<td>70-79 yrs</td>
<td>48.3</td>
<td>67.2</td>
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<td>Ball et al.</td>
<td>2007</td>
<td>Australia</td>
<td>1282</td>
<td>42 yrs</td>
<td>100</td>
<td>73</td>
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<td>Study</td>
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<td>Sample Size</td>
<td>Age (mean)</td>
<td>Gender</td>
<td>Dog Ownership%</td>
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<td>Moudon et al.</td>
<td>2007</td>
<td>United States</td>
<td>N=608</td>
<td>45-54 yrs</td>
<td>49% male</td>
<td>18% DO</td>
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<td>Coleman et al.</td>
<td>2008</td>
<td>United States</td>
<td>N=2199</td>
<td>45 yrs</td>
<td>52% male</td>
<td>28% DO</td>
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<td>Cutt et al.</td>
<td>2008</td>
<td>Australia</td>
<td>N=1813</td>
<td>40 yrs</td>
<td>40.5% male</td>
<td>44% DO</td>
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<tr>
<td>Yabroff</td>
<td>2008</td>
<td>United States</td>
<td>N=41514</td>
<td>65.4% 18-49 yrs</td>
<td>49% male</td>
<td>17.7% DO</td>
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*DO: Any walking for transportation

**DO: Any walking for leisure

***Accelerometer MVPA min/day

Mean ± SD
<table>
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<tr>
<th>Study</th>
<th>N</th>
<th>Age</th>
<th>Gender</th>
<th>DO</th>
<th>NO</th>
<th>NPO</th>
<th>MVPA (MET-hr/wk)</th>
<th>Frequency</th>
<th>Accelerometer:</th>
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<tr>
<td>Harris et al. 2009</td>
<td>240</td>
<td>≥ 65 yrs</td>
<td>52.1%</td>
<td>32.9%</td>
<td>26.4%</td>
<td>25.0%</td>
<td>17.0***</td>
<td>25%</td>
<td>MPVA min/day</td>
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<tr>
<td>United Kingdom</td>
<td></td>
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<td></td>
<td>DO: OR=1.54* (95% CI: 1.3–1.82)</td>
<td>NO: OR=1.11 (95% CI: 0.93–1.33)</td>
<td>NPO: OR=1.00</td>
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<tr>
<td>Oka &amp; Shibata*# 2009</td>
<td>5177</td>
<td>50% ≤ 39 yrs</td>
<td>50% male</td>
<td>18% DO</td>
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<td>Japan</td>
<td></td>
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<td></td>
<td>DO: 32.9%</td>
<td>NO: 26.4%</td>
<td>NPO: 25.0%</td>
<td>12.4*</td>
<td>15%</td>
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<tr>
<td>Gillum &amp; Obisesan 2010</td>
<td>5903</td>
<td>≥ 40 yrs</td>
<td>46% male</td>
<td>21% of 70-89 yr olds were DO</td>
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<td>United States</td>
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<td>Owen et al. 2010</td>
<td>2065</td>
<td>9-10 yrs</td>
<td>10% DO</td>
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<td>DO vs. NO (total sample):</td>
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<td>95% CI</td>
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<tr>
<td>Salmon et al. 2010</td>
<td>Australia</td>
<td>5-6 yrs</td>
<td>N=294 (5-6 yrs)</td>
<td>β=0.04</td>
<td>(95% CI: 0.17-0.56)**</td>
<td>10-12 yrs girls: 1.5 sessions/week more DO than NO</td>
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<td>10-12 yrs</td>
<td>N=926 (10-12 yrs)</td>
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<td></td>
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<td>NO vs. DO (total sample): β=-0.35</td>
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<td></td>
<td></td>
<td></td>
<td>N=1152 mothers</td>
<td></td>
<td></td>
<td>N=957 fathers 40 yrs (mean) 53% DO</td>
<td>5-6 yrs girls: DO=29.3 min/day more accelerometer measured MVPA (95% CI: 5.5-53.1) than NO</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N=957 fathers</td>
<td>N=1152 mothers</td>
<td></td>
<td>N=957 fathers 40 yrs (mean) 53% DO</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates 11 studies included in the walking meta-analysis; # Indicates 6 studies included in the PA meta-analysis

DO=dog owner; NO= Non-dog owner; DW=dog walker; NDW=non-dog walker; PO=pet owner; NPO=non-pet owner

MVPA=Moderate Vigorous Physical Activity; METs-h/wk= Metabolic equivalents hours/week

*P <0.05; **P <0.01; ***P <0.001; N=sample size; OR=odds ratio; 95% CI= 95% confidence interval; β=linear regression B coefficient
Table 2: Prevalence of dog walking in publication date order (1996-2010)

<table>
<thead>
<tr>
<th>Author</th>
<th>Year of study</th>
<th>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</td>
<td>Australia</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>
<td></td>
</tr>
<tr>
<td>Johnson &amp; Meadows 2002</td>
<td>United States</td>
<td>N=24 66 yrs (mean) 16.7% male 100% DO</td>
<td>45.8</td>
<td></td>
<td>4 (mean)</td>
<td></td>
</tr>
<tr>
<td>Schofield et al. 2005</td>
<td>Australia</td>
<td>N= 1237 57.2% DO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suminski et al. 2005</td>
<td>United States</td>
<td>N=474 37 yrs (mean) 43.9% male 45.4% DO</td>
<td>27.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ham &amp; Epping 2006</td>
<td>United States</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>
<td></td>
</tr>
<tr>
<td>Coleman et al. 2008</td>
<td></td>
<td>N=2199 45 yrs (mean)</td>
<td>70</td>
<td>Of those who walked</td>
<td>180 ±186 (mean)</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Gender</td>
<td>Age</td>
<td>Dog Ownership (DO)</td>
<td>N</td>
<td>Activity Duration/day</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-------------</td>
<td>--------</td>
<td>--------------</td>
<td>--------------------</td>
<td>--------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>United States 22</td>
<td>Australia</td>
<td>52%</td>
<td>40 yrs (mean)</td>
<td>28% DO</td>
<td>1813</td>
<td>78</td>
</tr>
<tr>
<td>Cutt et al. 2008</td>
<td>Australia</td>
<td>40.5%</td>
<td>18+ yrs</td>
<td>44% DO</td>
<td>629</td>
<td>77</td>
</tr>
<tr>
<td>Timperio et al. 2008</td>
<td>Australia</td>
<td>44.8%</td>
<td>5-6 yrs</td>
<td>100% DO</td>
<td>281</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10-12 yrs</td>
<td></td>
<td>864</td>
<td>36.9</td>
</tr>
<tr>
<td>Tudor-Locke &amp; Ham 2008</td>
<td>United States</td>
<td>31.9%</td>
<td>30-44 yrs</td>
<td></td>
<td>47731</td>
<td>2.6 (2.3-2.8) dog</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>walked in a 24 hour</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harris et al. 2009</td>
<td>United Kingdom</td>
<td>52.1%</td>
<td>≥ 65 yrs</td>
<td></td>
<td>240</td>
<td>21.6</td>
</tr>
<tr>
<td>Merom et al. 2009</td>
<td>Australia</td>
<td>30.7%</td>
<td>30-44 yrs</td>
<td></td>
<td>3415</td>
<td>Of those who walk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Sample Size</td>
<td>Regular Dog Walkers</td>
<td>Irregular Dog Walkers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------</td>
<td>---------------------</td>
<td>-----------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian (nee Cutt) et al. 2010 Australia</td>
<td>N=483 ≥18 yrs 100% DO</td>
<td>100</td>
<td>59.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmon et al. (2010) Australia</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)</td>
<td>192.9 (mean) (SD: 112.6)**</td>
<td>5.3 (mean) (SD: 2.9)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoerster et al. (2010) United States</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>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DO=dog owner; N=sample size; SD=Standard Deviation; *P <0.05; **P <0.01; ***P <0.001
Appendix:

Figure 1: Literature Search Strategy