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

Elizabeth Richards

Purdue University - Main Campus, erichards@purdue.edu

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Dog ownership and physical activity: A review of the evidence

Brief running title: Review of dog ownership and PA

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1 **Abstract**

2 **Background:**

3 Dog walking is a strategy for increasing population levels of physical activity (PA).
4 Numerous cross-sectional studies of the relationship between dog ownership and PA have
5 been conducted. The purpose was to review studies comparing PA of dog owners (DO) to
6 non-dog owners (NDO), summarize the prevalence of dog walking, and provide
7 recommendations for research.

8 **Methods:**

9 A review of published studies (1990-2010) examining DO and NDO PA and the prevalence
10 of dog walking was conducted (N=29). Studies estimating the relationship between dog
11 ownership and PA were grouped to create a point-estimate using meta-analysis.

12 **Results:**

13 Most studies were conducted in the last five years, were cross-sectional, and sampled adults
14 from Australia or the United States. Approximately 60% of DO walked their dog, with a
15 median duration and frequency of 160 minutes/week and 4 walks/week, respectively. Meta-
16 analysis showed DO engage in more walking and PA than NDO and the effect sizes are small
17 to moderate ($d=0.26$ and $d=0.16$ respectively). Three studies provided evidence of a
18 directional relationship between dog ownership and walking.

19 **Conclusions:**

20 Longitudinal and interventional studies would provide stronger causal evidence for the
21 relationship between dog ownership and PA. Improved knowledge of factors associated with
22 dog walking will guide intervention research.

23

24

25 Introduction

26 Regular physical activity (PA) is important in the prevention of chronic disease^{1,2}.
27 Nevertheless, a significant proportion of youth and adults do not meet the recommended level
28 of PA required for health benefits³⁻⁵. Walking is a popular form of PA because it is
29 considered easy and requires little skill or finances^{6,7}.

30

31 Dog ownership may be associated with higher levels of PA⁸⁻¹¹. In many developed countries
32 rates of dog ownership are high. For example, an estimated 39% of United States (US)¹² and
33 40% of Australian¹³ households own at least one dog. This level of ownership illustrates the
34 strong level of attachment that exists between humans and canines. Considering the large
35 proportion of dog owners and that many dogs enjoy being walked, dog walking could provide
36 a potentially viable strategy for increasing population levels of PA.

37

38 Research on this topic is growing rapidly and its potential as a PA intervention strategy is
39 being recognized¹⁴. Therefore, a review of the evidence is timely. This paper (1) reviews
40 studies that compared PA of dog owners (DO) to non-dog owners (NDO) and (2) summarizes
41 the prevalence of dog walking from the scientific literature. Based on these findings, we
42 discuss recommendations to help advance the field of dog walking research.

43

44 Methods

45 Search strategy

46 Electronic databases were searched for relevant published articles (MEDLINE, PsychINFO,
47 FAMILY: Australian Family and Society abstracts, ProQuest social science journals,
48 ScienceDirect, Web of Science, and Academic Search Complete). Dog-related keywords
49 (dog, dog walking, dog ownership, canine, pet, pet ownership, companion animal, human

50 animal interaction) were crossed with PA-related keywords (walking, PA, leisure-time PA,
51 leisure-time exercise, health, human health) for the search. The searches included only peer-
52 reviewed studies published in the English language between 1990 and 2010. Reference lists
53 from articles we included were also scanned and cross-referenced for additional potential
54 studies.

55

56 **Eligibility criteria**

57 Papers were excluded if the outcome measure was related to the health of the dog and not to
58 humans (Appendix). Reviews, reports, case reports, qualitative studies, and abstracts only
59 were excluded. Cross-sectional, surveillance, and cohort studies were included. Overall, 99
60 articles met the inclusion criteria. After excluding articles that did not report data comparing
61 DO and NDO PA or the prevalence of dog walking by owners, 29 articles were included in
62 the review. Among the cross-sectional studies, 11 studies reported on DO and NDO PA, nine
63 studies reported on the amount of dog walking by owners, and six studies reported on both
64 DO and NDO PA and the prevalence of dog walking by owners. In addition, three studies
65 reported longitudinal data on the relationship between dog ownership and PA.

66

67 **Meta-analysis**

68 This systematic review provided the opportunity to conduct a meta-analysis and calculate a
69 summary estimate of the (1) walking and (2) PA levels, of DO compared with NDO. Studies
70 were included in the meta-analyses if they featured a relationship between a walking (n=11;
71 see Table 1) or PA (n=6; see Table 1) variable and a dog ownership variable expressed in
72 terms of an effect size (r, OR, or d). The referent was NDO and the dependent variable was
73 minutes of walking or PA (when available). The meta value is subject to some variability
74 because studies used different metrics to measure the dependent variable, however, this was
75 overcome by using the standardized mean difference as the summary statistic. When multiple

76 ORs were present due to sub-analyses, only the total sample effect size was used. Along with
77 the weighted average standardized mean difference, 95% confidence intervals (CI) were
78 computed. Data were analyzed using Comprehensive Meta-analysis-2 software ¹⁵.

79

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

85

86 **Results**

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

88 Studies were published between 1996 and 2010, the majority being in the last five years and
89 either from Australia (n=7) or the United States (n=6). One study was conducted in Canada,
90 one in Japan, and two in the United Kingdom. Across the 17 studies, the mean sample size
91 was 4117 (range=127-41514) and median age of adult participants was 45 years (interquartile
92 range (IQR: 40.0, 59.1). Three studies sampled older adults only ¹⁶⁻¹⁸ and two studies
93 sampled children (range=5-12 years) ^{19,20}. Across studies 32-60% of adult samples were male,
94 with one study of women only ²¹. Fourteen studies reported the prevalence of dog ownership
95 among the study samples (median rate of dog ownership=24%; range=10-57%). Generally,
96 dog ownership was comparable to the estimated population rate of dog ownership within the
97 country of study, with the highest levels in Australia (37%).

98

99 Insert table 1 here

100

101

102 Overall, adult DO reported more minutes per week of PA (median: DO=329; NDO=277)
103 and/or walking (median: DO=129; NDO=111) than NDO. Four of the fourteen studies
104 reported differences between DO and NDO PA using objective measures (i.e., accelerometer
105 and/or pedometer). Among these studies, two sampled children^{19,20}, one sampled older adults
106¹⁸, and the other sampled adults²², however, all showed that DO had significantly higher
107 levels of objectively measured PA than NDO.

108

109 The point estimate for random effects meta-analysis was a standardized mean difference
110 between DO and NDO of 0.26 (95% CI: 0.16, 0.35) for walking and 0.16 (95% CI: 0.03,
111 0.30) for PA. Thus, DO walked more than NDO and were more physically active than NDO.
112 The effect can be categorized as a small to moderate yet meaningful difference.

113

114 **Prevalence of dog walking**

115 Table 2 summarizes 15 studies examining the amount of dog walking by DO (6 of these
116 studies are also included in Table 1). Studies were conducted between 2001 and 2010, the
117 majority either from Australia (n=8) or the US (n=6). Across the studies the mean sample
118 size was 4251 (range=24-47731) and median age of adult participants was 45 years (IQR:
119 37.0, 55.3). Two of these studies sampled older, predominantly female adults^{18,23}. Moreover,
120 two studies were conducted with the same sample of Australian children aged 5-6 and 10-12
121 years^{20,24} and three studies sampled different sub-groups from the same study²⁵⁻²⁷. Across
122 studies of middle-age adults 22-52% of the samples were male. Five studies included DO
123 only and the remainder either reported a dog ownership rate comparable to the population
124 rate of dog ownership within the country of the study (n=7) or did not report the prevalence
125 of dog ownership in their sample (n=3).

126

127

Insert table 2 here

128

129

130 The median prevalence of dog walking amongst DO across all studies was 59% (range=3-

131 80%). Ten studies provided descriptive data on duration and/or frequency of dog walking

132 (three studies provided both). Median duration and frequency of weekly dog walking

133 amongst studies sampling adults were 160 minutes (IQR: 114.6, 210.0) and 4 walks (IQR:

134 2.4, 4.8), respectively; this equates to approximately four walks per week of 40 minutes each.

135 Twelve percent of children aged 5-6 years and 18% of children aged 10-12 years walked their

136 dog at least 3 times per week²⁴. Across both age groups children walked their dog on average

137 1.7 times per week (SD=2.1)²⁰.

138

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

140 To date, three studies²⁸⁻³⁰ have examined the relationship between dog ownership and PA

141 using a longitudinal design.

142

143 In 1991, Serpell conducted a ten-month longitudinal study to examine changes in behavior

144 and health status of 71 adult subjects who recently acquired a pet from a UK animal shelter

145 (47 dog owners and 24 cat owners)²⁸. Dog owners increased their recreational walking more

146 over a 10-month period compared to non-pet owners.

147

148 More recently, a US study by Thorpe and colleagues examined dog walking behavior of 394

149 DO and 2137 NDO and walking speed over three years in a sample of community-dwelling

150 older adults (range 71-82 years)²⁹. At follow-up, dog walkers were twice as likely as non-

151 dog walkers and NDO to achieve recommended walking levels, independent of demographic
152 factors and health-related characteristics. While dog walkers and NDO showed similar
153 declines in usual and rapid walking speed, dog walkers maintained their initial mobility
154 advantage ²⁹. Although dog ownership appeared to facilitate walking behavior, the prevalence
155 of dog ownership was low (15.5%) and only a minority of older DO walked their dog (36%).
156
157 Finally, an Australian study by Cutt and colleagues in 2008 ³⁰ examined changes in socio-
158 demographic, environmental and intrapersonal factors associated with dog acquisition in
159 adult NDO at baseline to 12-months follow-up and the effect of dog acquisition on minutes
160 per week of recreational walking. At 12 months follow-up 12% (n=92) of baseline NDO had
161 acquired a dog and 681 had remained NDO. After adjusting for baseline variables, the effect
162 of dog acquisition on the increase in minutes of neighborhood recreational walking was 31
163 minutes/week (95% CI: 7.4, 54.2). However, this reduced to 22 minutes (95% CI: -1.5, 45.4)
164 after further adjustment for change in baseline to follow-up variables. Increase in intention to
165 walk mediated the effect of dog acquisition on recreational walking ³⁰. Importantly, this study
166 measured change in dog ownership status over time and adjusted for both baseline and
167 change over time confounders.

168

169 **Discussion**

170 Overall, the results of this review indicate that dog ownership is consistently associated with
171 higher levels of walking and PA compared to those who do not own dogs. Moreover, DO
172 (and dog walkers) were more likely than NDO (and non-dog walkers) to meet the
173 recommended levels of PA ². The results of the meta-analyses showed that DO walk more
174 and are more physically active than NDO. These effects can be categorized as a small to
175 moderate yet meaningful difference and are an important first step at summarising this data.

176 However, the analysis was limited due to variations in the metrics of the dependent variables
177 and study samples.

178

179 These findings, primarily from cross-sectional studies, are further strengthened by
180 longitudinal data; however, there is a paucity of longitudinal studies that contain measures of
181 dog ownership, dog walking or any other dog-related characteristics. For example, if
182 questions on dog ownership and dog walking behavior were regularly added to state and
183 national PA and or health surveys it could provide a potential source of longitudinal data that
184 would assist in determining the relationship between dog ownership, dog walking and PA.
185 Further, more research is required to confirm that getting a dog does in fact cause people to
186 walk more and whether the increase in walking as a result of acquiring and walking a dog is
187 at the expense of other types of PA (e.g., sport participation, transport-related trips) ³⁰.

188 Specifically, does dog acquisition influence changes in total PA, recreational walking,
189 transport-related walking, other moderate-intensity activity and high intensity activity over
190 the short and long term? Moreover, what impact does the long-term commitment of dog
191 ownership play in maintaining walking behavior?

192

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

200

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

214

215 Only four studies in this review used an objective measure of PA (i.e., accelerometer or
216 pedometer) to compare the PA level of DO and NDO ^{18-20,22}. The results confirm our findings
217 of studies using self-report measures of PA. Future studies should include objective outcome
218 measures to supplement self-reported measures. In particular, a reliable and valid measure of
219 the amount of walking DO engage in with and without their dog is required. Studies have
220 used self-report measures of minutes and frequency of walking with a dog. However, time
221 actually spent being physically active with a dog may vary widely from standing in a park
222 whilst the dog investigates off lead, to ten mile jogs on lead. A recent study of dog behavior
223 on walks suggests that a significant proportion of the dog's walking time is actually spent
224 sniffing ³⁴, which may result in many stationary and very slow walking speeds for owners and
225 may also vary according to whether the dog is on or off-leash. Thus, it is recommended that

226 future dog walking research objectively measures the duration, frequency , intensity and
227 patterns of walking done with a dog, the contribution this makes to their overall PA level, and
228 how the behavior of the dog (e.g., sniffing, chasing a ball, on/off leash) influences the
229 intensity and amount of walking that owners perform.

230

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

240

241 Despite shortcomings of the research to date, there is consistent correlational evidence for the
242 positive association between dog ownership and PA. To enable public health practitioners to
243 promote walking with the dog as an effective intervention tool to promote PA more research
244 is needed to understand the correlates, determinants and mediators of dog walking behavior.
245 Only five studies have examined the correlates of dog walking behavior^{25,27,35,36,37}. While it
246 appears that owner's perceived motivation, obligation and social support provided by the dog
247 to walk are the most important factors associated with both not walking with a dog as well as
248 regularly walking with a dog^{25,27}, further studies are warranted. The results of this review
249 showed that on average about half of all DO don't walk with their dog. Only one study to
250 date has examined the factors associated with not walking with a dog²⁵. Thus, in order to

251 develop successful interventions, we need a better understanding of why these DO don't walk
 252 their dog and how we can encourage them to do so. Finally, context specific measures of the
 253 correlates as well as the behavior being examined are necessary in order to identify effective
 254 strategies for intervention^{38,39}

255

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

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

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

275

276 **Conclusions**

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

289

290 **Author's contributions**

291 All authors contributed to the study conception and design, revised the manuscript critically
292 for intellectual content and approved the final version to be published. HC also analyzed the
293 data, interpreted the data, results and implications of the study and drafted the manuscript
294 revising it critically for important intellectual content at each stage. CW assisted with
295 identifying studies for inclusion, checked and interpreted the data, and substantially
296 contributed to drafting and revision of the manuscript. AB was involved with conceptualizing
297 the review, conducting the initial draft and reading and reviewing all manuscript drafts. LR

298 created the initial results tables and edited all versions of the manuscript. RR coordinated the
299 literature search, conducted the meta analyses and interpreted the findings and reviewed
300 manuscript drafts. KE assisted with identifying studies to be included in the paper and
301 critically reviewed manuscript drafts. JM contributed to the conceptualization of the
302 manuscript content, literature search and editing of manuscript drafts. RJT assisted with
303 identifying studies for inclusion, interpreted the results, and reviewed and edited drafts for
304 content.

305

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Table 1: Physical activity of dog owner and non-dog owners in publication date order (1996-2010)

f dog ownership and PA

Author Year of study Country of study	Sample characteristics: sample size age gender % dog owners	Achieve recommended level of physical activity	Mean minutes/week of physical activity	Mean minutes/week of walking
Dembicki & Anderson [∞] 1996 United States 17	N=127 60+ yrs 34.6% PO			<i>Minutes/day</i> DO: 37.8±27.8* NO: 20.6±23.2
Headey 1999 Australia 40	N=1011 16+ yrs (stratified by age & gender) 40% DO			<i>Mean frequency</i> DO: 4.0 walks NO: 2.5 walks
Bauman et al. [∞] # 2001 Australia 41	N=894 44 yrs (mean) 45.6% male 45.9% DO	DO: 46.9% NO: 47.3%	DO: 210 (95% CI: 186-228) NO: 198 (95% CI: 174-216)	DO: 120 (95% CI: 108-132) NO: 102 (95% CI: 84-108)
Giles-Corti & Donovan [∞] 2003 Australia 42	N=1773 18-59 yrs 31.8% male	<i>Walk ≥180 min/wk vs.</i> <i><179 min/wk</i> DO: OR=1.58 (95% CI: 1.19-2.09) NO: OR=1.00		

Schofield et al. ^{∞#} 2005 Australia 43	N= 1237 18+ yrs (stratified by age & gender) 57.2% DO	DO: 51.5% NO: 48.5%	DO: 334.8 NO: 346.4	<i>Walking for leisure</i> DO: 114.9 NO: 108.2
Brown & Rhodes ^{∞#} 2006 Canada 36	N=351 56 yrs (mean for men) 50.4% male 19.9% DO		DO: 410.3** NO: 287.5	DO: 300.2** NO: 168.4
Thorpe et al. ^{∞#} 2006 United States 16	N=2533 70-79 yrs 48.3% male 12.9% DO	<i>Any physical activity</i> DO: 67.2% NO: 56.6% NPO: 64.0% DO: OR=1.32 (95% CI: 1-1.76) NO: OR=0.57 (95% CI: 0.4-0.82) NPO: OR=1.00		<i>Non-exercise walking</i> DO: 67.9* NO: 32.1 <i>Exercise walking</i> DO: 75.4 NO: 57.8
Ball et al. [∞] 2007 Australia 21	N=1282 42 yrs (mean) 100% female 40% DO	<i>Any walking for leisure</i> DO: 73%* NO: 61%		

Moudon et al. [∞] 2007 United States 44	N=608 45-54 yrs 49% male 18% DO	<i>Walk ≥150 min/wk vs. <149 min/wk</i> DO: OR=1.99 (95% CI: 1.21–3.26) NO: OR=1.00		
Coleman et al. 2008 United States 22	N=2199 45 yrs (mean) 52% male 28% DO	DW: 53%* NDW: 33% NO: 46%	<i>Accelerometer MVPA min/day</i> DW: 35±24* NDW: 27±21 NO: 33±24	
Cutt et al. [∞] # 2008 Australia 26	N=1813 40 yrs (mean) 40.5% male 44% DO	DO: OR= 1.57** (95% CI: 1.14-2.16) NO: OR=1.00 <i>Walk ≥150 min/wk</i> DO: OR=1.59* (95% CI: 1.08–2.36) NO: OR=1.00	DO: 322.4*** NO: 267.1	DO: 150.3*** NO: 110.9
Yabroff [∞] 2008 United States 45	N=41514 65.4% 18-49 yrs 49% male 17.7% DO	<i>Any walking for transportation</i> DO: OR=0.91 (95% CI: 0.85-0.99) NPO: OR=1.00 <i>Any walking for leisure</i> DO: OR=1.6 (95% CI: 1.5-1.8) NPO: OR=1.00		DO: 129.3* NPO: 119.7

Harris et al. 2009 United Kingdom 18	N=240 ≥ 65 yrs 52.1% male		DW 1670 more pedometer steps/day than NDW	
Oka & Shibata ^{∞ #} 2009 Japan 46	N=5177 50% ≤ 39 yrs 50% male 18% DO	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	<i>MVPA (MET-hr/wk)</i> DO: 17.0*** NO: 10.9 NPO: 11.7	<i>(MET-hr/wk)</i> DO: 12.4* NO: 10.5 NPO: 9.8
Gillum & Obisesan 2010 United States 47	N=5903 ≥ 40 yrs 46% male 21% of 70-89 yr olds were DO		<i>Frequency</i> DO: 25% (8 times/wk)* (95% CI: 21-31) 15% (0 times/wk)* (95% CI: 13-18)	
Owen et al. 2010 United Kingdom 19	N=2065 9-10 yrs 10% DO		<i>Accelerometer:</i> <i>MPVA min/day</i> DO: 72 (95% CI: 68-75) NO: 69 (95% CI: 66-71) <i>Counts/min</i> DO: 511 (95% CI: 492-530)** NO: 486 (95% CI: 478-495)	

Salmon et al. 2010 Australia 20	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		NO vs. DO (total sample): $\beta=-0.04$ (95% CI: -0.45-0.38) 5-6 yrs girls: DO=29.3min/day more accelerometer measured MVPA (95% CI: 5.5-53.1) than NO	NO vs. DO (total sample): $\beta=-0.35$ (95% CI: 0.17-0.56)*** 10-12 yrs girls: DO=1.5 sessions/week more than NO
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[∞]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)

Author Year of study Country of study	Sample characteristics: sample size age gender % dog owners	Prevalence of dog walking (%)	Minutes/week of dog walking	Frequency/week of dog walking
Bauman et al. 2001 Australia 41	N=894 44 yrs (mean) 45.6% male 45.9% DO	41.0	57 (mean)	3 (median)
Johnson & Meadows 2002 United States 23	N=24 66 yrs (mean) 16.7% male 100% DO	45.8		4 (mean)
Schofield et al. 2005 Australia 43	N= 1237 57.2% DO	<i>By a household member</i> 60	<i>Duration/session</i> 30 (mode)	<i>By a household member</i> 7 (mode)
Suminski et al. 2005 United States 48	N=474 37 yrs (mean) 43.9% male 45.4% DO	27.8		
Ham & Epping 2006 United States 49	N=1282 55.4% ≥45 yrs 41% male 100% DO	<i>Daily dog walking of at least 10 mins</i> 80.2	42.3% ≥30 min/day	
Coleman et al. 2008	N=2199 45 yrs (mean)	70	<i>Of those who walked</i> 180 ±186 (mean)	

United States 22	52% male 28% DO			
Cutt et al. 2008	N=1813 40 yrs (mean)	78		2.6 (mean)
Australia 26	40.5% male 44% DO			
Cutt et al. 2008	N=629 18+ yrs	77	133.8 (mean) (SD: 112.8)	4 (mean) (SD: 2.8)
Australia 25	100% DO			
Timperio et al. 2008	N=281 (5-6 yrs) N=864 (10-12 yrs)	22.6 (5-6 yrs) 36.9 (10-12 yrs)		5-6 yrs: 1-2 times/wk=10.6% ≥3 times/wk=12%
Australia 24	44.8% DO (5-6 yrs) 57.3% DO (10-12 yrs)			10-12 yrs: 1-2 times/wk=18.7% ≥3 times/wk=18.2%
Tudor-Locke & Ham 2008	N=47731 person-days 31.9% 30-44 yrs	2.6 (2.3-2.8) dog walked in a 24 hour period	<i>Duration/day</i> 30 (median)	
United States 50	43.5% male			
Harris et al. 2009	N=240 ≥ 65 yrs	21.6		
United Kingdom 18	52.1% male			
Merom et al. 2009	N=3415 30.7% 30-44 yrs	<i>Of those who walk</i> 13.2 (prompted response)		
Australia 51	43.9% male			

Christian (nee Cutt) et al. 2010 Australia ²⁷	N=483 ≥18 yrs 100% DO	100	<i>Regular dog walkers:</i> 192.9 (mean) (SD: 112.6)** <i>Irregular dog walkers:</i> 48.0 (mean) (SD: 19.1)	<i>Regular dog walkers:</i> 5.3 (mean) (SD: 2.9)** <i>Irregular dog walkers:</i> 2.1 (mean) (SD: 1.3)
Salmon et al. (2010) Australia ²⁰	N=294 (5-6 yrs) N=926 (10-12 yrs) 47.4% boys 44% DO (5-6 yrs) 56% DO (10-12 yrs)	59.0		1.7 (mean) (SD: 2.1)
Hoerster et al. (2010) United States ³⁷	N=1152 mothers N=957 fathers 40 yrs (mean) 53% DO N=984 52 yrs (mean) 22.2% male 100% DO	68.5	139.9 (mean) (SD:181.3)	

DO=dog owner; N=sample size; SD=Standard Deviation; *P <0 .05; **P <0 .01,***P <0 .001

Appendix:

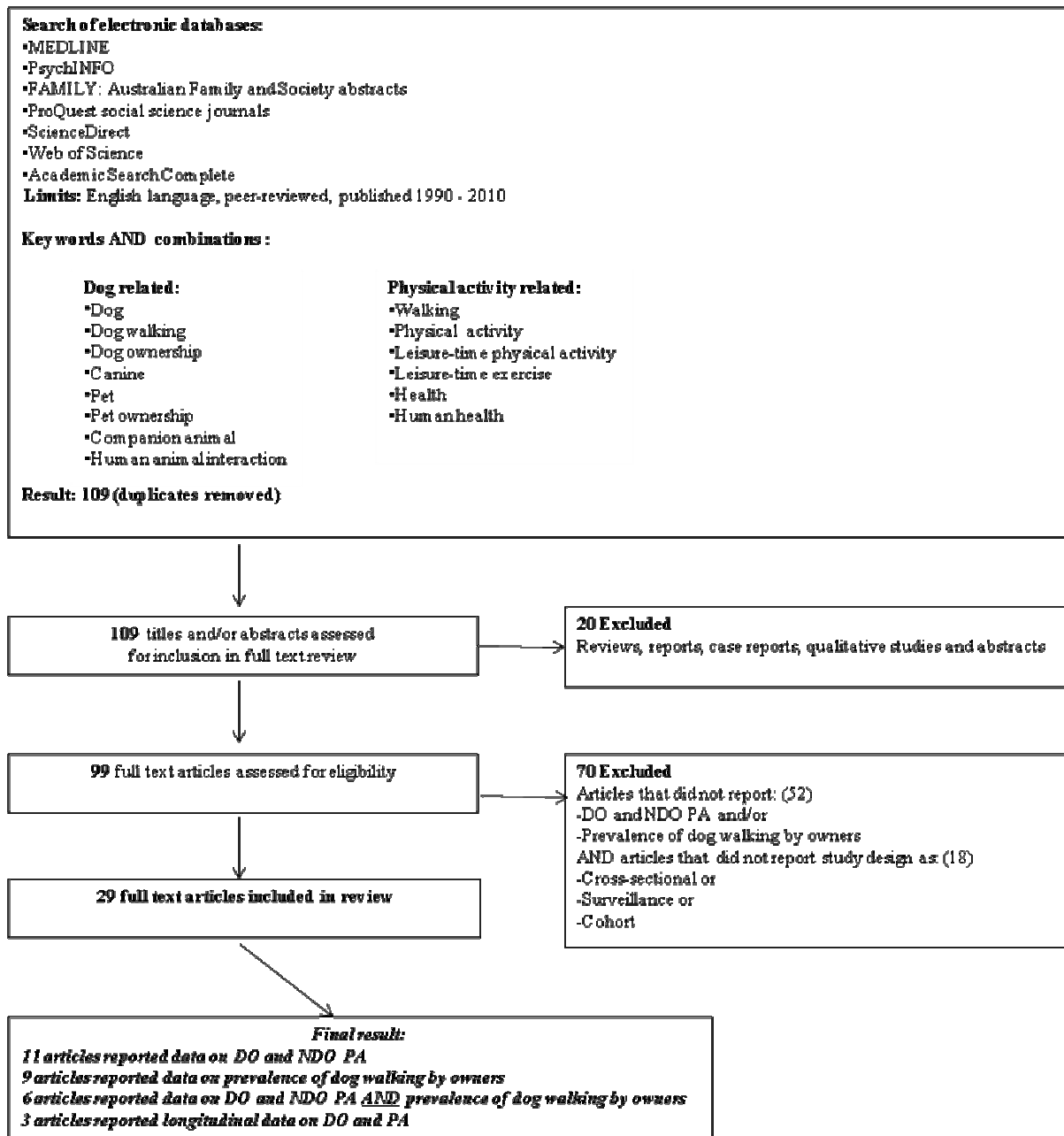


Figure1: Literature Search Strategy