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# Dog Ownership and Dog Walking: The Relationship with Exercise, Depression and Hopelessness in Patients with Ischemic Heart Disease

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## **Abstract**

**Background:** Dog ownership has been associated with increased physical activity in the general adult population.

**Objective:** The objective of this study was to examine dog ownership and dog walking and their relationship with home-based and Phase II cardiac rehabilitation exercise, depression, and hopelessness in patients with ischemic heart disease (IHD).

**Methods:** A total of 122 IHD patients were included in this prospective observational study. Patients completed dog ownership/walking questions during their hospitalization. The Cardiac Rehabilitation Exercise Participation Tool, Patient Health Questionnaire-9 (PHQ-9), and State-Trait Hopelessness Scale were completed by mail at 3, 8, or 12 months later. Regression modeling was used to evaluate the significance of dog ownership/walking on exercise, depression and hopelessness.

**Results:** The sample was 34.4% female and had a mean age of  $64.7 \pm 9.1$  years. Forty-two patients (34.4%) reported owning a dog. Patients who owned, but did not walk their dog, reported significantly lower levels of home exercise compared to patients who walked their dogs at least 1 day/week (non-dog walkers: 36.8% vs. dog walkers: 73.9%,  $p=0.019$ ). The odds of participating in home exercise were significantly higher for dog walkers compared to non-dog walkers (OR 8.1 [1.7, 38.5] vs. 1.0). There were no differences in Phase II cardiac rehabilitation exercise, depression or hopelessness between dog owners and non-dog owners or between dog walkers and non-dog walkers.

**Conclusions:** These findings show a beneficial effect on home-based exercise for those who dog-walk at least 1 day/week. Health care professionals should encourage dog walking to increase dog owners' physical activity levels.

## **Keywords**

ischemic heart disease, dog, exercise, depression, cardiac rehabilitation

## **Disciplines**

Medicine and Health

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The American Heart Association (AHA) recommends at least 30 minutes of moderate to intense aerobic activity at least 5 days per week for secondary prevention and risk reduction in patients with ischemic heart disease (IHD).<sup>1</sup> Despite clear guidelines and known benefits, less than 20% of individuals with IHD participate in a Phase II (outpatient monitored) cardiac rehabilitation (CR) exercise program.<sup>2,3</sup> Home-based CR exercise, as a supplement or alternative to Phase II CR, promotes physical activity, improves exercise capacity,<sup>4,5</sup> improves risk factor control, and increases health-related quality of life in patients with IHD.<sup>5</sup> However, of patients who receive a recommendation by their physician to exercise at home, only 47% report doing so.<sup>6</sup>

Evidence suggests that physical inactivity accounts for 25% of increased risk for cardiovascular mortality<sup>7</sup> and 30% increased risk of adverse cardiovascular events associated with depression.<sup>8</sup> A higher risk of myocardial infarction (MI) or death has been identified in patients with both IHD and depression symptoms, with physical inactivity accounting for 20% of the increased risk.<sup>9</sup> Hopelessness is another important psychological factor associated with increased adverse clinical events<sup>10</sup> and decreased survival<sup>11</sup> in patients with IHD. Evidence suggests an association between increased hopelessness and decreased exercise in both home<sup>6</sup> and Phase II CR settings.<sup>12</sup>

Dog ownership has been associated with increased physical activity in the general adult population, specifically related to more minutes per week of walking.<sup>13-17</sup> Dog owners in the general population who walk their dogs are more likely to achieve recommended physical activity levels.<sup>16,18</sup> Dog ownership/walking has also been examined in older adults. The Physical Activity Cohort Scotland study enrolled 547 people aged 65 years and older and identified dog owners as being 12% more physically active than non-dog owners.<sup>19</sup> Yet, in the Health, Aging and Body Composition (Health ABC) Study, which examined dog ownership and dog walking in U.S. adults aged 71 to 82 years, investigators found that only 36% of dog owners walked their dogs at least three times per week.<sup>20</sup> Despite the small percentage of dog walkers in the Health

ABC Study, older adults who walked their dogs were more likely to achieve 150 minutes of walking per week and at a faster walking speed than dog owners who did not walk their dog.<sup>20</sup>

Older dog owners in the general population have been identified as having fewer symptoms of depression than non-dog owners in some studies.<sup>21,22</sup> Yet, a study of 814 older dog owners in the general population found a higher incidence of depression in dog owners as compared to non-dog owners.<sup>23</sup> Less research has been done focusing on dog walking and depression, with only one published in the past 10 years. A study of younger adults (39 ±13 years) in the general population determined that regular dog walkers had significantly lower depression than dog owners who did not walk their dogs and non-dog owners.<sup>24</sup> No research has been done examining hopelessness in either dog owners or dog walkers in the general public or in illness populations.

A number of studies have explored the relationship between pet ownership/walking and risk for cardiovascular disease. Pet owners<sup>25</sup> and pet (dog) walkers<sup>24</sup> have been identified as having lower blood pressure than non-pet owners/walkers. Dog walkers have reported lower cholesterol levels, less diabetes, and less tobacco use as compared to non-dog walkers.<sup>24</sup> Research on dog ownership/walking in patients with established IHD is limited. An early study identified a beneficial impact of pet ownership on one-year survival in patients who had been hospitalized in a coronary care unit for MI or angina,<sup>26</sup> with pet ownership significantly predicting long-term survival.<sup>27</sup> A Scientific Statement from the AHA concludes that there is ample evidence to suggest an association between pet ownership and reduction of cardiovascular disease risk factors and increased survival in patients with established cardiovascular disease.<sup>28</sup> Yet, little is known about how dog ownership and dog walking may be associated with exercise habits, depression or hopelessness in patients with established IHD. Further study is needed since exercise is recognized as key to secondary prevention and there are known associations among depression, hopelessness and exercise.

## **Objective**

The objective of this study was to examine dog ownership and dog walking and their relationship with home-based and Phase II CR exercise, depression, and hopelessness in patients with established IHD. It was hypothesized that IHD patients who walk their dogs would report more frequent home-based and Phase II CR exercise than those patients who do not walk their dogs. It was also hypothesized that IHD patients who were dog owners, and those who own and walk their dogs, would report lower depression and hopelessness levels.

Research questions included:

- 1) Do IHD patients who own dogs report more frequent exercise than those patients who do not own dogs?
- 2) Is increased number of days per week of dog walking associated with increased number of days per week of patient exercise (beyond dog walking)?
- 3) Do IHD patients who own dogs report less depression and hopelessness than those patients who do not own dogs?
- 4) Do IHD patients who own and walk their dogs report less depression and hopelessness than those who do not walk their dogs?
- 5) Is increased number of days per week of dog walking associated with decreased depression and hopelessness?

## **Methods**

A prospective observational design was used with data collected over four time points (baseline, 3, 8, and 12 months). Time points were chosen based on standard completion of Phase II CR within 3 months and use of 8 and 12-month follow-up in prior research.<sup>12</sup> Inpatients were enrolled at a large teaching hospital in the Midwest from November 2010 to September 2011. Patients completed baseline measures while hospitalized, and follow-up data were collected by mail. The human subject review boards of the college and hospital approved the project.

## Sample

Patients were eligible if they were aged 21 years or older and had a diagnosis of MI, unstable angina, acute coronary syndrome, or underwent percutaneous coronary intervention, stent, or bypass surgery. Patients were excluded if they were unable to speak or read English, unable to provide consent or complete an interview, or had a planned discharge to an institutional setting.

A total of 188 inpatients provided dog ownership and dog walking data during their hospitalization. Patients were then contacted by mail to complete exercise, depression, and hopelessness questionnaires at 3 (n=91), 8 (n=78), and 12 months (n=99) later. Each patient also received two reminder phone calls at each time point. Time points were chosen on the basis of a standard Phase II CR program of 3 months and use of 8- and 12-month follow-up in prior research.<sup>12</sup> Of the original 188 patients, 122 provided data for at least one of the remaining follow-up time points; resulting in a 64.9% response rate. Eighty-nine of the 122 patients had measurements for 2 or 3 follow-up time points and 57 had measurements at all 3 follow-up time points.

Patients self-selected whether they participated in home or Phase II CR exercise. Patients who reported participating in Phase II CR were part of a twelve-week outpatient group exercise program. Phase II patients were also encouraged to exercise at home on non-attendance days. The Phase II CR program included monitored exercise training and group educational sessions focused on exercise, nutrition, smoking cessation, and stress reduction. Patients who reported home exercise participation had been provided written instructions in the hospital to gradually increase their exercise to 30 minutes per day, exercising at a speed and intensity that was comfortable for them, while not increasing their resting pulse by more than 20 beats per minute during exercise.

## Measures

Demographic characteristics (including dog ownership and dog walking), clinical history, cardiac diagnoses and procedures, depression, hopelessness, and exercise participation were measured. Demographics and clinical history were collected at baseline using a self-report questionnaire. Dog ownership and dog walking were measured by two questions asking patients if they own a dog and the number of days per week that they walk the dog. Cardiac diagnoses and procedures were collected using medical records review.

Depression was measured with the Patient Health Questionnaire-9 (PHQ-9), a 9-item measure of depression severity. Items are scored from 0 = *not at all* to 3 = *nearly every day*, providing a score range of 0 to 27. Internal consistency reliability<sup>29</sup> and criterion and construct validity<sup>30</sup> have been confirmed in prior research. Separate cognitive and somatic depressive symptom dimensions have been validated in patients with IHD.<sup>31,32</sup> The reliability of the total scale ( $\alpha = 0.85$ ) and two dimensions (somatic:  $\alpha = 0.70$ , cognitive:  $\alpha = 0.82$ ) were adequate in this study.

Hopelessness was measured using the State-Trait Hopelessness Scale (STHS). The STHS is a 23-item (10 state, 13 trait) instrument measured on a 4-point Likert-type scale (1 = *strongly disagree*, 4 = *strongly agree*). The STHS was developed using key components of the Theory of Hopelessness Depression.<sup>33</sup> Reliability and validity of the STHS are established in patients with IHD.<sup>34</sup> Earlier factor analysis identified a state hopelessness factor (6 of 10 state items), a trait hopelessness factor (8 of 13 trait items), and state and trait hopelessness absent factors (remaining items).<sup>34</sup> For this study, only hopelessness factor items (6 state and 8 trait) were analyzed because the aim was to determine differences in hopelessness between exercise groups. Adding the item scores and dividing by the number of items provides a total score for each factor. In the current study, the Cronbach's alpha for the hopelessness factor was high for the 6-item state (0.84 to 0.87 at all time points) and 8-item trait (0.85 to 0.89 at all time points) scales. In addition, alpha decreased in nearly all cases when an item was removed,

indicating that virtually all items contribute to the internal consistency of the scales. Lastly, item-total correlations were strong, varying between 0.42 and 0.77 for the state and 0.64 and 0.79 for the trait scales across all time points.

Home and Phase II CR exercise participation was measured using the Cardiac Rehabilitation Exercise Participation Tool (CREPT). The CREPT is a 20-item self-report questionnaire assessing a patient's referral and participation in home and Phase II CR exercise using both dichotomous questions and Likert-type scales. The CREPT was developed and tested in an earlier study of patients with IHD and deemed to have adequate reliability and content validity.<sup>12</sup>

### **Statistical Analysis**

Data were entered into IBM SPSS Statistics software, Version 20.0 (SPSS, Inc., Chicago, IL), with double data entry used to ensure data quality. SPSS and R were used for data analysis.<sup>35,36</sup> Multiple linear regression and multiple logistic regression were used to evaluate the significance of dog ownership and dog walking on hopelessness and depression and exercise behaviors, respectively. A power analysis was conducted due to the small sample sizes used for the primary dog ownership/walking comparisons in this study. It was determined that comparisons of dog owners to non-owners (n's of approximately 40 and 80, respectively) would result in 70% power to detect differences of  $\geq 25$  percentage points on dichotomous outcomes and 0.5 standard deviations on quantitative outcomes. For comparisons of dog walkers to non-dog walkers (among dog owners), samples of 20 per group would result in approximately 70% power to detect differences of 40 or more percentage points on dichotomous outcomes and 0.8 standard deviations on quantitative outcomes. Thus, while sample sizes were small, there was reasonable power to detect large effect sizes. All tests were two-sided and  $\alpha = 0.05$  was used to determine significance.

## Results

### Sample Characteristics

Participants were typical of IHD patients, with 34.4% being female and with a mean age of  $64.7 \pm 9.1$  years (Table 1). Forty-two patients in this study (34.4%) reported owning a dog, which approximates the national average of 36.5% of U.S. households.<sup>37</sup>

### Exercise among Groups

There were no significant differences in participation in home or Phase II CR exercise in dog owners versus those who did not own dogs (home CR: 57.1% vs. 62.5%,  $p=0.57$  and Phase II CR: 31.0% vs. 32.5%,  $p=0.86$ ) (Table 2). Among dog owners, 23 (54.8%) reported walking their dog at least 1 day/week. There was no significant difference in Phase II CR exercise participation among dog owners who walked their dogs at least 1 day/week and those who did not walk their dogs (dog walkers: 34.8% vs. non-dog walkers: 26.3%,  $p=0.56$ ). Patients who owned, but did not walk their dog, reported significantly lower levels of home exercise compared to patients who owned and walked their dogs at least 1 day/week (non-dog walkers: 36.8% vs. dog walkers: 73.9%,  $p=0.019$ ). Among those who walked their dog, there were higher rates of home CR exercise in more avid dog-walkers (87.5% if dog-walking 6-7 days/week;  $n=8$ ) versus those dog-walking only 1-5 days/week (66.7%;  $n=15$ ). The effects of smaller ranges of exercise could not be analyzed (for example, 1-2 and 3-5 days/week) because, among the 15 individuals who indicated that they walked their dog 1-5 days/week, only 2 of the 15 indicated 3-5 days/week.

### Depression and Hopelessness among Groups

In unadjusted analyses, dog-owners were significantly more depressed (mean=  $4.8 \pm 5.4$ ) as compared to non-dog owners (mean=  $3.2 \pm 3.5$ ,  $p= 0.045$ ), though this difference became non-significant after adjusting for age and sex ( $p= 0.13$ ). State and trait hopelessness levels were not significantly different between the two groups (Table 3). Further analysis showed no significant differences in depression levels of dog-owners who did not walk their

dogs (mean= 5.6 ± 5.5) and those who dog-walked 1-5 days/week (mean= 4.1 ± 5.4). Dog owners who walked their dogs 6-7 days/week had the lowest depression levels (mean= 1.7 ± 1.4), but differences were not statistically significant compared to those who walked their dog 1-5 days per week (mean= 5.4 ± 6.3, p= 0.12). Frequent dog walkers (6-7 days/week) also had the lowest state (mean= 1.7 ± 0.4) and trait (mean= 1.5 ± 0.7) hopelessness levels, but differences were also not statistically significant as compared to less frequent dog walkers (p= 0.47 and p= 0.12, respectively).

### **Sensitivity Analysis**

We conducted two separate follow-up analyses to ensure sensitivity of our findings to post-hospitalization response patterns. First, we further adjusted models reported in Tables 2 and 3 for whether or not a patient had data from each wave (3 separate indicator variables), as well as whether the patient had more than one post-hospitalization measurement. The pattern of significant findings in both tables remained the same. Second, we reduced the sample to (a) only patients with data from wave 2 (n=91) and (b) only patients with more than one post-hospitalization measurement (n=89). In both cases, estimated odds ratios/betas, as illustrated in Tables 2 and 3, remained similar (though less significant due to reduction in sample size) (detailed results not shown). In summary, the post-hospitalization response patterns had little impact on results.

### **Discussion**

We asked five research questions in this study. The first was whether IHD patients who *own* dogs report more frequent exercise than those patients who do not own dogs. Although dog ownership has been associated with increased physical activity in the general adult population,<sup>13-17</sup> no differences were found in the frequency of exercise between IHD patients who did and did not own dogs in this study. The second research question was whether increased number of days per week of dog *walking* is associated with increased number of days per week of patient exercise (beyond dog walking). Home exercise was significantly higher in

patients who walked their dogs at least 1 day per week as compared to non-dog walkers, with an additional (non-significant) trend for greater home exercise among avid dog walkers. Given that higher levels of cardiorespiratory fitness have been linked to reduced morbidity and mortality in patients with IHD,<sup>38,39</sup> it is reasonable to recommend any form of exercise as a secondary prevention strategy for IHD patients following hospitalization, including dog walking. Individuals who walk their dogs are likely expressing a value for exercise as part of a healthy lifestyle, as dog walkers have been identified as having lower blood pressure, lower cholesterol levels, less diabetes, and less tobacco use as compared to non-dog walkers.<sup>24</sup>

The third research question was whether IHD patients who *own* dogs report less depression and hopelessness than those patients who do not own dogs. Dog owners were significantly more depressed in this study as compared to non-dog owners, similar to findings in previous research with older dog owners in the general population.<sup>23</sup> However, findings in the current study were only significant in unadjusted analyses. After adjusting for age and sex, the differences were not significant. It is not surprising that younger IHD patients in this study would report more depression<sup>40,41</sup> and research is consistent in demonstrating that women with IHD report more depression and depressive symptoms compared to men.<sup>40,42-44</sup> There were also no group differences in state or trait levels of hopelessness, indicating that dog owners have a similar outlook and sense of control regarding their future<sup>33</sup> as IHD patients who do not own dogs. This is the first study examining hopelessness levels in dog owners in either the general population or in illness groups.

The fourth research question was whether dog owners who *walk* their dogs report less depression and hopelessness than those who do not walk their dogs. Dog walkers had lower levels of depression and trait hopelessness, but these findings were not statistically significant. The trend in lower depression levels in this sample is similar to earlier research that identified significantly lower depression in dog-walking younger adults in the general population.<sup>24</sup> Finally, we asked whether increased number of days per week of dog walking was associated with

decreased depression and hopelessness. Again, levels of depression and hopelessness were lower in those who walked their dogs the most (6-7 days/week), but significance disappeared after adjustment for sex and age. Additional research is needed with a larger and more diverse sample to evaluate the associations between dog walking and depression and hopelessness and associated covariates.

The key finding of this study was significantly higher home exercise levels in dog walkers who walked their dogs at least 1 day per week. An important underlying mechanism through which dog ownership leads to increased physical activity is the dog owner's sense of obligation for the health and well-being of one's dog.<sup>45</sup> Behavioral intention and motivation have been identified as important mechanisms through which dog ownership facilitates increased physical activity on the dog owner's part.<sup>46</sup> The majority of dog owners have positive intentions to walk, yet most fail to meet these intentions.<sup>43</sup> Strategies to assist a dog owner in putting intentions into action include assisting with affective judgments about a walking plan (e.g. a comfortable and safe place to walk), behavioral regulation (e.g. setting goals), habit (e.g. an exercise schedule), and identity formation (e.g. affirming commitment and progress).<sup>45</sup>

### **Limitations**

The sample was drawn from one Midwestern hospital and included a homogeneous sample, thereby limiting generalizability. The convenience sample could have resulted in selection bias. Dog walking rates were measured by self-report and this may have been affected by potential recall bias or socially desirable response bias resulting in participants over-reporting their exercise levels. Frequency of dog walking was limited to number of days per week and did not include length of time of the dog walks. Measurement of number of minutes of exercise per day at home or in a Phase II CR setting would have strengthened the study's findings. Patients also reported high rates of exercise prior to their IHD event, potentially resulting in a ceiling effect and hence fewer significant findings. There were small effects

associated with dog walking in this study and subsequent studies with larger more heterogeneous samples are needed.

### **Conclusions**

These findings show a beneficial effect on home-based exercise for those who own and walk their dog at least one day per week. When assessing a patient's physical activity level, health care providers can ask about dog ownership and encourage dog owners to walk their dog on a regular basis. Health care professionals should encourage dog owners to walk their dogs to increase the owners' physical activity levels. This is a simple and potentially effective way to increase physical activity in a high-risk population.

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