
# Dog OwnershipEffects on Elderly Owner's Cardiovascular Health: A Review

Senior Project

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## Abstract

In this review I discuss the current literature on the relationship between cardiovascular health and dog ownership in people over the age of 60 from a biological perspective. Dog ownership can reduce the risk of cardiovascular disease by lowering blood pressure and triglyceride levels, as well as increase levels of physical activity. My focus will be on two major questions 1) how does the relationship between blood pressure, triglycerides and dog ownership affect the risks of cardiovascular disease? 2) How does the relationship between dog ownership and physical activity affect the risks of cardiovascular disease? In reviewing 12 papers, I found that 9 papers showed dog ownership to be beneficial. Dog ownership can help reduce risks of cardiovascular disease by lowering blood pressure and triglyceride levels, as well as increase physical activity in older adults.

# Dog Ownership Effects on Elderly Owner's Cardiovascular Health: A Review

Cardiovascular disease, which is also referred to as heart disease, is a condition that results from narrowed or blocked blood vessels, valves, as well as irregular heart rhythm, and can result in chest pain, heart attack or a stroke. Cardiovascular disease is the leading cause of death in the United States (Heart Disease 2018). The most common cause of cardiovascular disease is atherosclerosis, which is a buildup of fatty plaques in the arteries. The plaque can build up and cause problems with blood flow through arteries, tissues, and organs (Heart Disease 2018). In 2016, cardiovascular disease was responsible for 1 of every 3 deaths among adults in the United States. The number of deaths is expected to grow from 17.6 million per year to 23.6 million per year among adults, in the United States by 2030 (American Heart Association 2019). It is important to be aware of the causes and symptoms of each cardiovascular disease because they differ between disease type, as well as between men and women. For example, men are more likely to experience chest pain as opposed to women who are more likely to experience chest discomfort, nausea, and shortness of breath (Heart Disease 2018). Examples of cardiovascular diseases include: Atherosclerotic disease, heart arrhythmias, heart defects, and dilated cardiomyopathy. Some symptoms of Atherosclerotic disease include chest pain and tightness, pain in the neck and jaw, and numbness in the legs and arms. Heart Arrhythmias are diseases that result in abnormal heartbeat. Heart arrhythmia patients can experience chest fluttering or a heartbeat that is too fast or slow. Dilated cardiomyopathy is asymptomatic in the early stages and therefore underdiagnosed. In later stages, symptoms include breathlessness, fatigue, and swelling of the legs, ankles, and feet (Heart disease 2018). Different treatments exist for certain heart diseases, such as medications and surgery. Methods of prevention include, daily exercise, avoidance of smoking, healthy diet, and maintenance of

blood pressure and cholesterol, which are all recommended for overall health and can help reduce the risk of all types of cardiovascular disease (Heart disease 2018). According to the American Veterinary Medical Association (2017-2018) 38.4% of households own a dog. A common hypothesis is that pet ownership, specifically dog ownership has beneficial effects on cardiovascular health including lower blood pressure and triglyceride levels, as well as increased participation in physical activity. This is especially supported through the relationship between physical activity and dog ownership (Richards et al. 2015; Heady et al. 2007; Brown and Rhodes 2006). The hypothesis that dog ownership has beneficial effects on owner's health is suggested by multiple papers, such as (Heady et al. 2007; Anderson et al. 1992), but the alternative hypothesis that dog ownership has no effect on owner's health is suggested by a few papers (Budoff 2016; Wright et al 2007; Parslow et al. 2003). I set out to review the literature to determine which hypothesis has better support.

## General Background and Terminology

The heart is divided into a left and right side. The right side, consisting of the right atrium and ventricle, is responsible for collecting and delivering blood to the lungs through the pulmonary arteries. The left side, consisting of the left atrium and ventricle, receives oxygen rich blood from the lungs. The left side of the heart pumps blood through the aorta to tissues throughout the whole body. The heart has four valves that must be formed correctly to prevent leakage (Heart disease 2018). Hypertension is one of the major risk factors for cardiovascular disease. Hypertension is another word for high blood pressure levels. High blood pressure is common among elderly populations because the risk of having hypertension increases with age (Wu et al. 2015). They estimated that hypertension

will affect about 65% of people 60 years of age or older. There are two types of blood pressure numbers: systolic blood pressure and diastolic pressure. Systolic blood pressure is the pressure when the heart is contracting and pumping the blood, while diastolic pressure is the pressure between the beats and when the heart is not moving (Benton [date unknown]). High blood pressure occurs when the pressure of the blood in your body against the artery wall is above normal (120 systolic/ 80 diastolic; Benton [date unknown]). A person is considered to have high blood pressure if they have a consistent pressure of 140/90 or higher. The ideal blood pressure is 135/85 or lower. Having high blood pressure is very common and often does not have clear symptoms. This is dangerous because if high blood pressure is left untreated the outcomes may include stroke, heart diseases, heart attack, or kidney failure (Benton [date unknown]). High triglyceride levels are another factor that contribute to the risk of cardiovascular diseases. Triglycerides are a type of fat or lipid found in your blood. When people eat more calories than are needed or burned, the body converts the calories into triglycerides and stores them for later energy use. Consistently eating more calories than burned, as well as foods containing high amounts of carbohydrates will result in hypertriglyceridemia, which is a condition where triglyceride levels are too high (Triglycerides: Why do…2018). Having high triglyceride levels can cause arteries to harden and narrow, due to plaque buildup, which in turn increases the risk of cardiovascular disease, specifically the likelihood of having a stroke (Triglycerides: Why do…2018). According to Elsawy and Higgins (2010) few older adults in the United States are physically active, and many do not reach the recommended 150 minutes of exercise each week. Participating in physical activity has shown to improve older individuals' quality of life (Elsawy and Higgins 2010). Overall, regular physical activity is important for any age group. It is especially important as people age because it helps prevent health issues that go with aging, such as weakening bones and muscles, as well as

helping people remain strong and independent (Centers for disease…2020). Lack of physical activity increases the risks of heart disease, stroke, hypertension, cancer, and many other diseases that commonly occur in older adults (figure 1).

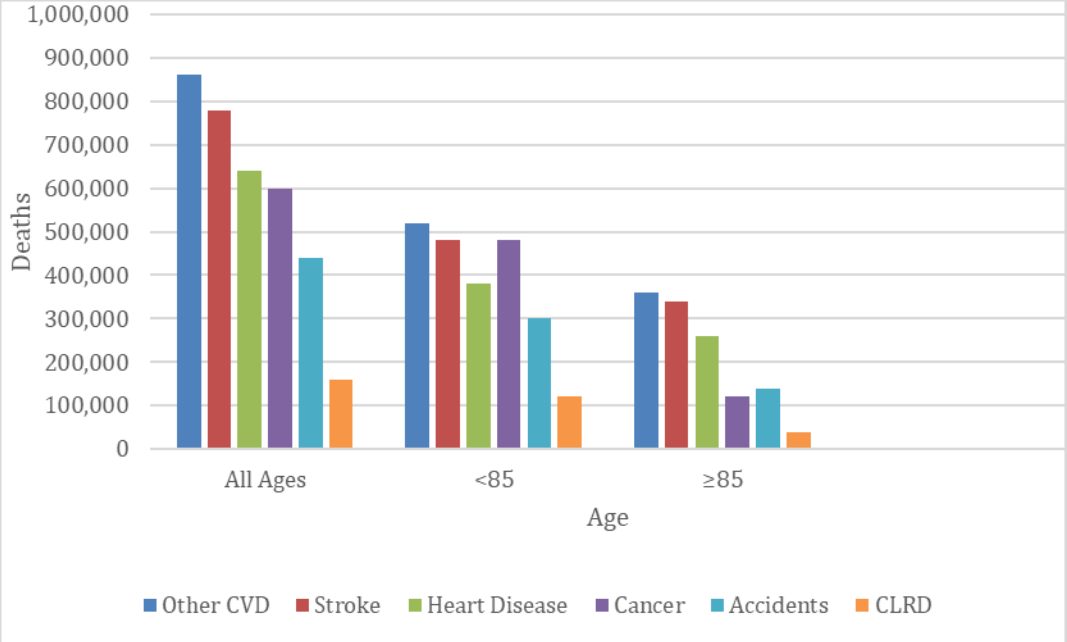


Figure 1: shows cardiovascular disease (including stroke and heart disease) and other major causes of death for people less than 85 years of age and people older than 85 in the United States in 2016; data adapted from Benjamin et al. (2019).

# Blood Pressure

Hypertension is common among older adults, but it is still unclear what the optimal blood pressure is (Wu et al. 2015). Hypertension is a leading risk factor of heart disease, specifically hypertensive and ischemic heart disease (High Blood…[date unknown]). Using a cohort to assess the relationship between blood pressure and mortality, Wu et al. (2015) found that mortality risks of older adults increased when systolic blood pressure levels were ≥160 mm Hg or the diastolic blood pressure levels were ≥100 mm Hg. The relationship between blood pressure and mortality showed that hypertension increased mortality among patients with cardiovascular disease (Wu et al. 2015). This study shows the importance of finding new methods that are successful in reducing hypertension. Non-human companionship has been associated with lower blood pressure in humans. Anderson et al. (1992) compared blood pressure levels of pet-owners and blood pressure levels of non-pet owners and showed that pet-owners had significantly lower systolic blood pressure, but not diastolic blood pressure (Anderson et al. 1992). Similarly, a clinical trial using 240 married couples found that the pet-owners had significantly lower systolic blood pressure levels and a study using 23 children aged 3-6 had significantly lower blood pressure during doctor appointments when a dog was present (Wright et al. 2007). In borderline hypertensive participants who adopted a dog from the shelter or never adopted a dog, Levine et al. (2013) found blood pressure levels between the groups were similar before the dog adoption. Two to 5 months after, the participants who adopted a dog had lower systolic blood pressure (Levine et al. 2013). A clinical trial of 48 hypertensive stockbrokers found that pet ownership showed better results than angiotensin-converting enzyme inhibitors, which are used to block the increase of blood pressure (Wright et al. 2007). They also conducted a study examining the relationship of pet ownership with systolic and diastolic blood pressure, pulse pressure, mean arterial pressure, and

hypertension. The results of this study showed that after adjustments for age and other covariates there were no significant changes in hypertension by pet ownership (table 1; Wright et al 2007). According to Levine et al. (2013) not all studies show a relationship between pet ownership and lower blood pressure, for example, the results of Parslow et al's. (2003) study showed that pet-owners had higher diastolic blood pressure and non-owners and pet-owners had similar systolic blood pressures. The results of Wright et al's. (2007) study showed that before adjustments, pet-owners had lower systolic blood pressure compared to participants who had never owned a pet, but after analysis adjustments there were no significant differences between owners and non-owners and systolic, diastolic, pulse, and mean arterial pressures. This study provides conflicting data compared to Anderson et al. (1992), who found a relationship between pet ownership and lower systolic blood pressure. Sudhir et al. (2011) found conflicting results among the literature on cat and dog owners, dogs were found to have more beneficial effects on their owners compared to cats.

Table 1: shows the unadjusted, age-adjusted, and multivariate-adjusted comparisons of systolic and diastolic blood pressure of dog and cat owners compared to non-pet owners; data adapted from Wright et al. (2007).

| Variable | Dogs (n=780) | Cats (n=133) | No Pets (n=247) |
|---|---|---|---|
| SBP (mm Hg) Unadjusted | 136.2 (134.7-137.7) | 137.1 (133.5-140.8) | 141.9 (139.3-144.6) |
| SBP (mm Hg) Age-adjusted | 137.0 (135.6-138.4) | 138.7 (135.3-142.1) | 138.5 (136.0-141.0) |
| SBP (mm Hg) Multivariate-adjusted | 142.5 (140.6-144.4) | 143.8 (140.3-147.3) | 144.3 (141.4-147.1) |
| DBP (mm Hg) Unadjusted | 76.3 (75.6-77.0) | 76.2 (74.6-77.8) | 75.7 (74.5-76.8) |
| DBP (mm Hg) Age-adjusted | 76.1 (75.4-76.7) | 75.9 (74.3-77.4) | 76.5 (75.3-77.7) |
| DBP (mm Hg) Multivariate-adjusted | 77.4 (76.6-78.3) | 77.4 (75.7-79.0) | 78.1 (76.8-79.4) |

## Triglyceride Levels

More than one third of adults in the United States have high triglyceride levels, which have been linked to the hardening of arteries and thickening of artery walls, as well as increasing the risk of cardiovascular diseases, such as stroke and coronary heart disease (Triglycerides: Why do… 2018). There is a variety of evidence supporting that elevated levels of triglycerides and triglyceride rich lipoproteins are a cause of atherosclerotic cardiovascular disease. Along with low-density lipoprotein (LDL) cholesterol, high levels of triglycerides and triglyceride rich lipoproteins may play a pathogenic role in the development of cardiovascular disease (Budoff 2016). The normal level of triglycerides is less than 150 mg/dL. A high level of triglycerides is 200-499 mg/dL and very high would be 500 mg/dL and above. High triglycerides tend to show up with other health problems,

such as high blood pressure, diabetes, obesity, and high levels of LDL cholesterol (Triglycerides: What you…2018). For patients to lower their triglyceride levels on their own, physical activity, losing weight, choosing better fats to eat, and cutting down on alcohol consumption are all recommended. Patients with heart disease and high triglycerides may need medication to help bring their triglyceride levels down. Some medications and dietary supplements available include: Fibrates, Niacin, Fish oil with omega-3 acid, and Statins (Triglycerides: What you…2019).

Aiba et al. (2012) studied whether pet ownership modulates cardiac autonomic nervous activity imbalance in patients who were currently diagnosed with diabetes mellitus, hypertension, and hyperlipidemia. Autonomic nervous activity is what controls the involuntary muscles of the heart (Shiel [date unknown]). The results supported Aiba et al. (2012) hypothesis that pet ownership modulates cardiac autonomic nervous activity in patients with lifestyle related diseases, such as hyperlipidemia. Researchers also reported that pet owners with coronary artery disease show a greater one-year survival rate compared to non-pet owners (Aiba et al. 2012). Common risk factors of coronary artery disease are hypertension, hyperlipidemia, and diabetes (Aiba et al. 2012). The relationship between pet ownership and triglyceride and plasma cholesterol levels showed that pet owners had significantly lower triglyceride and plasma cholesterol levels (Anderson et al. 1992). There is limited data available on dog ownership specifically.

Further research would aid in determining whether triglycerides and triglyceride-rich lipoproteins play a significant role in the causal pathway of atherosclerotic cardiovascular disease (Budoff 2016). Along with pet ownership, lower triglyceride levels could also be associated with factors, such as more exercise, which leads to a variety of health benefits. Increasing participation in physical activity can help lower triglyceride levels (Anderson et al. 1992).

# Physical Activity

Despite the efforts to reduce the risk of cardiovascular disease, obesity and physical inactivity remain at epidemic proportions (Levine et al. 2013). Over 60% of American adults are overweight or obese and over 50% do not participate in the recommended levels of physical activity. Physical inactivity is a risk factor for cardiovascular diseases, but the optimal frequency, duration, and intensity to prevent cardiovascular disease is unclear (Carnethon 2009). Since the development of modern medicine, regular physical activity has always been recommended and has shown beneficial results in the elderly population. These results include, decreased risk of falling and injuries, and reduced risk of cardiovascular disease, osteoporosis, and hypertension (Promoting wellness…2017). Although there are clear beneficial outcomes of physical activity, the definition of 'regular physical activity' has changed over time (Carnethon 2009). A 2003 study used 5 cohorts to study both intensity and frequency of physical activity and how it effects a 10-year incidence of cardiovascular disease, coronary heart disease or stroke mortality. The results showed that after controlling for factors, such as cigarette smoking, family history of heart disease, social class, blood pressure, and body mass index, increasing frequency of heavy activity (swimming, jogging, stair climbing) was associated with a 62% lower likelihood of cardiovascular disease mortality (Carnethon 2009). Brown and Rhodes (2006) conducted the first North American study that looked at both physical activity and dog walking. They explored the idea that dog ownership and feelings of responsibility and obligation to the dog would result in owners taking part in more physical activity. The survey results comparing the relationship between walking and physical activity levels of dog owners (primary walkers) and non-dog owners showed that dog owners reported more physical

activity.

It is estimated that over 40% of households in the United States own a dog, but an estimated 70% of owners do not walk their dogs enough to achieve health benefits. Richards et al. (2015) used a controlled physical activity intervention based on social cognitive theory. Forty-nine middle-aged participants who were all considered obese agreed to record their physical activity and receive emails about health benefits. This intervention aimed at increasing dog walking among dog owners, which may be important to raise physical activity participation among older adults in the United States. The results comparing the relationship between dog walking and the motivation to exercise showed that physical activity can be increased using dog walking as a strategy, especially if participants are informed of the potential health benefits for both the owner and the dog (Richards et al. 2015).

In China, pets were banned in urban areas until 1992. Once pet ownership was allowed, dog ownership grew rapidly. The newly allowed ownership provided a unique research opportunity (natural experiment) to assess the impact of owning a dog on human health. In the Chinese cities the new introduction of pets allowed researchers to assess whether pets had effects on health or if individuals who are healthier to begin with, usually make the decision to own a pet (Headey et al. 2007). The participants consisted of women aged 25-40 and half of the participants owned dogs and half did not. The results of the relationship comparing dog ownership and non-ownership to levels of physical activity showed that owning a dog is positively associated with exercising more and feeling fitter and healthier. The researchers also found that pet owners take fewer sick days off from work and go to the doctors less often (Headey et al. 2007). Dog ownership is a beneficial way to help increase participation in physical activity among older adults, which would lead to a healthier lifestyle.

# Further Research

Further research on dog ownership and pet ownership should include focus on pet ownership in relation to a healthier lifestyle and rehabilitation. Herrald et al. (2006) found that pet ownership predicts adherence to cardiovascular rehabilitation in participants that underwent cardiac surgery for a variety of cardiac insufficiencies. The majority of the 81 participants from a 12 week cardiac rehabilitation program owned a dog or both a dog and cat, suggesting that pets can provide medical benefits by providing their owners with love, security, responsibility, or purpose in life. The results comparing pet owners and non-owners and successful completion of the cardiac rehabilitation program showed that patients who owned pets were more likely to finish the recovery program. Seventy-nine-point two percent (79.2%) of the patients who did not own a pet completed the program and 96.5% of the patients who owned a pet completed the program (Herrald et al. 2006). This study shows that not only have researchers found beneficial effects of dog ownership relating to the reduction of cardiovascular disease risks, but dog ownership can also serve as motivation for elderly people to stay committed to their treatment plans and can result in more patients recovering (Herrald et al 2006).

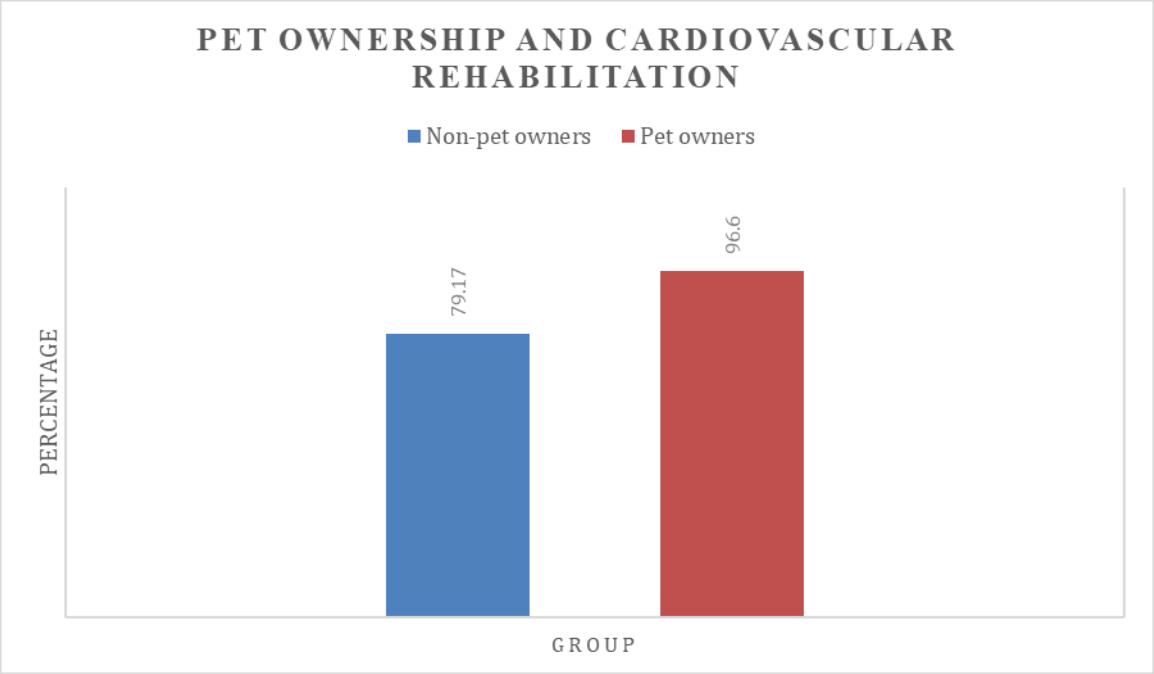


Figure 2: shows the percentage of patients with pets and without pets who completed the cardiac rehabilitation program; data adapted from Herrald et al. (2006).

## Conclusion

The majority of articles (9/12) comparing the health benefits of dog ownership and cardiovascular disease risks argue that dog ownership is beneficial. Nine articles found that dog ownership helped reduce the risks of cardiovascular diseases, such as lowering blood pressure, triglyceride levels, and increasing participation in physical activity (Richards et al. 2015; Levine et al. 2013; Aiba et al. 2012; Sudhir et al. 2011; Heady et al. 2007; Wright et al. 2007; Brown and Rhodes 2006; Herrald et al. 2006; Anderson et al. 1992). These articles commonly found a relationship between dog ownership and beneficial effects of cardiovascular health when variables, such as age and gender were not controlled for in the experiment. Two articles did not find a relationship between dog ownership and reduced risks of cardiovascular diseases (Budoff 2016; Parslow et al. 2003).

Wright et al. (2007) did not find a relationship between dog ownership and lower blood pressure levels after analysis adjustments. Multiple factors contribute to cardiovascular health and cardiovascular disease risk reduction. In a variety of studies about physical activity, dog owners were more physically active than non-owners. Richards et al. (2015) found that informing people of the health benefits of walking for themselves and their dog, provided motivation to increase dog walking. As Brown and Rhodes (2006) stated, dogs could be used as a beneficial intervention to motivate people to exercise more, which is important for all age groups, especially older adults. Dog ownership can serve as a beneficial method of reducing the risks of cardiovascular disease through lower blood pressure and triglyceride levels, as well as increasing physical activity among older adults.

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