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Dog ownership and mortality

**Is dog ownership associated with mortality? A nationwide registry study**

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Abstract

We examined the association between dog ownership and mortality and whether the association depends on having a spouse in a population-based registry study. All Danish citizens over age 18 years who died in 2015 (N=45,864) were matched to five people who remained alive in 2015 (N=229,320). The total sample were linked to a mandatory nationwide register of dog ownership. Dog ownership was associated with a slightly 8% lower all-cause mortality. The association was confined to people without a spouse (OR 0.86; 95% CI 0.82-0.91), while the association was weaker in people with a spouse (OR 0.98; 95% CI 0.93-1.03).
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Introduction

Social relationships have been shown to protect individuals from disease and premature death. Thus, people who have few or stressful social relationships have a higher disease incidence and poorer survival than people with positive social relations (1). There has been an increasing interest in the role of dogs as substitutes for human-to-human social relationships (2, 3).

Through a systematic search of PubMed and PsycINFO, we identified five studies of the association between dog ownership and mortality, which had conflicting results. Four of the five studies were questionnaire studies, of which two examined dog ownership among patients, while the fifth study was a register study in a general population. The first questionnaire study (N=424 patients) found that dog ownership was associated with better one-year survival after acute myocardial infarction (chi square 4.05; df=1, p=0.044) (4), whereas the second questionnaire study (N=489) of hospitalized patients did not confirm an association (chi square 1.30; df=1, p=0.249) (5). The third questionnaire study (N=11,394) (6) as well as the fourth questionnaire study (N=53,418) (7) conducted among the general population found no association between dog ownership and mortality (HR 1.17; 95% CI 0.94-1.46) (6) and, HR 1.00 (95% CI 0.91-1.09) (7). However, a recent nationwide register study (N=3,432,153) found a lower risk of death in dog owners in both single-households (HR 0.67; 95% CI, 0.65–0.69), as well as in multiple-person households (HR 0.89; 0.87–0.91) (8).

The studies had varying methodological weaknesses, including cross-sectional design, potential selection bias (4-7), incomplete follow-up (6, 7), no separate estimate of mortality, with potential misclassification (5), potential misclassification of dog owners (8), and limited generalizability of the findings to the general population in the studies of patients (4-7).
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To address the limitations of the early studies and the discrepancy of the two more recent studies, we examined the association between dog ownership and overall mortality from objectively collected information in a nationwide register-based study.

Methods

We examined the association between dog ownership and mortality in a nested case–control design using data from national registries. Since 1968, all residents of Denmark have been assigned a unique personal identification number allowing linkage among the Danish registries. Since 1993, it has been mandatory to register dog ownership in the Danish Dog Registry, which contains information on the dog as well as name and address of the owner. Dog ownership was defined as ever being registered as a dog owner in the dog registry. Of the 1,223,955 people in the registry, we identified 865,371 dog owners (71%). The study protocol was approved by the Danish Data Protection Agency (file no. 20185-41-4424). Approval from an ethics board is not required for studies involving the registries used in this study, according to Danish law.

Further information, on vital status (alive, dead), marital status (married, unmarried), education (basic, medium or higher) and income distribution as numbers of people in quintiles was obtained from the Danish Civil Registration System, the Population Register, the Register for Education of the Population and the Register of Income Statistics, respectively which are all considered virtually complete and are updated annually.
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Study population

We included all 45,864 Danish citizens over the age of 18 years who died in 2015 and a control cohort of people who were alive and were individually matched (1:5) on sex, age (birth day, month, and year), education, income and marital status (selected based on the previous literature). This resulted in a total population of 275,184 individuals.

Statistical analyses

We used conditional multiple logistic regression models to estimate odds ratios and 95% confidence intervals for the association between dog ownership and all-cause mortality. We examined the effect modification of marital status in likelihood-ratio tests. All analyses were adjusted for sex, age, educational level, income and marital status through matching.

Results

Of the 275,184 people included into the study, 8% were dog owners (Table 1). The mean age was 76 years (range, 20 to 102 years), with differences according to dog ownership: the mean age was 77 years for non-dog owners and 68 years for dog owners. Sex was distributed equally in the sample; men were more likely (57%) to be dog owners than women. The distribution in income quintiles and in length of education was similar for dog owners and non-dog owners. Almost half the dog owners and 39% of the non-dog owners had a spouse.

Dog owners had lower all-cause mortality, with an OR of 0.92 (95% CI 0.89-0.95). The association was confined to people without a spouse, among whom dog ownership was
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associated with 14% lower mortality (OR 0.86; 95% CI 0.82-0.91), while this association was weaker in people with a spouse (OR 0.98; 95% CI 0.93-1.03).

Discussion

In this population-based case-control study, dog ownership was associated with an 8% lower mortality rate and a 14% lower mortality rate was seen among people without a spouse. The results for dog ownership are in line with two of presented studies (4, 8) but contrary to findings of the three other studies published on this association (5-7).

Dogs may be seen as social companions who buffer stress in the same way as family members or friends (3, 9) or they may act as potential social catalysts. Dogs may also affect the owner’s health by increasing their level of physical activity (2). A recent study showed that elderly dog owners who walked their dog regularly had significantly more physical activity than those who did not (10). The observed difference in effect by marital status suggests that dog ownership may be beneficial for people living without a spouse, which was also shown in the study by Mubanga et al. (8). This supports the hypothesis that owning a dog can act as a substitute for a spouse or another close social relationship (1).

A limitation of the study is possible misclassification of dog ownership. As we could not rule out misclassification with regards to the exposure time of dog ownership, we defined dog ownership as ever versus never. Dog owners for whom the birth date could not be identified were classified as non-dog owners, and these potential misclassifications could result in underestimation of the association. Household members sharing the home of the dog owner were not classified as dog owners leading to potential misclassification as living in the same household as the dog may possible entail the same benefits as the dog owner has. We did not
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adjust for having children living at home, and we cannot rule out potential confounding as families with children may be more likely to have a dog. Furthermore, we cannot exclude confounding by indication, as some of the association might be due to selection of the people (perhaps especially among singles) who become dog owners; i.e. people who have the energy and funds to acquire a dog may be healthier than people who do not.

As modern society is gradually reducing social relationships, with potential health consequences, it is reasonable to explore alternative relationships. Our results suggest that owning a dog is associated with potential health benefits, especially for people living alone. Further studies with more detailed information on the duration of dog ownership and studies providing a more thorough understanding of the possible mechanisms linking dog ownership to mortality are needed.
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Acknowledgements

We wish to thank Anja Krøyer for her assistance with data management and Klaus Kaae Andersen for advice on statistical analyses.

Key points

- Social relationships are associated with people’s health and mortality.
- In a nationwide registry study, dog ownership was found to be associated with a lower risk for death among people who did not have a spouse.
- Owning a dog might have the beneficial protective health effects of other social relationships, such as having a spouse.

Declaration of interests

The authors report no conflicts of interest.

Funding

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References

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<table>
<thead>
<tr>
<th></th>
<th>Non-dog owners</th>
<th>Dog owners</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>250,970</td>
<td>24,214</td>
<td>275,184</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>127,939 (51.0)</td>
<td>10,259 (42.4)</td>
<td>138,198 (50.2)</td>
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<tr>
<td>Age years (mean (SD))</td>
<td>77.4 (13.0)</td>
<td>68.7 (13.0)</td>
<td>76.6 (13.1)</td>
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<td>Age group (years (%))</td>
<td></td>
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<tr>
<td>≤ 65</td>
<td>40,219 (16.0)</td>
<td>8,691 (35.9)</td>
<td>48,910 (17.8)</td>
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<td>&gt; 65–80</td>
<td>88,145 (35.1)</td>
<td>10,661 (44.0)</td>
<td>98,806 (35.9)</td>
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<td>&gt; 80</td>
<td>122,606 (48.9)</td>
<td>4,862 (20.1)</td>
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<td>Education level (n (%))</td>
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<tr>
<td>Basic</td>
<td>7,211 (2.9)</td>
<td>1,771 (7.3)</td>
<td>8,982 (3.3)</td>
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<tr>
<td>Medium</td>
<td>198,822 (79.2)</td>
<td>18,828 (77.8)</td>
<td>217,650 (79.1)</td>
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<td>27,374 (10.9)</td>
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<td>425 (1.8)</td>
<td>17,988 (6.5)</td>
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<td>1</td>
<td>54,560 (21.7)</td>
<td>6,232 (25.7)</td>
<td>60,792 (22.1)</td>
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<td>3,164 (13.1)</td>
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<td>Marital status (n (%))</td>
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<td>Spouse</td>
<td>97,792 (39.0)</td>
<td>11,984 (49.5)</td>
<td>109,776 (39.9)</td>
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