



## Research paper

# Pet ownership and symptoms of depression: A prospective study of older adults



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## ABSTRACT

**Background:** This paper aims to examine associations between pet ownership and symptoms of depression in a large, population-based sample of older adults. Specifically, we tested whether: (i) people who report more depressive symptoms are more likely to own a pet; (ii) pet ownership protects against an increase in depressive symptoms over time; (iii) associations differ by symptom type.

**Methods:** Data were drawn from the English Longitudinal Study of Ageing, a longitudinal panel study of men and women aged 50 and older ( $n = 7,617$ , 52.5% female). Pet ownership (dog/cat/other/none) was self-reported in 2010/11. Depressive symptoms were assessed in 2010/11 and 2016/17 using the 8-item centre for Epidemiologic Studies Depression (CES-D) scale. We analysed total CES-D score and derived symptom subscales (depressed mood, anhedonia, somatic symptoms) in relation to pet ownership, adjusting for sociodemographic and health-related covariates.

**Results:** A one-symptom increase in total CES-D score was associated with 7% increased odds of dog ownership ( $OR = 1.07$ , 95% CI 1.03–1.11). Significant associations were observed between each subset of depressive symptoms and dog ownership, with models run on z-scores showing a slightly stronger association for symptoms of depressed mood ( $OR = 1.13$ , 95% CI 1.06–1.21) compared with anhedonia ( $OR = 1.10$ , 95% CI 1.04–1.17) or somatic symptoms ( $OR = 1.10$ , 95% CI 1.03–1.18). Prospectively, no significant associations were found.

**Limitations:** Self-reported data; small sample size for some pet categories.

**Conclusion:** Amongst older adults in England, those with more depressive symptoms are more likely to own a dog, but pet ownership is not significantly associated with change in depressive symptoms over time.

## 1. Introduction

One in two older adults ( $\geq 55$  years) in the United Kingdom has experienced depression – approximately 7.7 million individuals – and one in five report worsening of depressive symptoms with age

(NHS England, 2017). Commonly reported triggers for depression include the death of loved ones, personal ill health, and financial worries (NHS England, 2017). Feelings of loneliness and social isolation are also important determinants of depressive symptoms in later life (Cacioppo et al., 2010; Ge et al., 2017). Although most research into

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depression uses a single sum total index of all symptoms, the standard diagnostic systems (i.e., DSM, ICD) refer to ‘subtypes’ of depression as worthy of attention, a position which may be extended to consideration of clusters of depressive symptoms. Depressive symptoms can be categorised into several distinct categories according to the nature of those symptoms, including depressed mood, anhedonia, and somatic symptoms.

Because of the symptoms associated with it, depressed mood is probably the most easily recognised and familiar form of depression and is associated with sadness, feelings of worthlessness, and suicidal thoughts or recurrent thoughts of death. These symptoms are most likely induced by elevated HPA axis function and serum cortisol, plus the influence of deficiencies in neurotransmitter systems such as the serotonergic system. Reductions in serotonin have been shown to adversely influence the core behavioural and somatic functions that underlie depression in laboratory animal studies, including appetite, sleep, sex, pain response, body temperature and circadian rhythm (Maes and Meltzer, 1995). In addition, human post-mortem studies have shown lowered levels of serotonin in depressed patients (Reimold et al., 2008; Stockmeier, 2003).

Anhedonia is less well-known than depressed mood in the general community, and is hypothesised to result from imbalance in catecholaminergic systems, principally dopamine. Symptoms include loss of interest and loss of pleasure in activities which were previously enjoyed by the individual.

Somatic symptoms of depression include weight or appetite changes, fatigue, sleep disturbances, and psychomotor agitation/retardation (Silverstein, 1999). These four symptoms have been seen as a core component of depression for over 20 years (Simon et al., 1999). There are many studies that report an association between somatic illness and depression. For instance, Katon et al. (2007) reviewed 31 randomised controlled trials with a total of 16,922 patients across a range of illnesses including diabetes, coronary artery disease, congestive heart failure, asthma, and arthritis. Self-reported somatic symptoms were at least as strongly associated with depression and anxiety as objective physiological measures, leading the authors to argue that diagnoses of anxiety and depression were “essential in understanding the cause ... of somatic symptom burden” (p. 147).

As might be expected, treatment indications are different for each of these three subtypes of depression and therefore it is of relevance to also investigate the possible ‘buffer’ factors that might help reduce people’s risk of developing each form of depression. One such possible factor is pet ownership.

There is a growing body of literature to suggest that animals and/or pet ownership can have a positive influence on physical and mental health (e.g. see reviews (Beetz et al., 2012; Cherniack and Cherniack, 2014)). Studies indicate that pet ownership may help to reduce depressive symptoms and depression, perhaps by helping pet owners form valued relationships with another living being, which in itself may engender positive feelings about themselves as well as about their pets (Cherniack and Cherniack, 2014). This close owner-pet relationship has also been shown to increase the levels of oxytocin, which is an important mood-related hormone in the brain and is itself associated with better mental health (Slattery and Neumann, 2010). Evidence for these mental health-enhancing effects comes from a study of 252 people living with HIV (mean age 49 years), who found that dog ownership reduced the likelihood of depression and conferred long-term health benefits (Muldoon et al., 2017). However, some evidence suggests the type of animal may influence any effect of pet ownership on mood: a study of 39 homebound older adults (mean age 76 years) who owned a cat or dog to which they were attached found that cat owners had lower levels of depressive symptoms than dog owners (Branson et al., 2017). While these studies point to potential benefits of pet ownership for depression, a recent review of 21 studies of pet ownership and depression concluded that the association was not yet supported by sufficient evidence to draw firm conclusions (Needell and

Mehta-Naik, 2016). Additionally, the existing evidence base has several important limitations, including relatively poor methodological quality, small samples, and an absence of robust longitudinal or experimental design (Cherniack and Cherniack, 2014). Moreover, there are several important questions that must be addressed before intervention can be recommended:

- 1 Are people who report more depressive symptoms more likely to own a pet?
- 2 Does pet ownership protect against an increase in depressive symptoms over time?
- 3 Do these associations vary according to symptom type (depressed mood, anhedonia, somatic symptoms)?

The present study therefore aimed to examine the association between pet ownership and symptoms of depression in a large sample of older English adults.

## 2. Method

### 2.1. Study population

The English Longitudinal Study of Ageing is a longitudinal panel study of men and women aged 50 years and older (Stephens et al., 2013). Baseline data for the present analyses were drawn from Wave 5 (2010/11; the first wave in which participants were asked about pet ownership) and follow-up data were from Wave 8 (2016/17; the latest wave of data available). Of the 10,317 participants interviewed in Wave 5, 7617 (73.8%) had complete data on pet ownership, all covariates and depressive symptoms. These participants formed our analytic sample. Follow-up data were available for 5334 (70.0% of the baseline sample) participant. Ethical approval was obtained from the London Multi-Centre Research Ethics Committee and all participants provided informed consent.

### 2.2. Measures

Pet ownership was assessed with by asking participants: “Do you keep any household pets inside your house/flat?” Those who responded yes were also asked: “What pets do you keep inside your house/flat? (dog/cat/bird/other furry pets/other)”. Data were analysed using a four-level variable: no pet, dog, cat or other pet, as has been done previously (Batty et al., 2017).

Depressive symptoms were assessed with an eight-item version of the centre for Epidemiologic Studies Depression Scale (CES-D), which asks respondents to indicate whether they had experienced eight symptoms over the past month using a binary (yes/no) response (Radloff, 1977). We analysed the total CES-D score (range: 0–8) and scores on three derived subscales reflecting depressed mood (symptoms: “felt depressed”, “was happy” (reverse-scored), “felt lonely”, “felt sad”; range: 0–4); anhedonia (symptoms: “enjoyed life” (reverse-scored); range 0–1); and somatic symptoms (symptoms: “felt everything they did was an effort”, “felt their sleep was restless”, “could not get going”; range 0–3). Higher scores on the total scale and each subscale indicated more depressive symptoms.

We included information on a range of covariates, selected *a priori*. Sociodemographic variables included age; sex; ethnicity (white vs. non-white); marital status (married/living as married vs. never married/separated/divorced/widowed); and household non-pension wealth (a sensitive indicator of socioeconomic status in this population (Banks et al., 2003)). Health-related variables included smoking status (smokers vs. non-smoker); frequency of alcohol intake (never/rarely [never – once or twice a year], regularly [once every couple of months – twice a week], or frequently [3 days a week – almost every day]); level of physical activity (inactive [no moderate/vigorous activity on a weekly basis], moderate activity at least once a week, and vigorous

activity at least once a week); and limiting long-standing illness, defined as the presence of any long-standing illness, disability, or infirmity that limits activities in any way.

### 2.3. Statistical analysis

Analyses were performed using IBM SPSS Statistics 25. Data were weighted to correct for sampling probabilities and for differential non-response and to match the English population distributions for age and sex. For cross-sectional analyses, the weights accounted for the differential probability of being included in Wave 5 of ELSA. For prospective analyses, we applied a longitudinal weight that accounted for non-response at Wave 8 based on the sample who participated in Wave 4.

We used one-way independent analysis of variance for continuous variables and chi-square tests for categorical variables to analyse associations between pet ownership and covariates (measured at baseline). We used multinomial logistic regression to test cross-sectional associations between total CES-D score, depressed mood, anhedonia, and somatic symptoms and odds of dog ownership, cat ownership and “other” pet ownership relative to no pet at baseline. To facilitate comparison across subscales (which each include a different number of symptoms), we analysed z-scores in addition to raw scores. We then used multiple linear regression to test the prospective associations between pet ownership and change in total CES-D scores, depressed mood, anhedonia, and somatic symptoms over six-year follow-up. All models were adjusted for age, sex, ethnicity, marital status, wealth, smoking status, alcohol intake, physical activity, and limiting long-standing illness. Prospective analyses were additionally adjusted for baseline score on the outcome of interest. The reference category was ‘no pet’ for all analyses. Cross-sectional results are reported as adjusted odds ratios (ORs) with 95% confidence intervals (CIs), which can be interpreted as the increase in the odds of pet ownership associated with each additional symptom reported. Prospective results are reported as unstandardised B values for with 95% CIs, which can be interpreted as the adjusted mean difference in change in depressive symptoms over time between each pet ownership group and non-pet owners.

### 3. Results

There were 7617 men and women in our sample (mean [SD] age 66.46 [8.93] years; 52.8% female; 97.2% white), of whom 1381 (18.1%) were dog owners, 959 (12.6%) were cat owners, and 235 (3.1%) were “other” pet owners. Sample characteristics in relation to pet ownership are summarised in Table 1. Pet owners were on average significantly younger than those with no pet, and a higher proportion were white and married. Cat owners tended to be more highly educated and wealthy than the other groups, and “other” pet owners were the least wealthy. Pet owners, in particular dog owners, were more likely to smoke and be physically active. Dog owners were more likely, and cat owners were less likely, to have a limiting long-standing illness. There was no significant association between pet ownership and sex or alcohol intake.

Cross-sectional associations between depressive symptoms and pet ownership are summarised in Table 2. After adjustment for covariates, a one-symptom increase in total CES-D score was associated with 7% increased odds of dog ownership relative to no pet (OR = 1.07, 95% CI 1.03–1.11). Analysis of the derived depressive symptoms subscales revealed significant associations between each subscale and dog ownership, with models run on z-scores showing a slightly stronger association for symptoms of depressed mood (OR = 1.13, 95% CI 1.06–1.21) compared with anhedonia (OR = 1.10, 95% CI 1.04–1.17) or somatic symptoms (OR = 1.10, 95% CI 1.03–1.18). There were no significant associations between total CES-D score or any subscale and odds of cat or “other” pet ownership.

Prospectively, there was a small decline in depressive symptoms amongst dog and cat owners and a small increase in individuals with no

pet and “other” pet owners over six-year follow-up, but these differences were not statistically significant (Table 3).

### 4. Discussion

In this large sample of older English adults, we observed a positive association between number of depressive symptoms and odds of dog ownership. When we analysed the three distinct subsets of depressive symptoms separately (depressed mood, anhedonia, and somatic symptoms), each category was associated with greater odds of dog ownership, with a slightly stronger association observed in those with higher levels of depressed mood than those with anhedonia or somatic symptoms. However, no significant associations were found between depressive symptoms (overall or by subscale) and cat or other pet ownership. Importantly, no significant associations were observed in longitudinal models. That is, there was no significant difference in the degree of change in depressive symptoms over time between those who did and did not own a pet. Taken together, these results suggest that those with higher levels of depressive symptoms may seek pet ownership in the form of dogs, but owning a pet does not confer any statistically significant benefits for depressive symptoms over time.

There are several possible reasons as to why those who are depressed might seek to own a dog. Literature suggests that people who are lonely often acquire a dog for companionship. For example, in an Australian sample of 3465 prospective dog adopters, respondents expected that having a dog would be associated with increased walking, happiness and companionship, and decreased stress and loneliness (Powell et al., 2018). Thus, people whose depressive symptoms are at least partly driven by loneliness may seek out a dog in order to decrease their negative feelings. It is also possible that people with more depressive symptoms seek out a dog in order to become more physically active. Dog ownership is associated with increased physical activity in older individuals, particularly in those living alone (Feng et al., 2014; Garcia et al., 2015; Westgarth et al., 2017). With physical activity closely linked with mood, owning a dog could therefore be perceived to be an effective intervention for decreasing depressive symptoms in older people (Schuch et al., 2016); although this is not consistent with our results.

Although pet ownership was significantly associated with the z-scores of each of the three CES-D depression subtypes, the association was slightly stronger for symptoms of depressed mood than for anhedonia or somatic symptoms. It is conjectural at this stage, but should this difference in the strength of association be meaningful, it could be related to the different underlying neurobiological factors implicated in these different subtypes of depression. That is, depressed mood is associated with the serotonergic system and it may be that participants in this study who had less effective serotonergic systems may have also felt the need to seek ownership of a dog to compensate for their sadness and loneliness. This hypothesis needs further investigation via serum sampling but provides a plausible pathway between depressed mood and pet ownership that also helps to explain the relatively weaker association between dog ownership and anhedonia and somatic depression.

While our longitudinal data suggested a small decrease in depressive symptoms over six-year follow-up amongst dog owners and a small increase amongst non-pet owners, this difference was not statistically significant. This contradicts preliminary data suggesting that pet therapy (particularly when dogs are involved) can ameliorate depressive symptoms in older people and in different conditions and settings including serious mental illnesses (Moretti et al., 2011), nursing homes (Sollami et al., 2017) or dementia (Olsen et al., 2016). There are several methodological differences between our investigation and these previous studies that might explain these discrepant results. For example, different measures were used to assess depressive symptoms and depression, and there were differences in the age range of the samples and lengths of follow-up. In addition, the analyses were adjusted for

**Table 1**  
Sample characteristics in relation to pet ownership.

	No pet (n = 5042) <sup>a</sup>	Dog (n = 1381)	Cat (n = 959)	Other (n = 235)	p
Age (mean [SD] years)	68.02 (8.89)	64.33 (7.57)	64.40 (7.98)	63.24 (7.79)	<0.001
Female sex (%)	52.5	54.1	53.1	49.8	0.566
Non-white ethnicity (%)	3.7	1.1	1.4	2.0	<0.001
Married/living as married (%)	66.4	73.7	68.7	74.3	<0.001
Wealth quintile (%)					
1 (poorest)	16.9	21.9	14.7	25.8	<0.001
2	19.9	21.1	18.7	18.1	–
3	21.2	17.6	20.0	21.0	–
4	20.6	19.2	22.6	19.8	–
5 (richest)	21.3	20.2	24.0	15.3	–
Smoker (%)	11.5	19.2	15.5	15.7	<0.001
Alcohol intake (%)					
Never/rarely	22.7	26.0	21.5	25.7	0.144
Regularly	43.1	40.6	43.1	41.8	–
Frequently	34.2	33.5	35.4	32.5	–
Physical activity (%)					
Inactive	24.3	20.3	18.7	20.9	<0.001
Moderately active at least once a week	47.2	52.0	46.8	49.0	–
Vigorously active at least once a week	28.5	27.7	34.5	30.1	–
Limiting long-standing illness (%)	33.3	37.3	30.1	34.3	0.003

All figures are weighted to match the older English population.

SD = standard deviation.

<sup>a</sup> Unweighted sample sizes.

different covariates. In our analyses, we included ten covariates covering a broad range of sociodemographic and health-related factors, many of which were not accounted for in previous studies, which could explain our null findings.

There are several avenues for future research. First, replication is required to provide further insight into the effect of pet ownership on changes in depressive symptoms over time. Second, investigation into the effect of becoming a pet owner on mood could help clarify any benefits. Due to insufficient numbers of participants within the ELSA sample reporting acquiring a pet over the study period, we were unable to look at the association between change in pet ownership status and change in depressive symptoms over time. Studies using interrupted time-series designs that allow for identification of the immediate and lagged (i.e., apparent only after some time) effects of acquiring a pet could provide useful insight. Such designs offer a greater ability than simple cross-sectional studies to draw conclusions about causality. Third, assessment of associations of pet ownership with other indices of depression, such as the Individual Burden of Illness Index, could offer insight into not only the presence of depressive symptoms but also their influence upon participant functioning (IsHak et al., 2011).

To the best of our knowledge, this is the first study to explore the

potential association between pet ownership and depressive symptoms in community-dwelling older people. Strengths of the study include the large sample and data on a wide range of potential confounders. However, findings from the present study should be interpreted considering its limitations. First, many measures (e.g. those regarding physical activity and comorbidities) were self-reported, which might have introduced reporting or recall bias. Second, the sample was almost exclusively white, so findings may not generalise to other ethnic groups. Third, the diagnosis of depressive symptoms was made only via the 8-item CES-D, without considering a final diagnosis given by a specialist in psychiatry based upon the wider range of key symptoms and associated features which comprise that kind of in-depth assessment of depression and without considering the use of antidepressants. The single CES-D item for anhedonia is also restricted in measurement terms. Finally, the number of participants in some analytic groups (e.g. “other” pet owners”) was small, limiting statistical power.

In conclusion, the present results indicate that an increase in depressive symptoms is associated with higher odds of dog ownership in community-dwelling older people, but provide no evidence of a protective effect of pet ownership on changes in depressive symptoms over time. Further research is required to establish the exact nature of the

**Table 2**  
Cross-sectional associations between depressive symptoms and pet ownership.

	Dog Adjusted OR <sup>a</sup> [95% CI]	p	Cat Adjusted OR <sup>a</sup> [95% CI]	p	Other Adjusted OR <sup>a</sup> [95% CI]	p
Total CES-D score						
Raw score (0–8)	1.07 [1.03–1.11]	<0.001	1.03 [0.99–1.07]	0.174	0.98 [0.91–1.06]	0.650
z-score	1.14 [1.07–1.22]	<0.001	1.06 [0.98–1.15]	0.174	0.97 [0.83–1.12]	0.650
Depressed mood						
Raw score (0–4)	1.13 [1.06–1.20]	<0.001	1.04 [0.97–1.12]	0.314	0.97 [0.84–1.11]	0.632
z-score	1.13 [1.06–1.21]	<0.001	1.04 [0.96–1.13]	0.314	0.96 [0.83–1.12]	0.632
Anhedonia						
Raw score (0–1)	1.39 [1.14–1.69]	0.001	1.12 [0.87–1.43]	0.378	0.70 [0.42–1.17]	0.176
z-score	1.10 [1.04–1.17]	0.001	1.03 [0.96–1.12]	0.378	0.90 [0.77–1.05]	0.176
Somatic symptoms						
Raw score (0–3)	1.10 [1.03–1.18]	0.005	1.05 [0.97–1.13]	0.253	1.00 [0.86–1.16]	0.996
z-score	1.10 [1.03–1.18]	0.005	1.05 [0.97–1.14]	0.253	1.00 [0.86–1.16]	0.996

All figures are weighted to match the older English population.

Reference category: no pet.

<sup>a</sup> Adjusted for age, sex, ethnicity, marital status, wealth, smoking status, alcohol intake, physical activity and limiting long-standing illness.



**Table 3**

Prospective associations between pet ownership at baseline and change in depressive symptoms over six-year follow-up.

	Mean (SD) change in depressive symptoms	Adjusted B <sup>a</sup> [95% CI]	p
<b>Total CES-D score (0–8)</b>			
No pet	0.01 (1.83)	Ref	–
Dog	–0.08 (1.93)	0.09 [–0.03; 0.21]	0.134
Cat	–0.06 (1.85)	0.10 [–0.03; 0.23]	0.143
Other	0.08 (1.55)	0.10 [–0.15; 0.35]	0.438
<b>Depressed mood (0–4)</b>			
No pet	0.003 (1.03)	Ref	–
Dog	–0.02 (1.14)	0.04 [–0.03; 0.11]	0.240
Cat	–0.02 (1.08)	0.03 [–0.04; 0.11]	0.414
Other	0.08 (0.91)	0.05 [–0.09; 0.19]	0.468
<b>Anhedonia (0–1)</b>			
No pet	0.003 (0.32)	Ref	–
Dog	–0.01 (0.36)	0.01 [–0.01; 0.03]	0.334
Cat	–0.02 (0.35)	–0.003 [–0.03; 0.02]	0.813
Other	0.01 (0.32)	0.03 [–0.02; 0.07]	0.280
<b>Somatic symptoms (0–3)</b>			
No pet	0.004 (1.00)	Ref	–
Dog	–0.05 (0.97)	0.04 [–0.03; 0.10]	0.243
Cat	–0.02 (1.01)	0.05 [–0.02; 0.12]	0.147
Other	–0.01 (0.90)	0.001 [–0.13; 0.13]	0.986

All figures are weighted to match the older English population.

<sup>a</sup> Adjusted for age, sex, ethnicity, marital status, wealth, smoking status, alcohol intake, physical activity, limiting long-standing illness and baseline score.

relationship between pet ownership and depression and provide insight into the causal pathways underpinning differences across pet subgroups and dimensions of depression.

## Ethics

Ethical approval was obtained from the London Multi-Centre Research Ethics Committee and all participants provided informed consent.

## Contributors

All authors have made a substantial, direct and intellectual contribution to the work. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

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## Declarations of Competing Interest

None.

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