Received: 21 September 2021 | Accepted: 1 March 2022

DOI: 10.1002/gps.5698

RESEARCH ARTICLE

International Journal of Geriatric Psychiatry WILEY

Pet ownership supports quality of life in home-dwelling people with Alzheimer's disease

Tarja Välimäki[1] | Anne Koivisto[2,3,4] | Virve Kärkkäinen[5] | Tuomas Selander[6] | Kristiina Hongisto[7] | Minna Rusanen[2,3,8]

[1]Department of Nursing Science, University of Eastern Finland, Kuopio, Finland

[2]Department of Neurology, Institute of Clinical Medicine, University of Eastern Finland, Kuopio, Finland

[3]Neurology of Neuro Center, Kuopio University Hospital, Kuopio, Finland

[4]Geriatrics, Internal Medicine and Rehabilitation, Helsinki University Hospital and Department of Neurosciences, Faculty of Medicine, University of Helsinki, Helsinki, Finland

[5]Neuro Center, Kuopio University Hospital, Kuopio, Finland

[6]Science Service Center, Kuopio University Hospital, Kuopio, Finland

[7]Department of Geriatrics, Institute of Public Health and Clinical Nutrition, University of Eastern Finland, Kuopio, Finland

[8]Population Health Unit, Finnish Institute for Health and Welfare, Helsinki, Finland

Correspondence
Minna Rusanen, Department of Neurology, Institute of Clinical Medicine, University of Eastern Finland, P.O. Box 100, Kuopio 70029, Finland.
Email: minna.rusanen@kuh.fi

Abstract

Objectives: Human-animal interactions have beneficial psychosocial and psychophysiological effects on individuals in both the presence and absence of medical health conditions. No previous prospective studies with long follow-up have investigated the effects of domestic pets on individuals with Alzheimer's disease (AD) who live at home. We examined the effects of pets on quality of life (QoL) and general well-being during a 5-year follow-up of home-dwelling persons with AD.

Methods: In a prospective study including 223 patients with very mild (Clinical Dementia Rating Scale [CDR] 0.5) or mild (CDR 1) AD at baseline who participated in the ALSOVA study, 40 (18%) had a pet. Self- and proxy-rated QoL in AD quality of life-AD (QoL-AD), 15D, and self-rated visual analogic scale (VAS) were assessed annually for 3 years and after 5 years. The Mini-Mental State Examination, Neuropsychiatric Inventory, and CDR sum of boxes (CDR sum of boxes) were measured at the same visits.

Results: A significant positive effect of pet ownership ($p = 0.003$, proxy-rated QoL-AD) on QoL was found over the entire follow-up. However, self-rated QoL-AD, 15D, and VAS did not significantly differ between pet owners and non-pet owners.

Conclusions: The findings suggest that having a pet may support QoL in home-dwelling persons with AD. Self-rated or general QoL or well-being measurements are not an accurate method for studying QoL in individuals with dementia over time due to a lack of insight. Adding proxy-rated evaluations to this kind of study is recommended.

KEYWORDS
15D, Alzheimer's disease, cognition, dementia, quality of life, visual analogic scale

Key points

- Older adults with Alzheimer's disease living at home with domestic pets preserve their quality of life better than individuals living at home without pets.

Tarja Välimäki and Anne Koivisto contributed equally to this work and shared the first authorship.

- Having a pet helps older adults with Alzheimer's disease maintain positive relationships and activities of life at home without specific intervention.
- The disparity with self-reported and proxy-reported quality of life scores in the longitudinal study requires further research on the quality of life measurements.

1 | INTRODUCTION

Alzheimer's disease (AD) is the most common memory disorder under the dementia umbrella. Disease-modifying treatments are still lacking, so supporting the individual's well-being and maintaining an optimal quality of life (QoL) are essential goals in disease management.[1] The World Health Organization defines the QoL as how an individual perceives their position in life based on the culture and value systems around them and their goals, expectations, standards, and concerns. The concept is broad and affected in a complex manner by the individual's physical health, psychological state, level of independence, social relationships, and personal beliefs, as well any relationship they have with salient features of their environment.[2] The disease course of AD is progressive, and previous research has shown that QoL declines as AD progresses, especially with the increasing severity of neuropsychiatric symptoms.[3,4] Thus, various approaches are needed to maintain optimal QoL for patients throughout the disease course.

Human-animal interactions have many beneficial psychosocial and psychophysiological effects on individuals in both the presence and absence of specific medical health conditions.[5] Pet ownership and animal assistance during therapy are promising therapeutic approaches in treating and educating patients with various illnesses. Animal-assisted intervention (AAI) is defined by the International Association of Human-Animal Interaction Organizations as a "goal-oriented and structured intervention that intentionally includes or incorporates animals in health, education, and human services for therapeutic gains in humans." For example, animal-assisted therapy and animal-assisted activities, which are forms of AAI, have been used in various settings to care for individuals with memory disorders. However, previous studies have had varying study designs and have been carried out mainly among individuals living at nursing homes or assisted living facilities, usually among patients with at least moderate dementia stage memory disorder.[6-8] Nevertheless, results regarding the effect of AAIs on the QoL of dementia patients are conflicting,[9,10] with both positive[6,7,11] and negative[12] findings. Thus far, little is known about the effects of having domestic pets as a natural part of everyday life on individuals with AD. Pets may provide meaningful and activating interactions for those with memory disorders, but pet ownership may also become a burden on the person with dementia who is living at home.

To the best of our knowledge, no previous prospective studies with long follow-up have included detailed information on QoL, disease progression, and neuropsychological testing on the effects of domestic pets on home-dwelling persons with AD. Therefore, the present study investigated the influence of owning pets on the QoL and general well-being in a prospective 5-year follow-up study among patients with AD living at home.

2 | METHODS

2.1 | Participants and study design

This study is part of the prospective 5-year ALSOVA follow-up study. Participants were patients with very mild or mild AD and their caregivers, and were recruited during the first year after AD diagnosis in 2002–2006 from three hospital districts in Central and Eastern Finland. The last follow-ups were carried out in 2011, and the registry data were added to follow-up data in 2015–2017. The inclusion criteria were age ≥65 years, Clinical Dementia Rating Scale (CDR) of 0.5 or 1, informed consent, community-dwelling, the absence of other life-threatening illnesses, and having a family caregiver (spouse, sibling, child, or some other relative in daily contact with the patient). The endpoint of the study was institutionalization or death.

AD was diagnosed by specialists (a geriatrician or neurologist) at memory clinics according to the National Institute of Neurological and Communicative Disorders and Stroke and Alzheimer's Disease and Related Disorders Association criteria[13] and The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.[14] Differential diagnostic examinations were carried out, including a clinical examination, brain imaging (CT or MRI), laboratory screening, and a neuropsychological examination. A neurologist in the study group confirmed the AD diagnoses. All patients with AD used AD-targeted medication as currently recommended (15).

The study participants and their caregivers were followed up annually for 3 years, with an additional visit at 5 years. At each follow-up, the study nurse or psychologist performed a structured interview for the individual with AD and their caregiver. Data were collected on age, gender, education, physical health, medication, household composition, living arrangements, general well-being, and QoL. In addition, a neuropsychological evaluation of the study participant was carried out by a psychologist.[4]

Information regarding pets was available for 223 (94.5%) of all ALSOVA study participants, who formed the study population for this sub-study. Pet ownership was assessed at each visit through targeted questions in the interviews of the caregivers by the study nurse. The caregivers were asked if the participant with AD had pets and, if they answered yes, were asked to specify the type of animal(s).

2.2 | Measures

Three patient-reported instruments were used to assess QoL or general well-being: the QoL in Alzheimer Disease quality of life-AD (QoL-AD) questionnaire,[15] the generic 15D,[16,17] and a visual analogue scale (VAS; 19). A caregiver-rated assessment of the patient's QoL was also carried out using the QoL-AD questionnaire.[15]

The QoL-AD was developed to assess AD patients' QoL from the perspective of the patient and caregiver[15] and contains 13 items: physical health, energy, mood, living situation, memory, family, marriage, friends, self as a whole, ability to do chores, ability to do things for fun, money, and life. Each item has response options ranging from 1 (poor) to 4 (excellent). These are then added together to generate a summary score ranging from 13 (worst) to 52 (best). Because the data from the present study include married, widowed, and single patients, the marriage dimension was excluded from the total score to facilitate patient subgroup comparisons, limiting the potential score range to 12–48.

The 15D is a generic (i.e., not disease-specific), multidimensional, standardized, self-administered measure of health-related quality of life (HRQoL) with profile and single index score properties.[16,17] HRQoL is defined as the individual's perception of the impact of a health condition on everyday life.[18] The 15D instrument provides a comprehensive measure of HRQoL for AD by covering the most relevant concepts important to patients with AD.[19] The 15 dimensions of the 15D are mobility, vision, hearing, breathing, sleeping, eating, speech, excretion, usual activities, mental function, discomfort and symptoms, depression, distress, vitality, and sexual activity. Each dimension has five grades of severity weighted using population-based preferences to obtain a single index score. The value of the 15D index ranges from 0.1062 (worst) to 1 (full health), as 0 represents being dead.

The patient's satisfaction with life was assessed using a 10-cm visual analogic scale (VAS). This was a single-item assessment of QoL using one question on general well-being with a rating from 0 (worst possible) to 100 (best possible).[20]

The Mini-Mental State Examination (MMSE)[21] assessed cognition. MMSE is a 30-point instrument widely used to measure cognitive ability, attention, memory, orientation, language, and visuospatial ability. The overall score ranges from 0 to 30, with higher scores indicating better cognitive function.

The 12-item Neuropsychiatric Inventory (NPI) is an interview-based tool that evaluates the frequency and severity of delusions, hallucinations, agitation/aggression, dysphoria, anxiety, euphoria, apathy, disinhibition, irritability/lability, aberrant motor activity, nighttime behavioral disturbances, and appetite abnormalities.[22] Each NPI item is rated on both frequency (scores from 1 to 4) and severity (scores from 1 to 3). Each item score is the product of the frequency score multiplied by the severity score. The total score is the sum of the 12 items and ranges from 0 to 144, with higher scores indicating more severe symptoms.

The CDR was used to evaluate the severity of the AD. CDR is a global assessment tool containing six domains: memory, orientation, judgment and problem-solving, community affairs, homes and hobbies, and personal care.[23,24] The rating is obtained through semi-structured interviews of the participants with AD and their caregivers in which the six domains are rated on a 5-point scale: 0 = no impairment; 0.5 = questionable impairment; 1 = mild impairment; 2 = moderate impairment; and 3 = severe impairment (personal care is scored on a 4-point scale without the 0.5 rating). The six domains are then formulated to either a global rating (i.e., 0, 0.5, 1, 2, or 3) through a complex scoring algorithm or to a CDR sum of boxes CDR sum of boxes (CDR-SOB) score, which is obtained by simply adding up the domain ratings, ending with a continuous score ranging from 0 to 18. The CDR-SOB score has been demonstrated to correspond to the global scores; CDR-SOB scores from 0.5 to 4.0 correspond to a global score of 0.5, from 4.5 to 9.0 to a global score of 1.0, from 9.5 to 15.5 to a global score of 2.0, and from 16.0 to 18.0 to a global score of 3.0.[24]

2.3 | Statistical analysis

The study groups (pet owners vs. non-pet owners) were compared at baseline using an independent samples *t*-test for continuous variables and Pearson's chi-squared test for categorical variables. The group differences during follow-up were analyzed by a linear mixed effect, adjusting for age, education, and gender. In the analyses of the variables self- and proxy-rated QoL-AD, 15D, VAS, NPI total, and CDR-SOB variable, the baseline MMSE was included as an adjusting variable because the group differences in the MMSE were significant at baseline. The measures detected at each time point over the follow-up was used to create pooled means with standard deviation (SD) to present group differences at the result table. Change in pet ownership was taken account in the statistical analyses. The data were analyzed in IBM SPSS statistics version 26.0 software. $p < 0.05$ was set to indicate significant results.

3 | RESULTS

The baseline characteristics of the study population (n = 223) are described in Table 1. A total of 40 (18%) study participants had pets at baseline. In almost half of cases, the pet was a dog (n = 19, 48%) and more than one third had a cat (n = 15, 38%). The other pet mentioned for example was a guinea pig. Percentage of pets, dog and cat ownerships were the same at visit one. After that, number of pet ownership diminished slightly (11% at visit two, 12% at visits three and five).

We found no significant differences between the study groups in the sociodemographic characteristics.

At baseline, QoL-AD (self- and proxy-rated), 15D, VAS, NPI, and CDR-SOB did not differ between the study groups, though the participants with pets had lower ($p = 0.009$) MMSE scores (mean 20.2 [SD 3.5]) than those without pets (21.7 [3.3], Table 1). Over the 5-year follow-up, the mean proxy-rated QoL-AD score was significantly better for the pet owners than non-pet owners (26.4 [4.5] vs 25.0 [5.2]; $p = 0.003$, Table 2). As Figure 1 shows the mean

TABLE 1 Baseline characteristics of the study population with Alzheimer's disease

Characteristic	All n = 223	Pet n = 40	No pet n = 183	*p*-Value
Age	75.2 (6.6)	73.8 (7.4)	75.5 (6.5)	0.136
Education	7.6 (3.3)	7.3 (3.1)	7.6 (3.4)	0.598
Female gender	52.5%	42.5%	54.6%	0.164[a]
Self-rated QoL-AD	30.3 (5.6)	29.2 (5.2)	30.5 (5.7)	0.170
Proxy-rated QoL-AD	27.5 (4.7)	27.5 (4.2)	27.6 (4.9)	0.932
15D	0.86 (0.08)	0.86 (0.10)	0.86 (0.08)	0.614
VAS	79.1 (16.8)	78.7 (16.3)	79.2 (16.9)	0.858
MMSE	21.4 (3.4)	20.2 (3.5)	21.7 (3.3)	**0.009**
NPI	8.8 (9.8)	7.8 (10.1)	9.0 (9.7)	0.479
CDR-SOB	4.2 (1.5)	4.1 (1.5)	4.2 (1.4)	0.557

Note: Values are expressed as means with standard deviations (SDs) unless otherwise noted. The independent samples *t*-test was used unless otherwise noted and $p < 0.05$ indicates significance between the pet and no pet groups. QoL-AD = Quality of Life in Alzheimer Disease questionnaire, a summary score ranging from 13 (worst) to 52 (best); 15D = a generic (i.e., not disease-specific), multidimensional, standardized, self-administered measure of health-related quality of life; VAS = a one-item assessment of QoL, including a single question of general well-being with a rating from 0 (worst possible) to 100 (best possible); MMSE = Mini-Mental State Examination, which has a score range of 0–30, with higher scores indicating better cognitive performance; NPI = Neuropsychiatric Inventory, which has a score range of 0–144, with higher scores indicating more severe symptoms; CDR-SOB = Clinical Dementia Rating-Sum of Boxes, with higher scores indicating more severe symptoms and progressed dementia. Bold value indicates significance level as the column heading shows.

Abbreviations: CDE-SOB, Clinical Dementia Rating-Sum of Boxes, MMSE, Mini-Mental State Examination; NPI, Neuropsychiatric Inventory; VAS, visual analogic scale

[a]Pearson's chi-squared test was used.

TABLE 2 Group comparisons between the pet and non-pet owners during the 5-year follow-up, using the linear mixed effect model.

5-year follow-up	Pet n = 40	No pet n = 183	Difference (95% CI)[a]	*p*-Value
Self-rated QoL-AD	29.7 (6.1)	30.7 (5.8)	−0.7 (−1.8; 0.5)	0.261
Proxy-rated QoL-AD	26.4 (4.5)	25.0 (5.2)	1.6 (0.6; 2.7)	**0.003**
15D	0.87 (0.13)	0.84 (0.13)	0.00 (−0.02; 0.02)	0.848
VAS	76.7 (19.7)	75.8 (22.0)	2.1 (−2.3; 6.4)	0.347

Note: Values are expressed as means with standard deviations (SDs) unless otherwise noted. The measures detected at each time point over the follow-up was used to create presented pooled means with SDs. $p < 0.05$ indicates significance between the groups. QoL-AD = Quality of Life in Alzheimer Disease questionnaire, a summary score ranging from 13 (worst) to 52 (best); 15D = a generic (i.e., not disease-specific), multidimensional, standardized, self-administered measure of health-related quality of life; VAS = a one-item assessment of QoL, including a single question of general well-being with a rating from 0 (worst possible) to 100 (best possible). Bold value indicates significance level as the column heading shows.

Abbreviations: QoL-AD, Quality of Life in Alzheimer Disease, VAS, visual analogic scale.

[a]The adjusted group differences are presented as the average values during the follow-up with 95% confidence intervals (CIs).

proxy-rated quality QoL-AD was better in pet owners compared to non-pet owners in all time points, and the mean difference during the entire follow-up was 1.6 ([95% confidence interval (CI) 0.6; 2.7], $p = 0.003$). Self-rated QoL-AD, 15D, and VAS did not differ between the study groups (Table 2).

We have previously reported MMSE, NPI and CDR-SOB results over time.[25] MMSE difference between the groups seen at baseline attenuated during follow-up.

4 | DISCUSSION

This study found that individuals with AD living at home with domestic pets preserved their QoL better than individuals with AD living at home without pets. This effect was seen in the proxy-rated QoL-AD evaluation, though both pet owners and non-pet owners with AD estimated their QoL to be preserved at the same level in the self-rated QoL or well-being measurements.

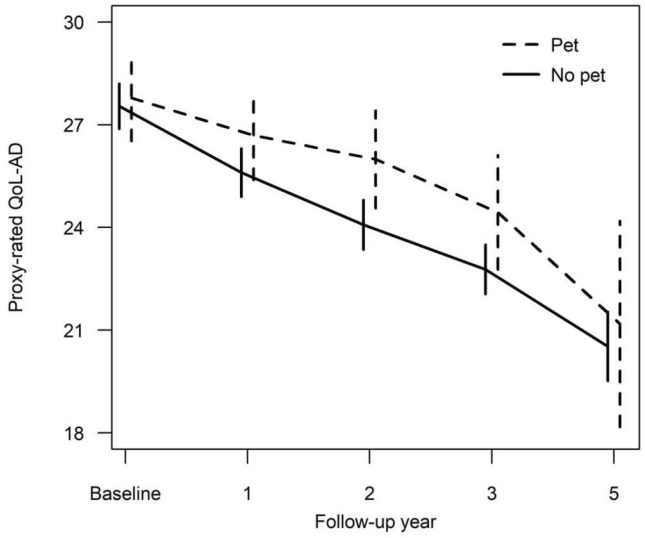

FIGURE 1 The mean proxy-rated quality of life (QoL) in Alzheimer's disease (AD) quality of life-AD (QoL-AD) in pet owners and non-pet owners over a 5-year follow-up. Data are shown as the mean with 95% confidence interval (CI) (CI) at each time point. The mean difference during the entire follow-up was 1.6 ([95% CI 0.6; 2.7], $p = 0.003$)

Only a few reports have focused on the impact of domestic pets as a natural part of everyday life on the QoL of individuals with AD, which is likely to be fundamentally different from an AAI setting in the studies. One study with 1542 patients with mild-to-moderate dementia living at home showed that having a dog and being involved in its care is associated with a lower likelihood of being lonely.[11] Interestingly, the same study noted that having a pet and not being involved in its care is associated with higher depression and lower QoL as measured by the QoL-AD questionnaire.[11]

A recent review reported that companion animals positively contribute to the mental and/or physical health of older adults (age ≥60 years). Involvement with a companion animal significantly improved participants' QoL and relieved depression, anxiety, cognitive impairment, and behavioral and psychological symptoms of dementia.[26] However, previous studies regarding dementia have mainly focused on the effects of AAIs on nursing home or assisted living residents with a variation in study designs and study settings. In a Swedish study evaluating the effects of AAI on QoL in a small sample of individuals with dementia in nursing homes, the QoL in Late-stage Dementia (QUALID) total score improved after the intervention.[6] Another study in a nursing home setting showed that animal-assisted activities may positively affect symptoms of depression and QoL measured using the QUALID in older people with dementia, especially those in late-stage disease.[7] However, no effect on QoL was detected among home-dwelling persons with dementia attending day-care centers.[12] One randomized controlled trial of dog-assisted therapy versus a human-therapist only for individuals with mild to moderate dementia living in residential aged care facilities demonstrated that participants in one facility who received dog-assisted therapy had better depression scores and improved QoL-AD scores, but the scores were worse for participants in another facility.[8]

Human-animal interaction has been demonstrated to have many beneficial effects on humans regarding social attention, social behavior, interpersonal interactions, and mood; stress-related parameters, such as cortisol, heart rate, and blood pressure; self-reported fear and anxiety; and mental and physical health, especially cardiovascular diseases.[5] In particular, contact with a dog provides various positive effects through non-verbal communication, including tactile experience, companionship, and assisting in social interactions with other people. Also, living with a pet can serve as an opportunity to nurture and care for another living being, explaining previous findings of decreased loneliness in pet owners.[27] Some evidence indicates that dog ownership also improves physical activity among older adults.[28,29] One previous study on home-dwelling persons with mild-to-moderate dementia demonstrated that having pets increases the likelihood of walking.[11] Thus, these features of human-animal interactions and possibly better physical activity may reflect better QoL among home-dwelling persons with AD with domestic pets.

In the ALSOVA study, we previously reported that pet owners with AD preserved their functional capacity better than individuals with AD without pets as measured by the AD Cooperative Study–Activities of Daily Living (ADCS-ADL) inventory. In addition, the disease progression was slower among pet owners, and they had milder AD (measured by the CDR-SOB) during the follow-up than the participants without pets. The participants with domestic pets also had fewer neuropsychiatric symptoms than those without pets.[25] It is plausible that these features also contribute to better QoL among pet owners.

The positive effect of a domestic pet on QoL was observed only in the proxy-rated QoL-AD score. Patient-rated and caregiver-rated QoL estimates are known to differ.[4,30] Furthermore, individuals with AD estimate their own QoL as being preserved better than estimated by caregivers.[4,31,32] We previously reported that the AD patient's ability to respond to the QoL questionnaires unassisted or even assisted diminishes at an early moderate stage of AD.[4] The divergence between self- and caregiver-rated QoL may be related to a lack of insight and difficulty understanding the questionnaire as AD progresses.

On the other hand, in the validation of the self-rated QoL-AD measurement, AD progression was taken into account. During the development of this measurement, moderate levels of cognitive impairment did not have a negative effect on the reliability or validity of the self-rated Qol -AD measurement, and all participants with a MMSE score of 10 and over were able to complete the measure.[33] Yet, the difference between the scores gained from the persons themselves and caregivers was noted[33] and has been reported elsewhere.[34] Possible explanations for this disparity include the burden of higher dependence of the person with dementia.[35] Although proxy reports are essential to consider, it must be noted that there may be a bias toward reporting negative behaviors such as

irritability and depression as playing a more prominent role in QOL than as perceived by people with dementia[36] but further research is still required in this area. To get as valid information as possible, self-rated and proxy-rated QoL measurements must be carried out and reported.

The strengths of this study include the long follow-up of 5 years, the comprehensive information on a variety of AD-related symptoms from both the participant with AD and the caregiver, and the detailed clinical evaluation of the study participants during the follow-up visits. This gives us an excellent opportunity to investigate the QoL of the participants in a prospective setting. The limitations of this study are related to the progressive nature of AD; 30.5% of the original study population participated in the fifth and final follow-up visit. The longitudinal study setting among persons with progressive memory disease unavoidably leads to relatively high drop-out rates.[25] The percentage of pet ownership diminished naturally over the follow-up as expected in this patient group. However, used statistical analyses enabled to analyze the effect of pet ownership over time at each time point to examine influence of pets on their owners' QoL as well as possible. However, the drop-out rate is comparable to similar studies with aged study participants.[37] ALSOVA is one of the few studies to include a well-defined AD population with this long follow-up time. LMM enables us to examine the average effects of pet ownership during the follow-up rather than only at the end of the follow-up period.

As there is no cure for AD, maintaining an optimal QoL is one of the essential goals in disease management. According to our results, a domestic pet may support QoL in home-dwelling persons with AD. In the future, more attention should be paid to individual natural family settings that can promote QoL at home. People with memory disorders, such as AD, may have beneficial hobbies and other pleasurable activities, which may be more effective than short interventions. Therefore, challenges lay in the possibility of maintaining enjoyable activities with advancing memory disorder.

ACKNOWLEDGEMENTS

We are deeply grateful to all of the study volunteers and their caregivers for participating in the study. We thank ALSOVA Research Project study nurse Helena Mäkelä, RN, and psychologist Ilona Hallikainen, PhD, for conducting several test batteries and interviews for the study participants and their caregivers over the years.

CONFLICT OF INTEREST

No author have any conflict of interest to declare. The authors do not have any affiliations or financial involvement with any organization or entity with a financial interest in, or in financial competition with, the subject matter or materials discussed in the submitted work.

ETHICS STATEMENT

The ethical committee of Kuopio University Hospital (original decision no. 64/00) and the Finnish Institute for Health and Welfare (THL, Dnro THL/1576/5.05.00/2014) gave favorable opinions for the ALSOVA study (latest updates 2020). The potential participants were informed of the study orally and in writing, emphasizing the voluntary nature of their participation and the confidentiality of the collected data. Both the patient and the caregiver signed the informed consent form. The caregivers also provided proxy consent on behalf of the patients.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ORCID

Tarja Välimäki https://orcid.org/0000-0001-6178-5671
Kristiina Hongisto https://orcid.org/0000-0002-3446-2751

REFERENCES

1. Ettema TP, Droes RM, de Lange J, Ooms ME, Mellenbergh GJ, Ribbe MW. The concept of quality of life in dementia in the different stages of the disease. *Int Psychogeriatr*. 2005;17(3):353-370. https://doi.org/10.1017/s1041610205002073
2. Saxena S, Orley J, WHOQOL Group. Quality of life assessment: the world health organization perspective. *Eur Psychiatr*. 1997;12 (Suppl 3):263s-266s. https://doi.org/10.1016/s0924-9338(97)89095-5
3. Vogel A, Bhattacharya S, Waldorff FB, Waldemar G. Proxy-rated quality of life in Alzheimer's disease: a three-year longitudinal study. *Int Psychogeriatr*. 2012;24(1):82-89. https://doi.org/10.1017/s1041610211001128
4. Hongisto K, Vaatainen S, Martikainen J, et al. Self-rated and caregiver-rated quality of life in Alzheimer disease with a focus on evolving patient ability to respond to questionnaires: 5-year prospective ALSOVA cohort study. *Am J Geriatr Psychiatr*. 2015;23(12):1280-1289. https://doi.org/10.1016/j.jagp.2015.07.002
5. Beetz A, Uvnas-Moberg K, Julius H, Kotrschal K. Psychosocial and psychophysiological effects of human-animal interactions: the possible role of oxytocin. *Front Psychol*. 2012;3:234. https://doi.org/10.3389/fpsyg.2012.00234
6. Nordgren L, Engstrom G. Animal-assisted intervention in dementia: effects on quality of life. *Clin Nurs Res*. 2014;23(1):7-19. https://doi.org/10.1177/1054773813492546
7. Olsen C, Pedersen I, Bergland A, Enders-Slegers MJ, Ihlebaek C. Effect of animal-assisted activity on balance and quality of life in home-dwelling persons with dementia. *Geriatr Nurs*. 2016;37(4):284-291. https://doi.org/10.1016/j.gerinurse.2016.04.002
8. Travers C, Perkins J, Rand J, Bartlett H, Morton J. An evaluation of dog-assisted therapy for residents of aged care facilities with dementia. *Anthrozoös*. 2013;26(2):213-225. https://doi.org/10.2752/175303713x13636846944169
9. Zafra-Tanaka JH, Pacheco-Barrios K, Tellez WA, Taype-Rondan A. Effects of dog-assisted therapy in adults with dementia: a systematic review and meta-analysis. *BMC Psychiatr*. 2019;19:41. https://doi.org/10.1186/s12888-018-2009-z
10. Yakimicki ML, Edwards NE, Richards E, Beck AM. Animal-assisted intervention and dementia: a systematic review. *Clin Nurs Res*. 2019;28(1):9-29. https://doi.org/10.1177/1054773818756987
11. Opdebeeck C, Katsaris MA, Martyr A, et al. What are the benefits of pet ownership and care among people with mild-to-moderate dementia? Findings from the IDEAL program. *J Appl Gerontol*. 2020:733464820962619
12. Olsen C, Pedersen I, Bergland A, Enders-Slegers MJ, Patil G, Ihlebaek C. Effect of animal-assisted interventions on depression,

agitation, and quality of life in nursing home residents suffering from cognitive impairment or dementia: a cluster randomized controlled trial. *Int J Geriatr Psychiatr*. 2016;31(12):1312-1321. https://doi.org/10.1002/gps.4436
13. McKhann G, Drachman D, Folstein M, Katzman R, Price D, Stadlan EM. Clinical diagnosis of Alzheimer's disease: report of the NINCDS-ADRDA work group under the auspices of department of health and human services task force on Alzheimer's disease. *Neurology*. 1984;34(7):939-944. https://doi.org/10.1212/wnl.34.7.939
14. American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*. 4th ed. American Psychiatric Association; 1994.
15. Logsdon R, Gibbons L, McCurry S. Quality of life in Alzheimer's disease: patient and caregiver reports. *J Ment Health Aging*. 1999;5:e21-e32.
16. Sintonen H. *The 15D Measure of Health-Related Quality of Life. II. Feasibility, Reliability, and Validity of its Valuation System*. National Centre for Health Program Evaluation; 1995. Working paper 42.
17. Sintonen H. The 15D instrument of health-related quality of life: properties and applications. *Ann Med*. 2001;33(5):328-336. https://doi.org/10.3109/07853890109002086
18. Perales J, Cosco TD, Stephan BC, Haro JM, Brayne C. Health-related quality-of-life instruments for Alzheimer's disease and mixed dementia. *Int Psychogeriatr*. 2013;25(5):691-706. https://doi.org/10.1017/s1041610212002293
19. McGrath C, Rofail D, Gargon E, Abetz L. Using qualitative methods to inform the trade-off between content validity and consistency in utility assessment: the example of type 2 diabetes and Alzheimer's disease. *Health Qual Life Outcome*. 2010;8(1):23. https://doi.org/10.1186/1477-7525-8-23
20. Kertzman S, Aladjem Z, Milo R, et al. The utility of the visual analogue scale for the assessment of depressive mood in cognitively impaired patients. *Int J Geriatr Psychiatr*. 2004;19(8):789-796. https://doi.org/10.1002/gps.1141
21. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189-198. https://doi.org/10.1016/0022-3956(75)90026-6
22. Cummings JL, Mega M, Gray K, Rosenberg-Thompson S, Carusi DA, Gornbein J. The Neuropsychiatric Inventory: comprehensive assessment of psychopathology in dementia. *Neurology*. 1994;44(12):2308-2314. https://doi.org/10.1212/wnl.44.12.2308
23. Hughes CP, Berg L, Danziger WL, Coben LA, Martin RL. A new clinical scale for the staging of dementia. *Br J Psychiatry*. 1982;140(6):566-572. https://doi.org/10.1192/bjp.140.6.566
24. Morris JC. The Clinical Dementia Rating (CDR): current version and scoring rules. *Neurology*. 1993;43(11):2412-2414. https://doi.org/10.1212/wnl.43.11.2412-a
25. Rusanen M, Selander T, Kärkkäinen V, Koivisto A. The positive effects of pet ownership on Alzheimer's disease. *J Alzheimer's Dis*. 2021;84(4):1669-1675. https://doi.org/10.3233/JAD-210557
26. Hughes MJ, Verreynne ML, Harpur P, Pachana NA. Companion animals and health in older populations: a systematic review. *Clin Gerontol*. 2020;43(4):365-377. https://doi.org/10.1080/07317115.2019.1650863
27. Gee NR, Mueller MK. A systematic review of research on pet ownership and animal interactions among older adults. *Anthrozoös*. 2019;32(2):183-207. https://doi.org/10.1080/08927936.2019.1569903
28. Christian HE, Westgarth C, Bauman A, et al. Dog ownership and physical activity: a review of the evidence. *J Phys Act Health*. 2013;10(5):750-759. https://doi.org/10.1123/jpah.10.5.750
29. Dall PM, Ellis SLH, Ellis BM, et al. The influence of dog ownership on objective measures of free-living physical activity and sedentary behavior in community-dwelling older adults: a longitudinal case-controlled study. *BMC Publ Health*. 2017;17(1):496-500. https://doi.org/10.1186/s12889-017-4422-5
30. Buckley T, Fauth EB, Morrison A, et al. Predictors of quality of life ratings for persons with dementia simultaneously reported by patients and their caregivers: the Cache County (Utah) Study. *Int Psychogeriatr*. 2012;24(7):1094-1102. https://doi.org/10.1017/s1041610212000063
31. Conde-Sala JL, Turro-Garriga O, Garre-Olmo J, Vilalta-Franch J, Lopez-Pousa S. Discrepancies regarding the quality of life of patients with Alzheimer's disease: a three-year longitudinal study. *J Alzheimers Dis*. 2014;39(3):511-525. https://doi.org/10.3233/jad-131286
32. Conde-Sala JL, Turro-Garriga O, Pinan-Hernandez S, et al. Effects of anosognosia and neuropsychiatric symptoms on the quality of life of patients with Alzheimer's disease: a 24-month follow-up study. *Int J Geriatr Psychiatr*. 2016;31(2):109-119. https://doi.org/10.1002/gps.4298
33. Logsdon RG, Gibbons LE, McCurry SM, Teri L. Quality of life in Alzheimer's disease: patient and caregiver reports. *J Ment health Aging*. 1999;5:21-32.
34. Heßmann P, Dreier M, Brandes I, et al. Differences between self- and proxy-assessment of health-related quality of life in patients with mild cognitive impairment and Alzheimer's disease. *Psychiatr Prax*. 2018;45(2):78-86.
35. Römhild J, Fleischer S, Meyer G, et al. Inter-rater agreement of the quality of life-Alzheimer's disease (QoL-AD) self-rating and proxy rating scale: secondary analysis of righttimeplacecare data. *Health Qual Life Outcome*. 2018;16(1):131. https://doi.org/10.1186/s12955-018-0959-y
36. Burks HB, des Bordes JKA, Chadha R, Holmes HM, Rianon NJ. Quality of life assessment in older adults with dementia: a systematic review. *Dement Geriatr Cogn Disord*. 2021;50(2):103-110. https://doi.org/10.1159/000515317
37. Phung KT, Waldorff FB, Buss DV, et al. A three-year follow-up on the efficacy of psychosocial interventions for patients with mild dementia and their caregivers: the multicenter, rater-blinded, randomized Danish Alzheimer Intervention Study (DAISY). *BMJ Open*. 2013;3(11):e003584-003584. https://doi.org/10.1136/bmjopen-2013-003584

How to cite this article: Välimäki T, Koivisto A, Kärkkäinen V, Selander T, Hongisto K, Rusanen M. Pet ownership supports quality of life in home-dwelling people with Alzheimer's disease. *Int J Geriatr Psychiatry*. 2022;1-7. https://doi.org/10.1002/gps.5698