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Guardians' perceptions of caring for a dog with canine cognitive dysfunction

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Abstract

Background: Canine cognitive dysfunction (CCD) is a neurodegenerative disease that is difficult to diagnose, as its clinical signs are similar to those of other age-related conditions. The experience of caring for a senior dog with or without CCD is not well described.

Methods: Data were collected via an online survey. Using a mixed methods design, the level of CCD and burden of care were measured using validated tools, and open-ended questions gathered qualitative data. A general linear model showed the factors associated with guardian burden of care.

Results: Sixteen percent of guardians experienced a clinically significant burden of care. Factors associated with burden of care included severity of CCD, sleep location, guardian employment, household size, dog age, guardian age and the dog taking medication. Few dogs with CCD were prescribed CCD medications to ameliorate clinical signs. Euthanasia, strong attachment mitigating burden and the complexities of caregiving were themes presented by guardians.

Limitations: Measures are based on self-reports and as such the usual limitations apply.

Conclusions: The burden of caring for an older dog is greater if they have CCD. More attention to the treatment of senior dogs, including medications to reduce clinical signs of CCD, could improve the welfare of older dogs and decrease the clinical burden experienced by guardians.

KEYWORDS
burden of care, companion animal, dog dementia, pet caregiving, senior

INTRODUCTION

There are over 6.3 million companion dogs living in Australian homes, almost half of which are aged over 5 years.[1] Given that the average life expectancy of companion dogs is around 12 years, a large proportion of dogs are living well into old age.[2] With age comes an expected decline in cognitive function. Behaviours associated with normal canine ageing include a reduction in time spent active, playing or chewing, less enthusiastic greetings towards owners and latency in responding to known commands, as well as an increase in fears and phobias, pacing, circling and wandering, night-time waking and difficulty finding dropped food.[3] However, similar to humans, many older dogs (>8 years) are diagnosed with a neurodegenerative disease called canine cognitive dysfunction (CCD), similar to Alzheimer's disease.[4] Pathologies shown to highly correlate with CCD in dogs include the accumulation of the peptide amyloid-beta in the brain, brain atrophy as a result of neuron loss and massive decline in neurogenesis, and increased oxidative stress and chronic inflammation.[5–8] CCD also results in significant changes in behaviour in affected dogs.

CCD is characterised by changes in social interactions, disorientation in familiar environments, changes in sleep–wake cycles, deficits in learning, memory and toilet training and changes in anxiety and activity levels.[9] It is likely that CCD is underreported by pet owners, as many of the changes in behaviour are dismissed as a normal part of ageing,[9] and some of the behavioural signs are almost indistinguishable from those of natural ageing. To date, attempts to distinguish between normal and pathological ageing in a rigorous, reliable way have been hampered by inconsistencies in definitions and methodologies

across studies and difficulty in merging the findings of both behavioural and pathological test findings in a coherent, meaningful way.[10] For now, a number of validated questionnaires used to determine the levels of cognitive impairment based on guardian observations remain an important tool for this challenge. Veterinarians also find CCD difficult to diagnose, as there are no biomarkers that accurately test for the disease, particularly in the early stages.[11] Generally, studies agree that around a quarter of dogs aged between 8 and 12 years and 70% of dogs over 15 years may have CCD.[12–14]

Pet ownership is widely regarded as good for our physical and psycho-emotional health, motivating us to take better care of ourselves.[15] However, little is known about the experience of owners when the burden of caring for the dog becomes greater than the purported benefits of ownership. Burden of care, understood as the impact of caregiving upon the caregiver's own basic needs,[16] is an emerging area of interest in the veterinary field and has been shown to have negative impacts on a guardian's quality of life and social, mental and financial health.[17–19] Most research into senior dogs focuses on enhancing longevity through medications, nutrition and supplements but fails to consider the factors that may impact their care through the burden experienced by their caregivers.

In an effort to understand more about the experience of owning senior dogs with and without CCD, this study sought to (1) examine the association between the severity of CCD and the level of burden experienced by the guardian; (2) identify risk factors for experiencing a high burden of care; and (3) gain an insight into the lived experience of living with and caring for a senior dog. It was predicted that caregiver burden would increase as the severity of CCD increased, that guardian age and employment status would also increase caregiver burden (assuming that full-time workers have limited spare time and that older guardians have their own competing health issues that may impact their caregiving capacity) and that the lived experience of caring for a dog with CCD would be described negatively.

MATERIALS AND METHODS

Survey development

This study used an exploratory mixed methods design where both qualitative and quantitative data were collected. A 58-item questionnaire was created using two validated tools: the Zarit Burden Interview (ZBI) (18 items)[20] and Disorientation, social Interactions, Sleep/wake cycles, House soiling learning and memory, Activity, Anxiety (DISHAA) questionnaire (18 items).[14] Demographic information for the human guardians was collected, including age, sex, number of people in the household and employment status (four items). Dog demographics were also collected, including size (small <10 kg, medium 10–26 kg, large 26–44 kg, giant >44 kg), age, sex, sexual status, breeding (pure or cross), where they slept at night, diagnosis of disease and prescription of medication (12 items). For more details, the reader can refer to the Supporting Information for the complete questionnaire.

The ZBI tool, adapted and validated for companion animal owners,[20] was used to assess the level of burden experienced by guardians. This tool asks 18 questions, such as 'Do you feel that your social life has suffered because you are caring for your pet?' and 'Do you feel you could do a better job in caring for your pet?', with Likert-scale answer options from 0 to 4 (never to nearly always). The sum of these is then calculated, with a score of 18 or more indicating a higher-than-normal level of burden.[20]

The DISHAA questionnaire is a tool used in veterinary practice for assessing the likelihood and severity of CCD and was used to assess the presence and level of cognitive impairment in the dog participants in this study.[21] It focuses on six behavioural areas: disorientation, changes in social interactions, sleep–wake cycles, house soiling, learning and memory, activity and anxiety. It includes questions such as 'Does your dog get lost in their home or yard?' and 'Has your dog decreased interest in approaching, greeting or affection/petting?'. Respondents are asked to identify signs that have arisen or progressed since 8 years of age and older, with 0—none, 1—mild, 2—moderate and 3—severe. Total possible scores range from 0 to 54. Answers to the 18 questions were summed, with a score of less than 4 indicating no signs of CCD, 4–15 consistent with mild CCD, 16–33 moderate CCD and greater than 33 indicating severe CCD.

Recruitment

The survey was made available online via SurveyMonkey and opened between December 2021 and February 2022. Participants were recruited through Australian-based veterinary clinics, dog training organisations and advocacy bodies, CCD and senior dog-dedicated Facebook groups and other dog-related online groups. These groups were asked to distribute the recruitment advertisement to their members, clients, followers and the like via social media platforms, and further sharing among participants was encouraged. To be included in the study, participants needed to be 18 years of age or older, currently own or have recent experience of living with and caring for a dog aged 8 years or older, and live in Australia. The study was conducted with the approval of the Human Research Ethics and Animal Ethics Committees at the University of Adelaide (H-2021-201, S-2021-059).

Statistical methods

Data were analysed using SPSS Statistics 27. A *p*-value of less than 0.05 was considered statistically significant. The main outcome (dependent variable) was the ZBI score. All variables were examined for

normality using the Shapiro–Wilk test, with CCD and ZBI scores showing non-normally distributed data (both $p \leq 0.001$). Descriptive statistics and comparison of means for each variable against the dependent variable (ZBI score) were used to characterise the sample data. Spearman's test of correlation was used to determine the relationship between the CCD score and ZBI score.

For those variables where normality was violated, to determine relevant covariates and factors to include in the full model, non-parametric Kruskal–Wallis and Mann–Whitney *U* tests were run. Items with a *p*-value of 0.2 or less were included. A general linear model was then created for the dependent variable ZBI score, which included all main effects and plausible interactions. Backwards stepwise regression was used to remove non-significant factors, leaving the final model.

Qualitative analysis

We asked a series of open-ended questions to measure the lived experience relating to the care of senior dogs. Questions included 'Which behaviour that your dog displays do you find it most difficult to live with?'; 'Does your dog have any conditions/health issues diagnosed by a veterinarian and if so, what are they?'; and 'Do you have anything else you would like to tell us?'. Analysis of the free-text responses was conducted using a basic content analysis, as described by Drisko and Maschi.[22] Semantic inductive coding of the dataset was initially conducted by Tracey L. Taylor. Familiarisation with the dataset was achieved by immersion in the responses and reading the responses multiple times. Using Microsoft Excel, individual responses were coded, which were then merged into preliminary themes and subthemes over several iterations. These were then reviewed and refined by all authors, and any disagreements were resolved through consensus. Only participants with dogs who had CCD were included in the analysis. The themes reported represent 461 out of the 537 dog owners who provided an open-ended response to at least one of the questions.[22]

RESULTS

A total of 637 online survey responses were received, of which 537 (84%) were complete and included in the data analysis. Most respondents were female, over 45 years of age, had two people living in the home and worked full time (Table 1). The majority of dogs in the survey had mild CCD, were between the ages of 9 and 14 years, medium sized, not on any medication and slept in a bedroom (Table 2).

CCD scores were not normally distributed (right skewed), with a median of 8 and range of 0–49 (maximum score possible 54). ZBI scores were also not normally distributed (right skewed), with a median of 9 and range of 0–43 (maximum value is 72). A clinically increased burden of care was experienced by 88 (16.4%) participants, determined as a score above 17.[18] The correlation between CCD and ZBI scores was tested using a Spearman's rho test, showing a moderately positive correlation[23] of 0.506 ($R^2 = 0.248$, $p \leq 0.001$).

TABLE 1 Demographic information for guardians of senior dogs who participated in an online survey of Australian adults who had experience living with and caring for a dog aged over 8 years ($n = 537$).

Demographics of human survey participants ($n = 537$)	*n*	%
Gender		
Female	498	92.7
Male	39	7.3
Age (years)		
18–34	98	18.3
35–44	94	17.5
45–54	128	23.8
55–64	145	27.0
≥65	72	13.4
Number of people living in the home		
1	109	20.3
2	274	51.0
3	85	15.8
≥4	69	12.8
Type of work		
Full time	237	44.1
Part time/casual	177	33.0
I do not work/retired/work from home	123	22.9
Zarit Burden Interview score (level of burden)		
Normal burden (score ≤17)	449	83.6
Increased burden (score >17)	88	16.4
Range	0–43	Max 72

There was a statistically significant difference between CCD score (categorised as no, mild, moderate and severe) and burden of care ($H(3) = 124.898$, $p \leq 0.001$) and a Bonferroni correction showed significant differences between all pairwise comparisons (Figure 1).

Age of dog, breed type (pure/cross), sleep location, number of people in the household, whether the dog was on medication, whether the dog kept their guardians up at night by vocalising or moving about, the guardian's employment status, CCD score and the guardian's age met the *p* less than 0.2 significance threshold to be incorporated into the general linear model (Table 3).

The results from the final model showed that guardians who lived alone and were between the ages of 25 and 44 years and cared for dogs who were between the ages of 8 and 12 years, slept inside (but not in the bedroom), were on medication and had CCD had an increased burden of care (Table 4). There was also a significant interaction ($p = 0.038$) between

TABLE 2 Demographic information of dogs who were represented in an online survey of Australian adults who had experience living with and caring for a dog aged over 8 years ($n = 537$).

Demographics of dog participants ($n = 537$)	*n*	%
Sex		
Female	266	49.5
Male	271	50.5
Breed		
Crossbred	272	50.7
Purebred	265	49.3
Different breeds/crosses represented	>156	
Age (years)		
8	48	8.9
9	67	12.5
10	66	12.3
11	70	13.0
12	64	11.9
13	82	15.3
14	72	13.4
15	34	6.3
≥16	34	6.3
Size		
Small (<10 kg)	159	29.6
Medium (10–26 kg)	229	42.6
Large (26–44 kg)	136	25.3
Giant (>44 kg)	13	2.4
Medications		
None	257	47.9
Yes, 1 medication	131	24.4
Yes, 2 medications	78	14.5
Yes, 3 or more medications	56	10.4
Other	15	2.8
Sleep location		
In a bedroom	356	66.3
In the laundry	15	2.8
In the lounge room	97	18.1
Outside	32	6.0
Other	37	6.9
DISHAA score (level of CCD)		
No CCD (score <4)	134	25.0
Mild (score 4–15)	267	49.7
Moderate (score 16–33)	121	22.5
Severe (score >33)	15	2.8
Range	0–49	Max 54

Abbreviations: CCD, canine cognitive dysfunction; DISHAA, Disorientation, social Interactions, Sleep/wake cycles, House soiling learning and memory, Activity, Anxiety.

the age of the dog and whether they were purebred or crossbred, with similar levels of burden in purebred dogs regardless of age over 8 years, but in crossbred dogs, burden was higher in the 8–12-year group (Figure 2). This model explained 31.7% of the variation in the data ($R^2 = 0.317$).

Survey participants were asked to state and describe in a free-text box if their dog had any medical conditions or health issues diagnosed by a veterinarian (Table 5). The top five conditions were arthritis ($n = 76$), allergies ($n = 54$), heart murmur/issues ($n = 48$), anxiety ($n = 41$) and blindness/cataracts ($n = 40$). Many dogs had more than one condition, indicating that comorbidities are common in this cohort of dogs. Out of the 403 dogs in this survey that had some level of CCD according to the DISHAA questionnaire results, only 23 had received a formal diagnosis from a veterinarian. All but one of those diagnosed had scores indicating moderate or severe disease.

Participants were also asked to state and name any medications their dog might be on that could affect their behaviour. The medications listed by participants were divided into three groups: CCD specific, CCD plus anxiety and any medications. Propentofylline and selegiline were considered CCD-specific medications (all are therapeutic agents approved for use and known to be efficacious for dogs with CCD).[24] Anxiety-related medications included fluoxetine, gabapentin, trazodone, diazepam, clomipramine, alprazolam and clonidine. Any other answer was included in the 'any medications' group. Seven percent of dogs with both severe and moderate levels of CCD were taking CCD-specific medication. This dropped to 0.4% for those with mild CCD. When anxiety medications were added to the CCD medication groups, this increased to 40% for severe, 21% for moderate, 13% for mild and 4% for dogs with no signs of CCD (Figure 3).

In response to one of the open-ended questions, 'Which behaviour that your dog displays do you find it most difficult to live with?' 448 respondents (83.4%) volunteered answers. Sorted by count, the top five themes were night-time disturbance ($n = 67$), barking ($n = 63$), house soiling ($n = 39$), aggression ($n = 31$) and separation issues ($n = 30$).

Lastly, 349 (65%) participants responded to the question 'Is there anything else you would like to tell us?'. After removing the 'no' or 'N/A' type responses, 221 remained and underwent analysis where key themes were revealed. The main themes identified were strong feelings of attachment, anticipatory grief, strong attachment mitigating burden and behavioural concerns.

Strong feeling of attachment: Participants wrote about how strongly they were attached to their dog, with one commenting: 'I love my girl so much that I am willing to do anything for her. Nothing is too much trouble'.

Anticipatory grief: Anticipatory grief and wanting more information about how to help their dog now, and what to expect in the future, were often mentioned together. Respondents were seeking more information and experiencing anticipatory grief in relation to making euthanasia decisions: 'I'd like more information on how to help our dog', 'I cry when I think about having to live without my dog after he crosses the rainbow bridge' and 'He's nearly 19, and I know he won't be with us much longer. I dread making the decision to euthanase him, as it's so hard to know when it's the right time'.

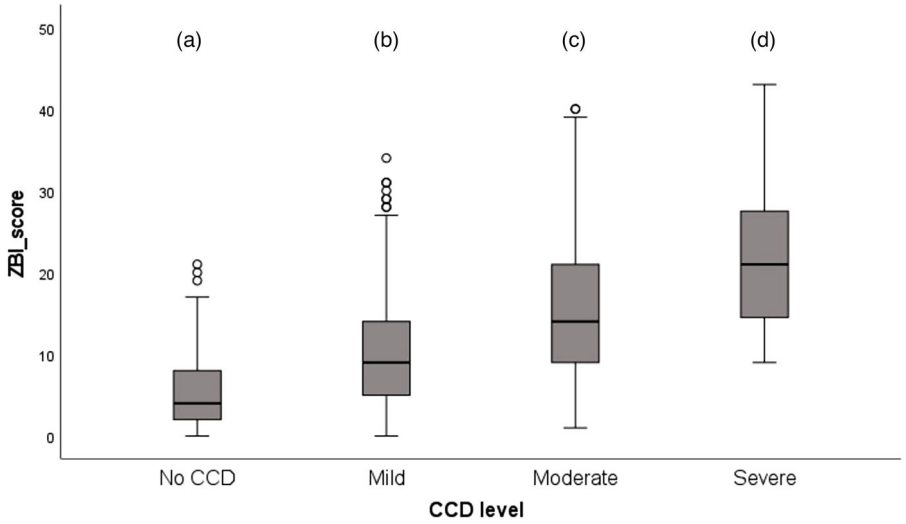

FIGURE 1 Boxplot showing the distribution of data for each level of severity of canine cognitive dysfunction (CCD) in relation to the level of burden experienced by caregivers. The bold lines through each box indicate the median, and open circles show outliers. Letters a–d indicate that each group is significantly different from the others. Kruskal–Wallis test, $p < 0.05$. ZBI, Zarit Burden Interview.

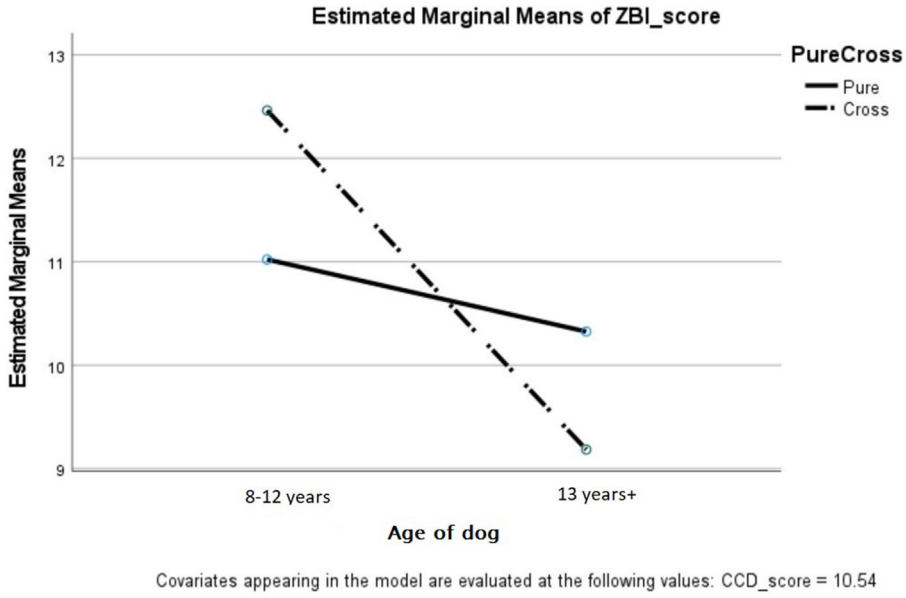

FIGURE 2 Plot showing the significant interaction between age of dog and breed type (pure or cross). Crossbred dogs showed much more variation in the level of burden experienced by their guardian. Both types showed higher burden in the 8–12-year-old group than in the 13-year-old or older group. CCD, canine cognitive dysfunction; ZBI, Zarit Burden Interview.

FIGURE 3 Percentage of dogs prescribed any medication, canine cognitive dysfunction (CCD)-specific medication or CCD plus anxiety medication according to the guardians of dogs aged 8 years or older who completed an online survey in Australia between December 2021 and February 2022.

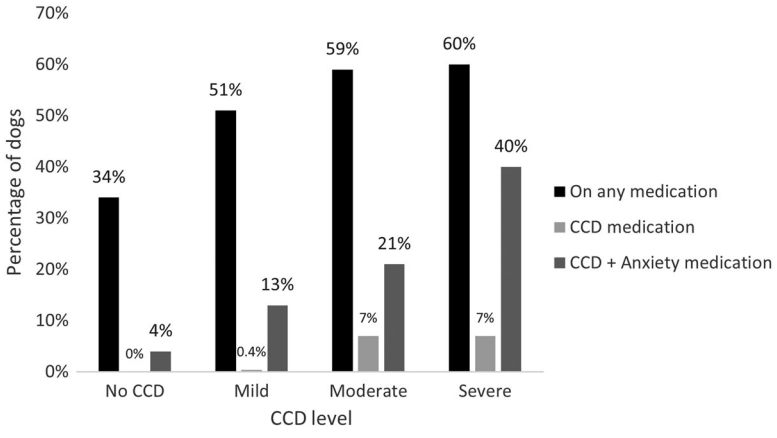

TABLE 3 Results from Kruskal–Wallis tests for each factor associated with adapted Zarit Burden Interview (ZBI) scores in guardians of dogs aged 8 years or older.

Factor	ZBI mean	ZBI range	95% CI	*p*-Value
Age of dog (years)				<0.001[a]
8–12	9.67	0–43	8.72–10.61	
≥13	11.43	0–39	10.40–12.45	
Breed type				0.163[a]
Purebred	9.85	0–39	8.90–10.79	
Crossbred	10.93	0–43	9.90–11.96	
Sleep location				0.010
Bedroom	9.84	0–43	9.01–10.67	
Inside	12.13	0–39	10.68–13.58	
Outside	8.94	0–28	6.4–11.49	
Number of people in the household				0.018[a]
Only me	12.06	1–40	10.49–13.62	
2 or more	9.97	0–43	9.19–10.75	
My dog often keeps me or my household awake at night when they vocalise or move about.				<0.001[a]
Agreement	13.82	0–43	12.19–15.45	
Neutral or disagree	9.27	0–40	8.54–10.00	
Dog on medication				0.003[a]
No	9.33	0–36	8.39–10.28	
Yes	11.37	0–43	10.35–12.38	
Guardian employment status				0.042
Full time	11.04	0-43	9.89–12.20	
Part time/casual	10.66	0-36	9.54–11.79	
Do not work/retired/work from home	8.70	0-36	7.42–9.98	
Guardian age (years)				0.004
18–34	11.99	0–43	10.13–13.85	
35–44	12.47	0–40	10.68–14.26	
45–54	10.29	0–39	8.82–11.75	
55–64	9.10	0–36	7.95–10.25	
≥65	8.32	0–36	6.60–10.04	
	Median	**IQR**		
CCD scores				<0.001
No CCD	4	6		
Mild	9	9		
Moderate	14	12		
Severe	21	17		

Abbreviations: CCD, canine cognitive dysfunction; CI, confidence interval; IQR, interquartile range; *p*-value, probability value (considered significant at <0.05).
[a]Results from Mann–Whitney *U*-test.

Strong attachment mitigates burden: Some respondents indicated that a strong attachment to their dog mitigates some of the burden of looking after them: 'I love having an older dog—she may require more veterinarian bills and observation, but she is gentle and sweet. Every moment I have with her now is a blessing', 'Despite her very old age and the care she requires, I wouldn't change it for the world' and 'Honoured to look after the "oldie". She has given me so much over the last 10 years. Time to pay back now'.

Behavioural concerns: Behavioural concerns that were far-reaching in nature were of concern to respondents. Some respondents indicated these had been life-long concerns and not related to the onset of age or CCD: 'He is reactive to other dogs' and 'He has always been highly fearful around strangers, which makes it more difficult as he gets old'.

One participant's response gave a particularly pointed example of the complexities and wide-ranging impacts of caring for a dog with CCD:

> 'My partner and I cannot leave him home alone for long at all. We are going to mat out the house for him. I worry about his

TABLE 4 General linear model parameter estimates of factors associated with Zarit Burden Interview (ZBI) scores in owners of dogs aged over 8 years ($n = 537$).

Factor	Coefficient	Standard error	*p*-Value
Age of dog (years)			
8–12	3.265	0.883	<0.001
≥13	0[a]		
Breeding (pure/cross)			
Pure	1.143	0.955	0.232
Cross	0[a]		
Number of people in household			
Only me	2.711	0.757	<0.001
Two or more	0[a]		
Medication			
No	−1.292	0.609	0.034
Yes	0[a]		
Sleep location			
Bedroom	0.398	1.248	0.750
Inside	2.046	1.326	0.123
Outside	0[a]		
Guardian age (years)			
18–34	1.887	1.110	0.090
35–44	2.528	1.113	0.024
45–54	0.276	1.034	0.789
55–64	–0.422	1.007	0.675
≥65	0[a]		
Covariate			
CCD score	0.476	0.037	<0.001

Note: Dependent variable—ZBI score.
Abbreviation: CCD, canine cognitive dysfunction.
[a]This parameter is set to zero because it is redundant.

TABLE 5 The full list of grouped responses provided by participants in an online survey of guardians of dogs over the age of 8 years old, in response to the question 'Does your dog have any conditions/health issues diagnosed by a vet? If so, what are they?'.

Condition/health issue	Count
Arthritis	76
Allergies	54
Heart murmur/issues	48
Anxiety	47
Blind/cataracts	40
Dental	32
Musculoskeletal issues	30
Tumour/lipomas	25
Deaf	24
Dementia	23
Endocrine issues	20
Incontinence	14
Kidney disease	14
Epilepsy/seizures	11
Liver disease	8
Ear issues/vestibular disease	8
Back leg weakness	7
Gastrointestinal issues	6
Obesity	5
Other[a]	24

[a]Other includes cancer, laryngeal paralysis, pancreatitis, pain, Parkinson's, autoimmune, depression, bleeding disorder, anal gland issues, underweight, enlarged spleen, Horner's syndrome, lung problem, perihilar congestion and Raine syndrome.

> quality of life. I feel my partner is really struggling with his deterioration and when the time comes for euthanasia I know it will be me forcing the issue. I feel constant anxiety about this decision looming because my partner still resents me forcing the decision for our other dog'.

Not all responses were negative in nature, however, with some participants affirming their senior dog's good health: 'Basically still very full of life and happy with his ageing so far!' and 'My dog is in excellent condition for his age'.

DISCUSSION

The aims of the current study were to investigate how the presence or severity of CCD impacts the burden experienced by the caregiver, identify the factors that contribute to being at risk of experiencing burden, and gain an understanding of the lived experience of caring for a senior dog with CCD. There were two critical findings from this study. First, caring for a senior dog with CCD is more burdensome than caring for an unaffected senior dog. This is a distinction that is not readily found anywhere else in the scientific literature. Second, even dogs with severe signs of CCD are not being prescribed medications that have known benefits,[24] raising questions about the care we provide senior dogs.

The overall prevalence of dogs with CCD in this study was 75%, comparable to that reported by Osella et al.[25] (73%) using a similar guardian self-report survey methodology. However, the current results are higher than those reported by researchers providing participants with an information sheet describing the possible behavioural and physical changes in ageing dogs, with 64% of the 8–12-year-old age group having some level of CCD in this study compared to the 25% reported by Azkona et al.[13] and 28% reported by Neilson et al.[12] In the 15 years or older age group, the difference was also stark, with 97% in this study compared to 70% in Neilson et al.'s paper.[12] These differences are likely due to differences in the measures used to score CCD and cohort effects.

The burden of care scores in this study were much lower than those previously reported in seriously/terminally ill or elderly companion animals more broadly.[17,26,27] The median in this study was also lower than that of guardians caring for pets with

suspected cancer.[28] It may be that CCD is less burdensome to caregivers than other diseases or that it occurs gradually and has a different level of burden according to severity. The nature of a voluntary, self-reporting questionnaire such as this one may have resulted in a bias toward those guardians more likely to willingly take on the responsibility of caring for an older dog. Participants may not see caring for their ageing dog as a burden and may continue to adjust their expectations and perceptions of caring responsibilities accordingly as their dogs age. This is supported by the qualitative responses that help to provide additional context to the ZBI scores. It is important to note, however, that approximately 16% of respondents in this study experienced a clinically significant level of burden. This is particularly relevant to veterinary practitioners, as a higher burden of care is associated with increased billable and non-billable contacts with clients as well as having a negative impact on treatment plan adherence.[29] We recommend that veterinarians have a discussion with clients about how they are coping with caring for their dog with CCD and if there is anything additional relating to the dog's health and behaviour that they can do to help reduce the burden.

Factors associated with burden of care

Burden of care was significantly lower in caregivers of older dogs without signs of CCD versus those with CCD. This is an important finding, as it could significantly change the way veterinarians approach consultations with older dogs, removing the temptation to dismiss signs of the disease as normal age-related changes and reducing the likelihood that guardians will not report signs of cognitive decline. Guardians of dogs with extra needs are seeking information about how best to care for them from outside sources when their veterinarian does not provide support.[30] A deeper understanding by veterinarians about the burden of caring for these dogs from routinely using the ZBI tool in clinical practice could enhance conversations with clients about the management, treatment options and end-of-life decisions their clients may need to consider for their senior dog.

Caregiver burden has been positively correlated with consideration of euthanasia in aged and seriously ill companion animals.[27] Therefore, any measures that can be taken to reduce the burden may change the outcomes for older dogs and their caregivers. In this study, respondents identified night-time disturbance, barking, house soiling, aggression and separation issues as the behaviours their dog showed that they found most challenging to live with. Interventions should focus on reducing these behaviours, such as providing structured cognitive enrichment, which has been shown to have neuroprotective effects in laboratory dogs, thereby reducing the presence of these types of behaviours.[31] Receiving emotional and practical support from a dog trainer has also been cited as a valuable resource for guardians of pets with behavioural problems, helping them cope with their burden at least temporarily.[30]

Other factors associated with burden of care, such as the age of the guardian, the age of the dog and their household composition, may not be modifiable variables by the treating veterinarian but could establish a profile of clients they may need to be sensitive to when delivering difficult diagnoses or discussing treatment options. Middle-aged respondents were more burdened in this study, just as middle-aged people generally are reported to be at their lowest ebb of well-being over their life course.[32] While this may not be unique to guardians of dogs with CCD, the knowledge could be used by veterinarians to guide their conversations and decision making. Guardians of dogs requiring medication, mostly for other conditions, also experienced increased burden, which has the potential to negatively impact compliance. Treatment compliance studies only tend to look superficially at guardian factors as reasons for non-compliance,[33] so further work in this area, with a specific focus on owners of older dogs with a life-long attachment to their pet, needs to be undertaken.

Open-ended questions: diagnoses and medications

When asked to name a condition/health issue their dog had been diagnosed with by a veterinarian, 4% of survey respondents named dementia (ranked tenth on the list), compared to 75% of dogs meeting the required threshold using CCD scores. Almost all of those with a veterinary diagnosis were moderately or severely affected by the disease, suggesting that diagnosis mostly occurs in advanced presentations. Additionally, prescription rates for CCD-specific medications (identified in this study as propentofylline and selegiline) were extremely low in dogs with all levels of CCD. Only 7% of dogs with severe CCD scores had been prescribed these drugs, the same percentage as in moderately affected dogs. It is unclear whether this is because of perceived drug ineffectiveness, other drug interactions or contraindications,[34–36] a lack of familiarity by veterinarians with the medications available or that perhaps clinicians are using medications to lessen the anxiety as a first step in alleviating the signs of CCD in the dog and reducing the burden of caring for them. With CCD accepted as a welfare issue,[37] it is important that veterinarians consider all options available to them.

Open-ended questions: lived experience

There was a strong sense of anticipatory grief in the sentiments shared by participants, which is often present alongside, but different from, caregiver burden,[38] and they showed a willingness to make great

sacrifices for the care of their dogs. From a veterinarian's perspective, clients with such strong emotions and complex needs can be challenging to engage with, as they often require more time to consult, have an increased frequency of visits, can become angry and emotional and in effect project their burden on the veterinary team.[26] Ducoté argues for better tools and education for veterinarians in providing palliative care to enhance their service delivery for the benefit of their clients and patients and build better resilience to protect their own wellbeing.[39] The use and importance of a veterinary social worker role may help in assisting both practitioners and clients navigate difficult conversations, feelings of grief, burden and guilt and ensuring effective communication to avoid conflict or misunderstandings.[40] Social workers with additional veterinary setting training are not commonplace but should be considered as a valuable skill set to add to practices for the benefit of staff and clients.

Limitations of study

Despite a large sample size, the participants were mostly female and may not be truly representative of the general population. The study was undertaken during the COVID-19 pandemic, and as such, the working full-time category in the guardian demographic section of the survey may have been a mix of those working from home as well as the more traditional away-from-home setting, which could skew our interpretation of burden for those results. Although a quarter of respondents had dogs without CCD, participants self-selected, and the survey most likely attracted those who knew or suspected their dogs could be affected. Financial stress is shown to influence the burden of dog ownership; however, no questions regarding household income were asked.[17,27,28,41] The presence of diseases other than CCD may also have been associated with burden of care in the respondents, and while the survey included questions on other diseases the dog was diagnosed with, it was not possible to include other diseases (e.g., arthritis) in the model. The dogs' chronological age was used in the analysis instead of fractional lifespan, although smaller dogs live longer than larger dogs.[42] In future studies fractional lifespan should also be used, although a study of cognitive function with ageing suggested that all dog breeds, regardless of size, exhibit similar ageing trajectories of cognitive decline and that larger dogs at the end of their shorter lives may have relatively limited cognitive decline.[43] The survey was also limited by the question regarding which medications their dog was prescribed that could affect their behaviour, which did not allow for nutraceuticals or other non-pharmacological interventions to be noted. The ZBI score was useful for determining a level of burden; however, responses to open-ended questions revealed additional and useful context. Further studies should examine the level of burden according to CCD severity. A CCD diagnosis can only be made by a veterinarian after a comprehensive investigation and elimination process; however, in this study, dogs were assumed to have the disease based simply on the results of the DISHAA questionnaire, which could also explain the prevalence in this sample.

CONCLUSIONS

The lived experience of caring for a dog with CCD is different from that of caring for a senior dog without CCD. The burden of care increases as the severity of the disease increases and in the presence of co-morbidities. Dog-related factors associated with caregiver burden include age, sleep location, severity of cognitive decline and whether they require medication. Human factors such as a guardian's age and the number of people living in the household are also associated with caregiver burden. There is a notable gap between the number of dogs showing signs of CCD and those being diagnosed and prescribed relevant medications, which requires further investigation. Guardians of senior dogs show strong attachment to their pets, which may explain not only a willingness to make drastic changes to their lives to care for their dogs but also a need for greater support from veterinarians. A veterinary social worker role, not common in Australia, may meet this need and should be considered by practices to improve service delivery and staff wellbeing.

AUTHOR CONTRIBUTIONS

Susan J. Hazel takes overall responsibility for the accuracy and authenticity of the research. Tracey L. Taylor chose the topic, and the scientific question was refined with the input of all authors. Tracey L. Taylor was responsible for the drafting of the manuscript, data collection and statistical analysis. Editing of the document, statistical support and overall guidance of the project was provided by Susan J. Hazel and Bradley P. Smith. All authors were involved in addressing the revisions required by reviewers.

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CONFLICT OF INTEREST STATEMENT

None of the authors has any other financial or personal relationships that could inappropriately influence or bias the content of the paper.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

The study was conducted with the approval of the Human Research Ethics and Animal Ethics Committees at the University of Adelaide (H-2021-201, S-2021-059).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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