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Development and validation of a survey for quality of life assessment by owners of healthy dogs

R.P. Lavan *

Outcomes Research, Zoetis, Inc., 5 Giralda Farms, Madison, NJ 07940, USA

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ABSTRACT

Assessing and maintaining quality of life (QOL) is a growing concern in companion animal practice, as improved nutrition and healthcare have extended canine longevity. The objective of this study was to develop a validated survey for evaluating QOL in healthy dogs for use in clinical and research settings. A total of 174 dog owners completed an initial QOL survey containing 21 items grouped into seven domains (CHQLS-21). After factor analysis of the responses, a final survey was constructed containing 15 items grouped into four domains (happiness, physical functioning, hygiene and mental status), plus two questions on general health and an item asking for a direct QOL assessment (CHQLS-15).

Psychometric analysis indicated that the CHQLS-15 had good validity, reliability, and internal consistency and was able to detect QOL changes affecting several domains across age groups in healthy dogs. The CHQLS-15 therefore provides a basis for dialog between clinicians and dog owners regarding the health of their pets, particularly in tracking changes in health status, evaluating response to treatment, and guiding end-of-life decisions. A validated QOL survey could be particularly useful in recognizing and managing functional decline as the healthy canine patient ages.

Introduction

Quality of life (QOL) assessments are considered to be among the principal endpoints in human clinical trials (Freeman et al., 2005) and are now commonplace in primary care practice (Brazier et al., 1992; Calvert and Freemantle, 2003). Only in the past decade has QOL been extensively studied and measured in companion animal medicine. Because age and health status are the strongest discriminators of QOL, most recent canine QOL surveys have been developed for various chronic and other disease conditions including heart disease (Freeman et al., 2005), spinal cord injuries (Budke et al., 2008), osteoarthritis (Hielm-Björkman et al., 2009), chronic pain (Wiseman-Orr et al., 2004), cancer (Lynch et al., 2011), kidney disease (Yearley et al., 2004), dermatological disease (Favrot et al., 2010), and inflammatory bowel disease (Craven et al., 2004).

Although disease and disability affect health status in dogs, their absence is not necessarily synonymous with declining QOL. There is a consensus that QOL in pets should be more broadly defined as states of comfort or discomfort representing a combination of physical and non-physical factors (McMillan, 2000; Wojciechowska et al., 2005). In addition to health status, these can include needs satisfaction, sense of control, social relationships, the extent of physical or emotional discomfort, and management of stress (McMillan, 2000; Wojciechowska et al., 2005; Wiseman-Orr et al., 2006; Hewson et al., 2007; Mullan and Main, 2007). Using this inclusive definition of QOL, it is harder to measure change in the clinically normal animal vs. one that is sick, particularly when QOL is assessed vicariously by the pet owner. The prevailing approach for constructing a valid canine QOL survey instrument is to identify various domains that independently contribute to QOL for individuals in the target population (McMillan, 2000). The domain concept allows QOL to be broken down into multiple components that reflect its multifactorial nature, and then within each domain survey designers can group various assessment items that are intrinsic to that aspect of QOL.

In primary care practices, QOL is a growing concern as improved pet nutrition and healthcare have extended canine longevity (Wojciechowska et al., 2005). In response to increasing recognition of the value of QOL assessment in clinical practice, previous efforts have been made to develop QOL survey instruments for routine use in canine patients (Wojciechowska and Hewson, 2005; Wojciechowska et al., 2005; Mullan and Main, 2007; Yeates and Main, 2009). Such a tool could be used in clinical trials and also would enable pet owners and clinicians to track changes in health status, evaluate response to treatment, and guide end-of-life decisions. Thus, a QOL survey could be particularly useful in recognizing and managing functional decline as the healthy canine patient ages.

* Tel.: +1 610 246 0645.
E-mail address: robert.p.lavan@zoetis.com

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The purpose of this study was to construct and assess the validity of a pet owner-administered, multi-domain canine health-related QOL survey (CHQLS) suitable for baseline and continuing evaluation of dogs in research and clinical care settings. By including physical and non-physical assessment domains, the CHQLS was designed to accurately reflect QOL in healthy dogs, a part of the canine population that is generally excluded from QOL surveys that focus on specific disease states.

Materials and methods

Survey development and testing

The prototype for the CHQLS was a cancer treatment survey (CTS) developed by the author to assess QOL in dogs and cats enrolled in clinical trials for the anti-neoplastic drug toceranib phosphate (R.P. Lavan, unpublished data; Lynch et al., 2011). The CTS was developed based on questionnaire responses by pet owners and clinicians. Their input was used to define the seven domains empirically thought to be related to QOL, namely, happiness, mental status, pain, appetite, hygiene, water balance (hydration), and mobility. Each domain contained three related items that were scored on a 5-level Likert scale. Two general health questions were added, followed by a direct QOL assessment. The direct QOL assessment was scored on a 10-point numeric rating scale from very poor to excellent. Based on informal responses from the owners of 60 healthy dogs who reviewed the CTS, its domains and items were considered appropriate for inclusion in an initial, 21-item CHQLS (CHQLS-21; Table 1) after minor modifications. Because clinicians who reviewed the survey prior to testing considered the two questions on general health to be valuable, these were retained in the final instrument.

The minimum sample size for the planned factor analysis was estimated to be 105. This was based on the rule-of-thumb that at least five times as many respondents should be used as the number of items in the questionnaire for factor analytic purposes (Gorsuch, 1983; Hatcher, 1994).

Dog owners who were employees at an animal health products company were invited to participate in the survey if they considered their dogs to be healthy. Dogs could be of any age or breed. Respondents were asked to provide demographic data for the pet owner and the gender, age, and bodyweight of their dogs. The online survey presented each domain and its three associated items in a single page. The online format did not allow the responders to go back and review or change their responses. Two weeks after they completed the initial survey, responders were invited to complete the survey a second time so that test–retest reliability between surveys could be analyzed. Responses to the online version of the CHQLS-21 were analyzed to determine which survey components were relevant to QOL for a healthy dog and should be retained or modified.

Table 1
Domains and assessment items in the prototype canine HRQL survey (CHQLS-21).

Domain or general health assessment	Item number and description
Happiness	(1) My dog wants to play (2) My pet responds to my presence (3) My pet enjoys life
Mental status	(4) My pet has more good days than bad days (5) My pet sleeps more, is less awake (6) My pet seems dull or depressed, not alert
Pain	(7) My pet is in pain (8) My pet pants frequently, even at rest (9) My pet shakes or trembles occasionally
Appetite	(10) My pet eats the usual amount of food (11) My pet acts nauseous or vomits (12) My pet eats treats/snacks
Hygiene	(13) My pet keeps him/herself clean (14) My pet smells like urine or has skin irritation (15) My pet's hair is greasy, matted, rough looking
Water balance	(16) My pet drinks adequately (17) My pet has diarrhea (18) My pet is urinating a normal amount
Mobility	(19) My pet moves normally (20) My pet lays in one place all day long (21) My pet is as active as he/she has been
General health	General health compared to last evaluation (office visit) General health compared to when dog was first acquired
QOL assessment	Current quality of life

HRQL, health-related quality of life.

Item retention within domains

Domain scores were created by summation of the component item scores. Factor analysis with varimax rotation was performed to evaluate the initial structure of the items and domains. Domain relevance was determined by an Eigenvalue >1.0. Strength of association among items was used to help determine which items should be retained to optimize domain structure. Percentage of the explained variation was used as a guide to reinforce the importance of the number of factors (domains) selected. Items were grouped into specific domains based on factor loadings $\geqslant 0.4$.

Item-to-item correlations of 0.3–0.8 were considered sufficient to group items within a domain (Fayers and Machin, 2007). Items outside this range were considered to be candidates for removal or relocation due to dissimilarity or redundancy. An item with >5% missing data indicated that responders had difficulty in interpreting the question or objected to the question itself, in which case the item was considered for removal. A pattern of extreme low or high scoring ('floor' and 'ceiling' assessments) would indicate the item might not be sensitive enough to detect gradations in QOL and would later be tested for discriminant (known-groups) validity.

Validity

The CHQLS-21 items and domains were analyzed for convergent validity through correlating to the general QOL item. A correlation of 0.4–0.7 indicated good convergent validity. Known groups (discriminant) validity was evaluated to determine whether item scores were statistically different among 3-year age blocks (0–3.0; 3.1–6.0; 6.1–9.0; $\geqslant$9.1 years). The known-groups analysis was based on the premise that individual QOL could decrease because of natural aging. Theoretically, there would be more rapid decline in QOL with the added burden of disease, making it more likely that a diseased population could be discriminated from a healthy population when QOL scores were compared. It was thought that the known-groups analysis of the items in the CHQLS-21 would be more rigorously tested by assessing changes within the population of healthy dogs. If the survey items failed to discriminate between age blocks, they would later be tested for their ability to discriminate between sick and healthy dogs when data from sick dogs became available, e.g. in clinical trials. A Kruskal–Wallis one-way ANOVA was used to compare item and domain scores for each of the four age blocks, with P values $\leqslant 0.05$ considered significant. Criterion validity was not evaluated since there was no external reference standard for surveying QOL in healthy dogs.

Reliability

Internal consistency was analyzed to determine the extent to which CHQLS-21 items within each domain measured that concept. A Cronbach-α score >0.7 indicated good internal consistency of the items measuring that concept. Test–retest reliability (repeatability) between surveys taken 2 weeks apart was determined. The 2-week interval was considered long enough that a responder would not necessarily recall responses to the first survey, and short enough so that there was little likelihood that changes in the dog's health status occurred. An intra-class correlation (ICC) coefficient $\geqslant 0.7$ indicated good repeatability of survey scores submitted for the same animal.

General health and QOL scoring

The general health questions asked the pet owner to assess changes in the dog's health since it was first acquired (long-term assessment) and since the last health evaluation (short-term assessment). A QOL score was provided by the pet owner (a direct assessment).

Results

Demographics

A total of 174 individuals responded to the initial invitation to participate; 94 responses were received following the second invitation. A total of 86 individuals completed both the initial and follow-up survey for purposes of test–retest analysis. A total of 167 people provided complete demographic information during the survey (Table 2). Demographic information for the dogs in the study is presented in Table 3.

Item structure

Four of the items in CHQLS-21 had a single missing response in the 168 surveys, a non-response rate of 0.6%. The other 17 items had no missing responses. Each of the two general health questions had missing responses but none exceeded 5% of the total. For the direct QOL item, one (0.6%) response was missing. In asking questions about the wellbeing of dogs considered healthy by the pet owner, it was expected that responses would predominantly be at the high end of the scale, reflecting the owner's perception that the dog was in good health. While ceiling tendencies were observed, they were not used to exclude individual items, but could partially explain the failure of an item in the known-groups analysis.

The CHQLS-21 item-to-item correlation was satisfactory for items in the happiness, pain, hygiene, water balance and mobility domains. Items in the mental status and appetite domains were not well correlated ($r = -0.016$ to 0.191), indicating that items in those domains were not necessarily measuring a similar concept.

After examining the frequency distribution of the ages of the 168 dogs, it was evident that data could be blocked into approximately four groups of equal size across the four non-overlapping 3-year increments.

Each of the CHQLS-21 items was evaluated for its ability to discriminate across the four age blocks, based on pet owner responses. Ten items were able to discriminate across age blocks (Table 4). All domains except appetite and hygiene contained at least one item that could discriminate between age blocks.

Using factor analysis with varimax rotation, the CHQLS-21 items were grouped into seven factors that had Eigenvalues >1.0, accounting for 67% of the variance. Several items factor-loaded outside their original domain, resulting in reassignment to a new domain or renaming a domain to better reflect its item content.

Based on factor analysis, the original CHQLS-21 items were consolidated into 17 items organized into five domains, namely, happiness (four items), physical functioning (five items), hygiene (three items), mental status (three items), and water balance (two items). The general health questions and the direct QOL assessment used in CHQLS-21 were retained. The CHQLS-21 survey was later consolidated into an instrument consisting of 15 items organized into four domains when the water balance domain was removed, and was designated CHQLS-15 (Table 5). Item-to-domain correlation analysis for CHQLS-15 demonstrated significant correlation of all items within their respective domains. Factor analysis of the four-domain survey demonstrated a one-factor solution, suggesting that the creation of a calculated total QOL score was acceptable.

Domain structure

An acceptable correlation (0.4–0.7) was found for three domains and the direct QOL score (happiness, 0.42; hygiene, 0.44; physical functioning, 0.68). The correlations for mental status (0.39) and water balance (0.30) were lower than desired but considered acceptable and worth retaining.

Table 2
Demographics of survey responders that provided demographic information.

Gender ($n = 166$)[a]		Occupation ($n = 167$)[b]	
Male	Female	Veterinarian or technician	Non-clinical
71 (42%)	95 (58%)	34 (20%)	133 (80%)

[a] Two responders did not provide gender information.
[b] One responder did not provide occupation information.

Table 3
Gender and age for healthy pet dogs ($n = 168$).

Gender		Age (years)			
Male	Female	0–3.0	3.1–6.0	6.1–9.0	⩾9.1
81 (48%)	87 (52%)	44 (26.2%)	44 (26.2%)	42 (25.0%)	38 (22.6%)

Mean CHQLS-15 domain scores were evaluated for their ability to discriminate across the four known-group age blocks. Scores for the happiness ($P = 0.001$), physical functioning ($P = 0.001$), and mental status ($P = 0.027$) domains discriminated across age blocks. Domain scores for hygiene ($P = 0.110$) and water balance ($P = 0.322$) did not have significant discriminative value across age blocks in healthy dogs.

Test–retest reliability

Three CHQLS-15 domains had an ICC coefficient ⩾0.7, indicating a high likelihood of obtaining a similar retest response for the same animal whose health status had not changed: physical functioning (ICC = 0.83), mental status (ICC = 0.79), and hygiene (ICC = 0.71). The ICC coefficient for happiness (ICC = 0.60) approached reliability, but the correlation for water balance was poor (ICC = 0.27). Both questions in the water balance domain had poor test–retest reliability and the domain was removed from the survey.

Discussion

Guided by the psychometric analysis, the original seven-domain, CHQLS-21 instrument was reduced to a smaller four-domain, 15 item instrument, CHQLS-15. The analysis showed that: (1) the original items needed to be regrouped into a new structure; (2) some domains needed to be renamed to better reflect the items included; (3) that items in the appetite and water balance domains in CHQLS-21 had poor internal reliability, and (4) the water balance domain had poor test–retest reliability. As a result, items in the appetite and water balance domains were not considered valid or reliable indicators of QOL for a healthy dog, and were not included in the CHQLS-15 instrument. Although the hygiene domain did not

Table 4
Kruskal–Wallis analysis of item scores across age blocks.

Item statement	*P* value
My pet wants to play	0.0001
My pet responds to my presence	0.007
My pet enjoys life	0.063
My pet has more good days than bad days	0.033
My pet sleeps more, is less awake	0.0001
My pet seems dull or depressed, not alert	0.002
My pet is in pain	0.0001
My pet pants frequently, even at rest	0.016
My pet shakes or trembles occasionally	0.135
My pet eats the usual amount of food	0.692
My pet acts nauseous or vomits	0.367
My pet eats treats or snacks	0.079
My pet keeps him/herself clean	0.205
My pet smells like urine or has skin irritation	0.974
My pet's hair is greasy, matted, rough looking	0.083
My pet drinks adequately	0.173
My pet has diarrhea	0.765
My pet is urinating a normal amount	0.107
My pet moves normally	0.0001
My pet lays in one place all day long	0.024
My pet is as active as he/she has been	0.0001

Table 5
Item-to-domain correlation in the final CHQLS-15 survey.

Domain	Item	Correlation with domain
Happiness	My pet wants to play	0.865
	My pet responds to my presence	0.918
	My pet enjoys life	0.924
	My pet has more good days than bad days	0.693
Physical functioning	My pet sleeps more, is less awake	0.668
	My pet is in pain	0.619
	My pet moves normally	0.832
	My pet lays in one place all day long	0.832
	My pet is as active as he/she has been	0.860
Hygiene	My pet keeps him/herself clean	0.786
	My pet smells like urine or has skin irritation	0.785
	My pet's hair is greasy, matted, rough looking	0.746
Mental status	My pet seems dull or depressed, not alert	0.672
	My pet pants frequently, even at rest	0.713
	My pet shakes or trembles occasionally	0.785

CHQLS, canine health-related quality of life survey.

have significant discriminant validity across age groups, it had adequate correlation (0.437) with the direct QOL score and had good test–retest reliability, supporting the decision to retain it in the final survey. Study results indicate that the CHQLS-15 has good validity, reliability, and high internal consistency in assessing QOL in healthy dogs.

Others have suggested that a QOL survey in clinical practice could be particularly useful for older pets to encourage discussion of topics such as obesity, pain management, exercise, and behavior problems (Yeates and Main, 2009). The CHQLS-15 instrument emphasizes external, psychosocial parameters of QOL that are readily observable by an attentive pet owner. In this respect, it differs from surveys that focus on physiologic or clinical parameters such as preexisting medical diagnoses (Wojciechowska et al., 2005), pain vocalization and gait analysis in osteoarthritic dogs (Hielm-Björkman et al., 2009), and cardiac deficits in dogs with heart disease (Oyama et al., 2008). It should be noted that parameters directly discernible by the pet owner have been reported to be more likely to have greater reliability among proxy assessors (Yeates and Main, 2009).

The ultimate goal of a QOL assessment is to focus on wellbeing as the first consideration in making healthcare decisions (McMillan, 2000). In this respect, a QOL survey has a potential role in influencing therapy decisions and assessing treatment response, particularly when the goal is palliative (Morris et al., 1998; Freeman et al., 2005). Other benefits of a QOL questionnaire are to raise awareness among pet owners and clinical staff of factors that influence wellbeing in individual animals, monitor changes in the dog's QOL over time (Mullan and Main, 2007), improve compliance, increase the client's sense of involvement in the dog's treatment plan, and improve the practice's relationship with its clients (Yeates and Main, 2009). To illustrate, 81% (66/81) of owners of dogs undergoing cancer treatment stated that completing a QOL survey made them feel more involved in their pet's treatment (Lynch et al., 2011).

Of particular importance is the role of QOL assessments in making end-of-life decisions affecting the dog. A recent study found that owners of dogs with a serious illness had high levels of concern about pet QOL (Oyama et al., 2008). Eighty-six percent of owners of dogs being treated for cancer were willing to exchange their dog's survival time for improved or stable QOL. Respondents were especially concerned about avoidance of pet suffering and the dog's ability to interact in a meaningful way with its owner. Poor QOL is often cited by pet owners as the single most important factor in deciding to have their dogs euthanased (Freeman et al., 2005). Regular use of a QOL survey for the healthy dog would document its QOL status over time, familiarize the pet owner with QOL assessments, and enable discernment of marginal QOL caused by aging, chronic conditions or disability.

One expert has proposed that QOL in animals or humans is a combination of comfort and discomfort (McMillan, 2000). These opposing physical states represent two broad qualitative domains that define QOL. Used together, positive and negative descriptors tend to minimize responder bias (Wiseman-Orr et al., 2006). For example, in the construction of a questionnaire on QOL in dogs with chronic pain, the investigators used the binary concept of 'well' vs. 'unwell' to construct a QOL survey (Wiseman-Orr et al., 2004). Our CHQLS-15 instrument conforms to this 'two-domain' concept in that all items in the instrument can be linked to either the animal's comfort (e.g., 'happiness') or discomfort (e.g., 'physical functioning', 'mental status').

The CHQLS-15 survey benefits from its brevity and ease of completion (generally, 10 min or less, including the pet owner's personal and demographic information). The 21 items from the CTS on which the CHQLS-21 and CHQLS-15 surveys were based had a 96% (111/116) completion rate by pet owners (Lynch et al., 2011). Of the CTS respondents, 97% (81/84) found it to be of acceptable length and 83% (69/84) found it to be very easy to complete (Lynch et al., 2011). In comparison, the SF-36 Health Survey that has been in general use for two decades to assess human functioning and wellbeing contains 36 items (Brazier et al., 1992). Previously developed canine QOL surveys tend to be considerably more complex that the CHQLS-15. A Canadian pre-appointment survey developed to assess QOL in dogs presented in general practice contained 38 items and was administered to the pet owner by an interviewer (Wojciechowska et al., 2005). A European canine QOL survey contained 109 descriptive terms arranged within 13 domains that pet owners could review prior to scoring on a 7-point numerical scale (Wiseman-Orr et al., 2004). Completion time for that survey was 15–25 min. A respondent's attention span could be expected to decline with increased survey length, detracting from its reliability.

The CHQLS-15 included multiple domains that defined QOL by its constituent parts. This design provides good construct validity, whereby all items in the survey help define QOL in healthy dogs (Hielm-Björkman et al., 2009). The survey concluded with a direct QOL question, a component that can be revealing in itself (Yeates and Main, 2009). Animal behaviorists note that a single overarching QOL assessment posed to the dog owner can by itself accurately reflect the pet's QOL. For example, one QOL survey concluded with a question that asked how willing the owner would be 'to take on the life their pet is now living' (McMillan, 2003; Mullan and Main, 2007). Some dog owners who responded said that this question gave them a new perspective on pet QOL (Mullan and Main, 2007). Other experts note that asking the pet owner the simple question, 'How is your dog's quality of life?', can encourage the owner to pause and consider this and it also reassures the client that the clinician considers the pet's interests to be paramount (Yeates and Main, 2009). It is clear that canine QOL surveys can take various forms and still be useful instruments. A statistically valid and reliable instrument for evaluating the healthy dog provides clinicians with an excellent vehicle for considering what is most important to the animal and to convey to the owner that the dog's QOL is their veterinarian's primary consideration.

Conclusions

Study results indicate that the CHQLS-15 has good validity, reliability and high internal consistency in assessing QOL in normal dogs. A statistically valid and reliable instrument for evaluating healthy dogs provides clinicians with a useful tool for considering what is most important to the animal, guiding healthcare decisions, and conveying to the owner that the dog's QOL is the veterinarian's primary consideration.

Conflict of interest statement

Robert Lavan is an employee of Zoetis, Inc.

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