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Development and validation of a questionnaire to assess health-related quality-of-life in cats with hyperthyroidism

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Abstract

Background: Health-related quality-of-life (HRQoL) assessment tools are becoming increasingly important for the assessment of diseases in veterinary medicine.

Objectives: To develop a tool to assess the HRQoL of hyperthyroid cats and their owners.

Animals: Cats with hyperthyroidism (n = 229) and without hyperthyroidism (n = 322).

Methods: Cross-sectional study design. A preliminary list of 28 questions relating to the HRQoL of hyperthyroid cats and the influence their cat's disease might have on owners was created. Each question consisted of 2 subquestions: (1) "how often does the item apply"; (2) "how strongly does the item affect HRQoL." The questionnaire was refined based on statistical analysis, including Mann-Whitney-*U* tests on each item, comparing the results from cats with and without hyperthyroidism. Internal consistency and reliability of the questions were measured by Cronbach's alpha (α). $P < .05$ was considered significant.

Results: Overall, 25/28 questions were retained within the final HRQoL tool, which had an excellent internal consistency ($\alpha = .92$). The tool produced a score between 0 and 382 (lower scores meaning better HRQoL). The median HRQoL score was 87.5 (range, 2-348) for cats with hyperthyroidism, and 27 (range, 0-249) for cats without ($P < .001$), suggesting the HRQoL was poorer in hyperthyroid cats.

Conclusions and Clinical Importance: This validated HRQoL tool is useful to reliably quantify the influence of hyperthyroidism on the quality-of-life of affected cats and their owners. In the future, it could be considered of assistance in the clinical assessment of cats with hyperthyroidism.

KEYWORDS
endocrinology, feline, interrater reliability, owner, survey, thyroid, validation, welfare

Abbreviations: CKD, chronic kidney disease; DM, diabetes mellitus; HRQoL, health-related quality-of-life; HT, hyperthyroid; ICC, intraclass correlation coefficient; IQR, interquartile range IS, Imogen Schofield; NHT, nonhyperthyroid; QoL, quality-of-life; RAIT, radioiodine treatment; TT4, total thyroxine; UK, United Kingdom.

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1 | INTRODUCTION

Hyperthyroidism is the most common endocrine disease in middle-aged to older cats.[1] Cats suffering from hyperthyroidism have an overproduction of thyroid hormones due to abnormal functional thyroid tissue.[2] As a result of excessive thyroid hormone levels, various clinical signs occur, including weight loss despite increased appetite, vomiting, hyperactivity, polyuria and polydipsia, diarrhea, susceptibility to respiratory distress and changes in coat quality.[2] These clinical signs might notably reduce the quality-of-life (QoL) of affected cats. Besides the clinical signs of the disease, its treatment and monitoring can represent a considerable burden for the owners and a stress factor for affected cats.[3] Since hyperthyroidism is a progressive and potentially life-threatening condition, therapeutic intervention is necessary to alleviate clinical signs and reduce negative effects of thyroid hormone excess on the body, especially the cardiovascular system. Currently, 4 treatment options are available, including medical treatment with antithyroid drugs, low iodine diet, radioiodine treatment (RAIT) and thyroidectomy, of which only the last 2 are often curative.[4] Treatment response is traditionally assessed by the measurement of total T4 (TT4), which, however, might not always adequately reflect disease control. Several factors including adverse effects, easiness of treatment administration or a possible overtreatment causing iatrogenic hypothyroidism might negatively affect outcome. Therefore, besides measurement of TT4 concentration, additional tools such as those evaluating QoL, might be useful to evaluate treatment success.

The use of questionnaires to evaluate QoL of people with various diseases as well as to assess QoL of general populations such as those living in certain geographic regions, is well established.[5,6] Quality-of-life assessments specifically related to a person's health (health-related QoL [HRQoL]) have also become an integral part of evaluation of treatment success and have been useful to guide treatment in patients suffering from various conditions such as diabetes mellitus (DM) or breast cancer.[7,8] Several studies used validated questionnaires to describe the impairment to HRQoL of people suffering from hyperthyroidism and to evaluate the effect of different forms of treatment.[9-13]

While validated tools to evaluate general QoL and wellbeing[14] in cats as well as tools for evaluation of HRQoL for different conditions such as DM,[15] chronic kidney disease (CKD),[16] or skin disease[17] exist, there is no tool to evaluate HRQoL in cats suffering from hyperthyroidism. Therefore, the aim of this study was to develop a tool (HyperthyroidismQoL-cat) to measure and quantify the owner perceived influence hyperthyroidism has on the HRQoL of their cat as well as the influence on the owner's daily live.

2 | MATERIALS AND METHODS

2.1 | Development of the HyperthyroidismQoL-cat

The HRQoL tool development followed a psychometric process which has previously been used in the development of HRQoL tools for different diseases.[15,16,18] The process consisted of item identification, selection, and refinement.

2.1.1 | Item Identification

The item identification was based on qualitative research (review of textbook chapters and recent peer-reviewed literature) to ensure items were centered on hyperthyroidism and its management. The first draft of items was discussed with a focus group consisting of 11 veterinarians acting in both primary care and referral practice (3 diplomates of an EBVS accredited college, 2 primary care veterinarians, 6 internal medicine clinicians working at referral practices). The focus group was asked to give feedback on the structure of the preliminary draft and important domains, to assess if all important aspects of the disease were covered and if response options were clear and appropriate. Additionally, author of a previously published study on the development of a health-related quality-of-life tool in dogs with Cushing's disease[18] was interviewed about their opinion on the pilot draft.

2.1.2 | Item selection

All identified items were included as a question in a preliminary draft questionnaire. Item questions concerning similar components of HRQoL (eg, activity) were grouped together into domains. Each question had 2 sets of answers; 1 set asking about the frequency at which the item had an influence on owners' and cats' lives, and the second answer set assessing how strongly the item was perceived to affect HRQoL. Each answer set consisted of 5 answers ranging from never to very often, and not at all to very strongly, respectively. For questions where a quantifying answer was not deemed suitable, a binary answer set with "yes" and "no" was used.

The focus group again was asked to evaluate the preliminary draft questionnaire and assess its structure, completeness and wording of the questions and answers. According to the feedback, missing questions were added while superfluous questions were removed. The revised questionnaire was then reviewed by 1 of the coauthors (IS), with experience in veterinary epidemiology and QoL research, for its practicability in terms of statistical evaluation. The questionnaire was created in both German and English language. Cat owners, both German (n = 3) and English (n = 1) native speakers without medical background, assessed the comprehensibility of the questions.

Following the adjustments according to the received feedback, the final survey was uploaded into an online survey program (LimeSurvey GmbH, Hamburg, Germany) in both German and English (Appendixes A and B).

When completing the questionnaire, the owners were advised to relate their answers to questions assessing QoL to the period of past 4 weeks. In addition to the questions concerning the QoL, general demographic and health-related data about the cat such as age and the presence of any diseases (hyperthyroidism and/or other conditions) and

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their therapy were collected. Based on this information, cats were divided into HT-group (cats with hyperthyroidism) and NHT-group (cats without hyperthyroidism). All cats previously diagnosed with hyperthyroidism were included in the HT-group, irrespective of the treatment modality they have/had been treated with, in agreement with studies from human medicine assessing QoL of people with hyperthyroidism.[19,20] Information on the quality of control of hyperthyroidism (eu-/hypo-/hyperthyroidism) or other conditions the cat was suffering from at the time of questionnaire completion was not collected. As this was a cross-sectional study, follow-up information was not available. One question asked the owners to rate the overall QoL of their cat on a scale from very poor to very good, with 5 possible grades.

The questionnaire was made available online for owners of cats suffering from hyperthyroidism or other diseases as well as cats without any known diseases. There were no exclusion criteria regarding the eligible cats. However, responses were later excluded if they were incomplete, the answers to the survey referred to several animals or referred to an animal that had already died.

The survey was disseminated via social media, cat related discussion forums, website links, and flyers which were distributed at several veterinary practices. Answers were collected over a 3-month period (November 2021-January 2022) in German and over a 2-month period (December 2021-January 2022) in English language.

2.1.3 | Item refinement

To develop the finalized HyperthyroidismQoL-cat tool, the questions were refined based on statistical analysis of the questionnaire responses. Mann-Whitney *U* tests were performed on each item, comparing the results from HT-group and NHT-group. Items with at least weak evidence of a difference between the 2 groups ($P < .20$) were retained because these were deemed to specifically relate to the influence of hyperthyroidism on a cat's HRQoL.[18]

The internal consistency of the questionnaire was measured by Cronbach's alpha, using only the responses of the HT-group. Internal consistency indicated the reliability of the questions to measure the same latent concept[21]; in the context of the present study, the latent concept was "HRQoL." Cronbach's alpha was calculated using a 1-way repeated measure analysis of variance model, with HRQoL question responses functioning as the repeated measure.[22-24] Pearson's correlations (r) were examined in an interitem correlation matrix to assess how much each individual question response correlated with all included questions. Low correlations of item questions within the interitem matrix ($r < .30$) were deemed poor and those respective questions were removed if the overall Cronbach's alpha coefficient increased after removal.[15,25] Pairs of questions with $r > .60$ were deemed highly correlated, suggesting the same information was being captured twice, therefore falsely raising the internal consistency of the tool.[26] The question with the smallest effect on the Cronbach's alpha was removed. An overall Cronbach's alpha of $\alpha > .70$ for the retained questions was deemed an appropriate internal consistency.[22]

To further assess the reliability of the tool, the internal consistency of the prespecified subsets of the HRQoL tool questions (ie, domains) were examined with Cronbach's alpha to assess if there was correlation between the items within the domains.[27]

2.2 | Validation of the HyperthyroidismQoL-cat

2.2.1 | Evaluation of discriminatory power

After excluding the questions identified by the statistical analysis during the process of item refinement, the total HRQoL score for each cat was calculated from the answers to the remaining questions. Each of the 5 answer options of the 2 answer sets available for each question was assigned a score (never/not at all = 0, rarely/insignificantly = 1, sometimes/fairly = 2, often/strongly = 3, very often/very strongly = 4). For yes/no answer options, "yes" was assigned a score of 2.5 and "no" a score of 0. For each question, the respective score of each of the 2 answer sets was multiplied with each other. The scores of all the questions were added together for the total score.

The final HRQoL scores were described for the HT- and NHT-group. The distribution of the scores was assessed by visual inspection of histograms and by the means of Shapiro-Wilk test. Mann-Whitney-*U* test compared HRQoL scores between the HT- and NHT-group. To assess the influence of individual items on the score within the HT and NHT-group, the mean scores of each question were plotted in descending order, starting with the item/question having the largest effect (ie, highest mean score), as reported previously by Niessen et al.[15]

2.2.2 | Reliability

The reliability of owner completion of the HRQoL tool was assessed with inter- and intrarater reliability. To assess intrarater reliability, 11 owners completed the questionnaire twice within a month's interval concerning the same cat, without major changes in the cat's overall health. For the interrater reliability, 5 owner pairs completed the questionnaire concerning the same cat at the same time. Absolute paired score reliability was assessed with intraclass correlation coefficients (ICC) using 1-way random effect models and by Bland-Altman plots. ICC results were interpreted as poor (<0.50), moderate (0.50 to <0.75), good (0.75 to <0.90) and excellent (≥0.90) reliability.[28]

2.2.3 | Correlation with owner reported QoL

To assess the validity of the tool, the correlation of HRQoL tool scores and owners' assessment of their cat's QoL (based on the single question with 5 possible answers) were analyzed using Spearman's rho correlation (indicating the tool's construct validity). The correlation was considered weak, moderate or strong for rho <.3, rho between .3 and .6 and rho >.6, respectively.[29]

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2.2.4 | Influence of cofactors

The proportion of cats with comorbidities between the HT- and NHT-group was compared by Fisher's exact test. Mann-Whitney-*U* tests compared HRQoL scores of cats with and without hyperthyroidism by health status (presence of any comorbidity; presence of DM or CKD). The median HRQoL scores in cats of the HT-group were compared across different age groups (7-10 years, 11-14 years, >14 years),[30] time since diagnosis (<3 months, 4-6 months, 7- 12 months, 1-2 years, 2-4 years, >4 years), treatment modalities (no treatment, iodine-reduced food, RAIT, transdermal methimazole, oral methimazole, thyroidectomy), and treatment groups (no treatment, curative treatment, noncurative treatment) using Kruskal-Wallis test.

2.3 | Statistical software

The statistical software Stata 17.0 (Stata, TX, USA) and SPSS (IBM SPSS, version 26, IBM Germany GmbH, Germany) were used for the above-mentioned analyses and to plot the graphs.

3 | RESULTS

3.1 | Item identification

Twenty-five items grouped together in 5 domains were identified through literature search and discussion with the focus group (Appendix A).

3.2 | Item selection

Based on the feedback of the focus group, 3 questions were added, making it a total of 28 questions in the pilot draft (Appendix A). Two item domains (activity and behavior/emotions) were combined into the domain "activity and behavior" reducing the total number of domains to 4. One of the 28 questions was rephrased. For 3/28 questions, it was decided that a quantitative answer set addressing the frequency of the item using 5 options was not practical (eg, "Does your cat show signs of persistent weight loss?"). For these questions, a "yes" or "no" option was used instead. Questions (without the answers sets) included in the pilot draft and their domains are shown in Table 1. For a complete table of all questions and answer sets see Appendix A.

3.3 | Item refinement

3.3.1 | Questionnaire responses

There were 551 valid questionnaire responses, of which 229 (41.6%) were by owners of cats in the HT-group and 322 (58.4%) by owners of cats in the NHT-group. A total of 709 submitted forms were excluded due to 1 of the following: incomplete surveys (n = 694), completion of 1 form for multiple cats (n = 14) and the cat being deceased before submitting the form (n = 1).

The overall median age of the included cats was 10 years (range, 0-22; interquartile range [IQR], 4-14). Hyperthyroid cats had a median age of 14 years (range, 1.75-22; IQR, 12-13) and the NHT-group cats 5 years (range, 0-21; IQR, 2-9; $P < .001$). The distribution of HT- and NHT-group cats across age categories is illustrated in Figure 1.

Over 3 quarters (n = 426/551, 77.3%) of the questionnaires were completed in German, the remaining (n = 125/551, 22.6%) were returned in English; a list of the countries of residence of the participants can be viewed in Appendix C. Most owners were made aware of the questionnaire online through social media and discussion groups (n = 439/551, 79%).

3.3.2 | Statistical item refinement

When comparing owner responses between the HT- and NHT-group, no difference was observed in the responses to "owner injury" ($P = .32$), so this question was removed from the HRQoL tool. Pairs of highly correlated items were identified from within the interitem correlation matrix: "owner daily life" with "owner absence" ($r = .72$), "cat fur" and "cat coat" ($r = .74$), and "cat coat" and "cat grooming" ($r = .76$). "Owner absence" and "cat coat" were removed as these resulted in the least change in Cronbach's alpha coefficient. This retained 25 items within the final HRQoL tool (Appendixes A [English] and B [German]) which had an excellent internal consistency ($\alpha = .92$). Within item correlations for prespecified subsets of questions (ie, domains) also demonstrated good internal consistency; domain 1 describing "owner factors" ($\alpha = .81$), domain 2 describing cat "dietary, gastrointestinal and urinary signs" ($\alpha = .80$), domain 3 describing cat "appearance" ($\alpha = .73$) and domain 4 describing cat "activity and behavior" ($\alpha = .87$).

3.4 | Validation of the HyperthyroidismQoL-cat

3.4.1 | Evaluation of discriminatory power

The final HRQoL tool produced a score between 0 and 382, zero being the best possible HRQoL and 382 the worst. The median HRQoL score for HT-group (87.5; range, 2-348; IQR, 58-130.5) was significantly higher than in the NHT-group (27; range, 0-249; IQR, 10-51), indicating worse HRQoL in hyperthyroid cats ($P < .001$). Distribution of HRQoL scores in cats of the HT- (n = 229) and NHT-group (n = 322) is shown in Figure 2.

All but 1 hyperthyroid cat was older than 7 years (Figure 1). When cats aged less than 7 years were excluded to preserve age matching, median HRQoL score in the NHT-group was 36 (range, 1-249; IQR, 18.5-77.5), which was still significantly lower when compared to the HT-group (87.5; range, 2-348; IQR, 58-130.5; $P < .001$).

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TABLE 1 Table of all 28 questions (with their short titles and the domains in bold) included in the pilot draft that were published online to be completed by cat owners.

Item	Question
Owner related	
1. "Daily life"	Due to your cat's health condition and/or its therapy, do you feel restricted in your daily life?
2. "Absences"[a]	Do you refrain from longer absences from home (vacations, visits) during which an external care of your cat would be necessary due to the state of health of your cat and/or its therapy?
3. "Emotional burden"	Does your cat's health condition and/or its therapy impose an emotional burden on you?
4. "Risk of injury"[a]	Is there an increase in injuries on your part (scratches, bites, etc.) when handling your cat (such as administering medication, playing, etc.)?
5. "Financial burden"	Does your cat's health condition and/or its treatment impose a financial burden for you?
6. "Medical treatment"	Are you concerned about whether you are performing your cat's medical treatments correctly?
7. "Side effects"	Are you concerned about any side effects of the medical therapy, that your cat could suffer from?
8. "Follow-ups"	Are necessary medical follow-ups a burden for you?
Cat-related: Gastrointestinal, dietary, urination	
9. "Appetite"	Have you noticed a change (increase or decrease) in your cat's appetite?
10. "Drinking behavior"	Does your cat show a change in its drinking behavior?
11. "Weight"[b]	Does your cat show signs of persistent weight loss?
12. "Nutritional condition"	Does your cat show variations in its nutritional condition?
13. "Vomiting"	Does your cat show vomiting?
14. "Diarrhea"	Does your cat suffer from diarrhea?
15. "Urination"	Does your cat show a change in urination behavior?
Cat-related: Appearance	
16. "Fur quality"[b]	Is your cat's fur less shiny?
17. "Coat"[a]	Does the coat of your cat look unkempt (scaly, matted, rough)?
18. "Grooming behavior"	Does your cat show decreased grooming behavior?
19. "Muscle score"[b]	Does your cat show reduced strength/muscling?
Cat-related: Emotions[c]	
20. "Mood"	Do you feel that your cat's mood has altered through its health condition and/or its treatment?
21. "Affection"	Has your cat's affection or attachment toward you changed?
22. "Stress"	Does your cat seem stressed more frequently?
23. "Sleeping behavior"	Does your cat show an altered resting and sleeping behavior?
24. "Behavior"	Is your cat increasingly withdrawn?
25. "Treatment stress"	Does your cat seem stressed due to a required medical therapy?
Cat-related: Activity and behavior[c]	
26. "Playing behavior"	Does your cat show a decrease in playing behavior?
27. "Environment"	Does your cat show less interest in its environment?
28. "Activity"	Has your cat changed in its activity?

Note: Questions that were eliminated during item refinement, questions with a "yes" or "no" answer set, and domains that were merged are marked using superscripts explained in the table footnote.
[a]Question was removed during the item refinement process.
[b]Question has a "yes" or "no" answer set.
[c]Domains were merged into "activity and behavior."

3.4.2 | Reliability

When assessing the reliability of the HRQoL tool, the intrarater ICC was 0.86 (95% CI 0.58-0.96; n = 11), indicating very good reliability between HRQoL scores assessed by the same owner at 2 time points. The Bland Altman plot (Figure 3) indicated that intrarater reliability is best at low HRQoL scores (when HRQoL is good). As the HRQoL scores increased (worse HRQoL), the difference between the HRQoL scores assigned by the same owner at 2 timepoints was greater, suggesting lower intrarater reliability at

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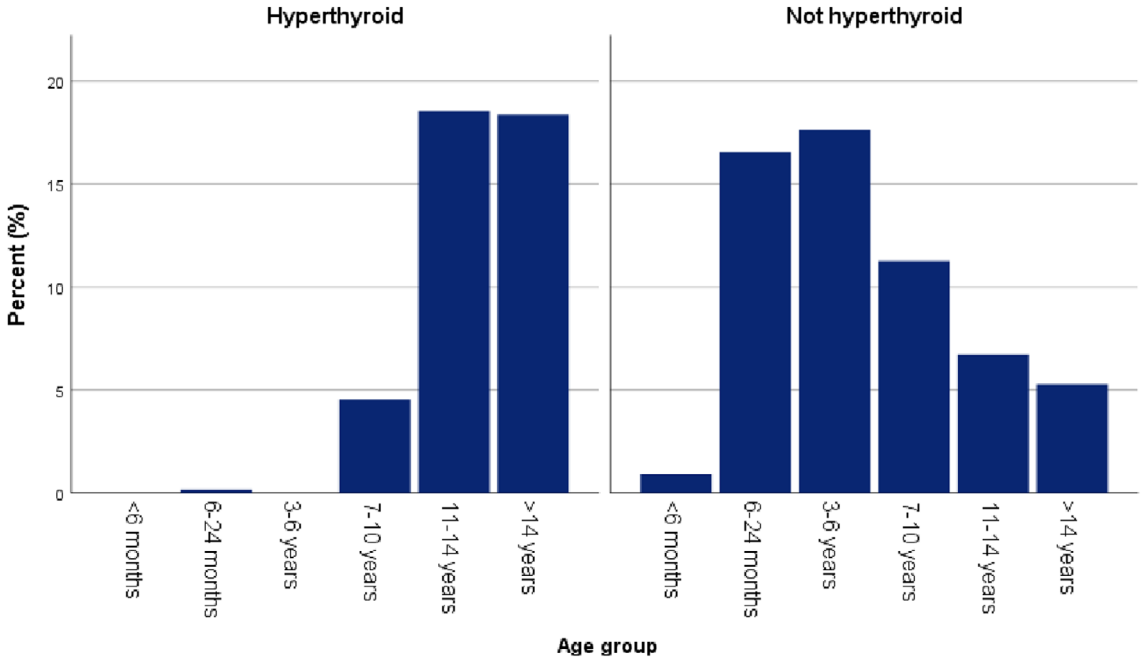

FIGURE 1 Histograms showing the distribution of cats across the age categories within the hyperthyroid (n = 229) and nonhyperthyroid (n = 322) group.

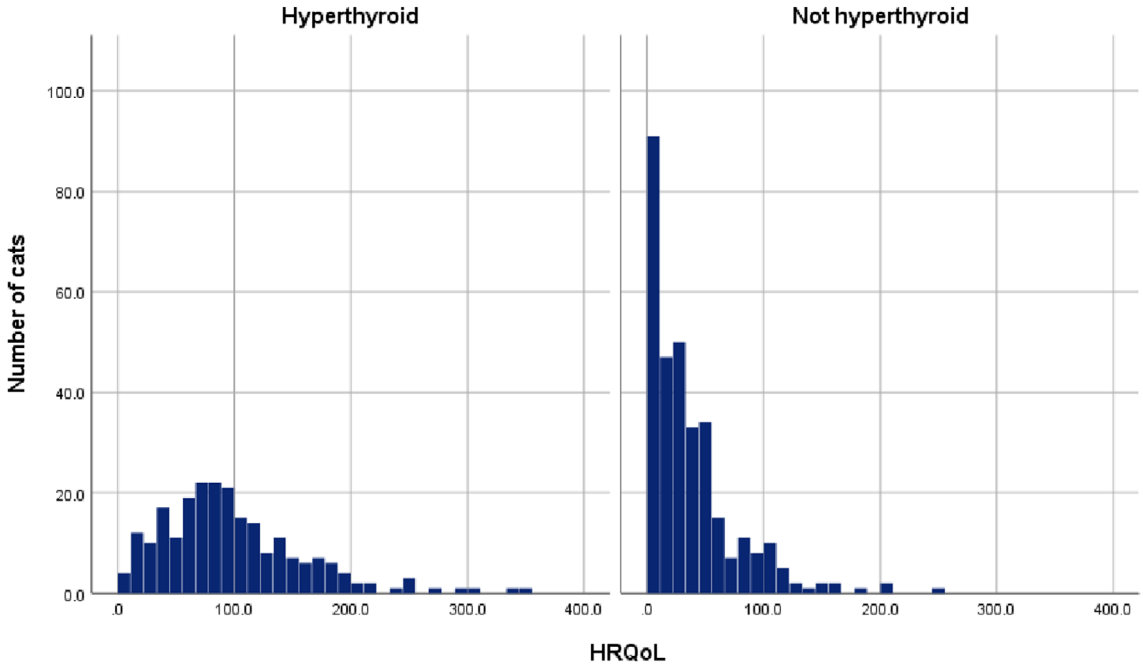

FIGURE 2 Histograms showing the distribution of health-related quality-of-life (HRQoL) scores in cats with (n = 229) and without hyperthyroidism (n = 322).

higher HRQoL scores. However, only a small number of cats assessed had a poor HRQoL.

Interrater agreement had an ICC of 0.94 (95% CI 0.63-0.99; n = 5), indicating excellent agreement between HRQoL scores assigned by 2 owners to the same cat at the same timepoint. The Bland Altman plot (Figure 4) indicates that there is excellent inter-rater reliability at low HRQoL scores. Only 1 cat had a high HRQoL score, therefore conclusions cannot be made for high HRQoL scores.

3.4.3 | Correlation with owner reported QoL

Owners of cats in the NHT-group generally rated their cat's QoL better than owners of cats in the HT-group (Figure 5).

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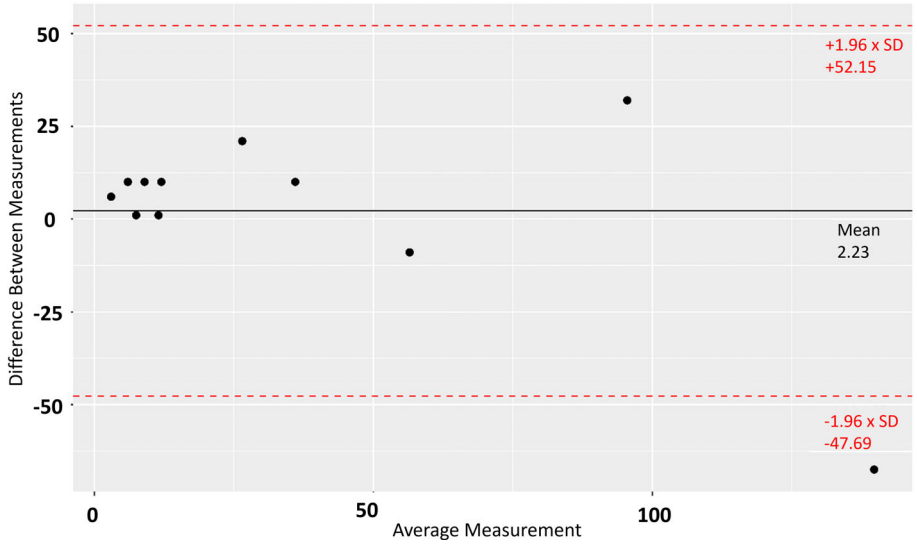

FIGURE 3 Bland Altman plot showing the difference of scores assigned by 11 owners answering the questionnaire at 2 timepoints 1 month apart. Solid horizontal line represents mean difference of HRQoL scores at the 2 timepoints. Dashed horizontal lines represent limits of agreement, defined as the mean difference ±1.96 SD of differences. The plot indicates that the difference becomes greater with higher (ie, worse) health-related quality-of-life (HRQoL) scores.

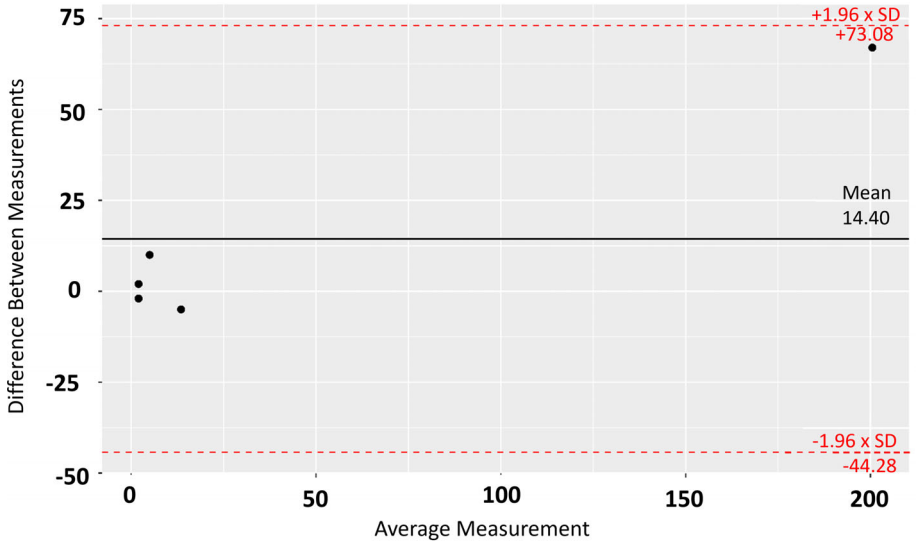

FIGURE 4 Bland Altman plot showing the difference of the health-related quality-of-life (HRQoL) score of 2 owners concerning the same cat at the same timepoint (n = 5 owner pairs). Solid horizontal line represents mean difference of HRQoL scores of the 2 owners. Dashed horizontal lines represent limits of agreement, defined as the mean difference ±1.96 SD of differences. The difference is small at low HRQoL scores, only 1 cat had a high HRQoL score.

There was a high positive correlation between the HRQoL score of hyperthyroid cats and owners' perceived overall QoL of their cat (Spearman's rho = .68, $P < .001$; Figure 6).

3.4.4 | Influence of cofactors

Effect of comorbidities on HRQoL scores in both hyperthyroid and nonhyperthyroid cats

Out of 551 cats, 270 (49%) had comorbidities other than hyperthyroidism, with 30 owners (3/30 in the HT-group and 27/30 in the NHT-group) not answering this question. The number of cats with each comorbidity and their distribution between the HT- and NHT-groups is shown in Table 2. Of the 270 cats with comorbidities, 61 suffered from multiple conditions (≥2). The proportion of cats with comorbidities (any comorbidity) was higher in the HT-group than in the NHT-group, with a higher proportion of cats with dental disease, CKD, gastrointestinal disease, and musculoskeletal disorder in the HT-group (Table 2). Other comorbidities did not differ in their frequency between these 2 groups (Table 2). Information about the treatment of comorbidities is provided in Table 3.

Median HRQoL scores of NHT-group cats differed between those with a comorbidity (50; range, 5-249; IQR, 28-87) and those without (15; range 0-96; IQR, 6-29; $P < .001$; Figure 7). Such a difference was also seen in the HT-group cats (with comorbidity: 94; range, 6-348; IQR, 71-151; without comorbidity: 75; range, 2-254.5; IQR, 49-118; $P = .004$; Figure 7); this was also true for specific comorbidities, DM, and CKD (Table 4). The HRQoL scores of HT-group cats without comorbidities (75; range, 2-254.5; IQR, 49-118) were significantly higher than HRQoL scores of NHT-group with comorbidities (50; range, 5-249; IQR, 28-87; $P = .001$).

Because clinical signs of DM, CKD and hyperthyroidism are similar,[31] the effect of these comorbidities on HRQoL was evaluated separately. There was no significant difference in the median HRQoL scores of 222 nondiabetic cats with hyperthyroidism (87.0, IQR 57.0-129.0) and a group of 9 nonhyperthyroid cats with

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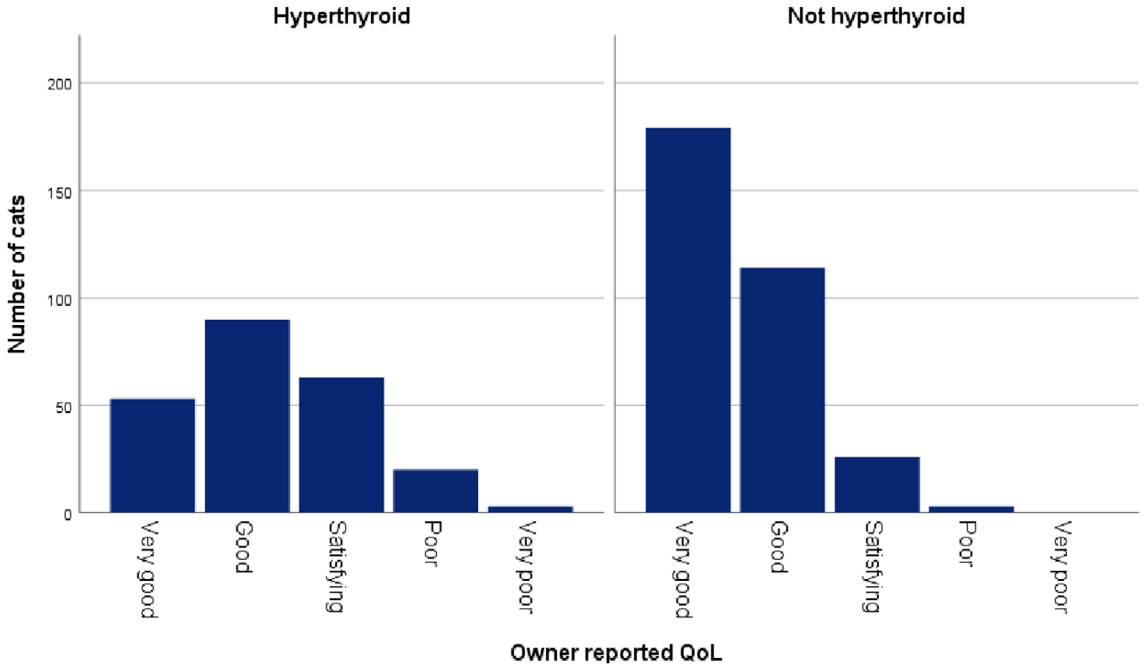

FIGURE 5 Histograms showing the owner perceived quality-of-life of their cats for hyperthyroid cats (n = 229) and nonhyperthyroid cats (n = 322).

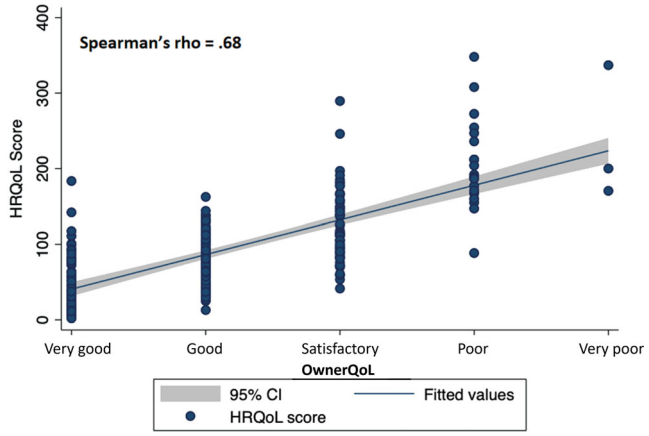

FIGURE 6 Correlation of owner rated quality-of-life (very good to very poor) and health-related quality-of-life (HRQoL) score totals in cats with hyperthyroidism (n = 229). Spearman's rho showed a strong correlation (rho = .68).

DM (59, IQR 53-85.5; $P = .35$). There also was no difference in median HRQoL scores of 195 non-CKD cats with hyperthyroidism (81.0, IQR 52.0-119.0) and a group of 19 nonhyperthyroid cats with CKD (72; range, 19-249; IQR, 35.5-106; $P = .29$).

Effect of age, disease duration, treatment modality, and comorbidities on HRQoL scores in hyperthyroid cats

The effect of age, time since diagnosis, treatment modality and comorbidities in the 229 hyperthyroid cats is summarized in Table 4. In cats treated with RAIT (n = 32), there were 6 cats treated <1 month prior to questionnaire completion; in all other cats more than 1 month elapsed since treatment (1-3 months: n = 4; 3-6 months: n = 7; 6-12 months: n = 6; 1-2 years: n = 5; 2-4 years: n = 1; >4 years: n = 2), but in 1 cat, the owner did not answer this question. Both cats treated with thyroidectomy were treated 2-4 years prior to questionnaire completion.

No differences in HRQoL scores were detected across different age groups ($P = .31$) or when cats were grouped based on time since diagnosis ($P = .58$), treatment modalities ($P = .07$) or into curative/noncurative and no treatment ($P = .16$; Table 4). The presence of comorbidities, however, had an effect on HRQoL (Table 4, Figure 7).

When looking at the mean scores of all questions, "side effects" had the highest mean score followed by the questions "appetite" and "emotional burden." "Emotional burden" also had the highest mean score in nonhyperthyroid cats. The lowest mean scores were noted for the questions "behavior," "affection" and "diarrhea" (Figure 8). The mean score was higher for the HT-group when compared to NHT-group in every question (Figure 8).

4 | DISCUSSION

This study developed and validated a questionnaire to assess the HRQoL in cats with hyperthyroidism. The final HyperthyroidismQoL-cat tool consisted of 25 questions and was shown to have a good internal consistency and validity, as well as a very good intra- and excellent interrater reliability. The very high internal consistency indicates the reliability of the questions to measure the same latent concept,[21] in this study the HRQoL of cats with hyperthyroidism.

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TABLE 2 Distribution of comorbidities in the HT-group (hyperthyroid cats) and NHT-group (cats without hyperthyroidism) in cats with known status for comorbidity (n = 521), with significant *P*-values shown in bold letters.

Comorbidity	Total, n (%)	HT-group, n (%)	NHT-group, n (%)	*P*-value
Cats with known comorbidity status	521	226	295	
No comorbidity	251 (48.2%)	88 (38.9%)	163 (55.3%)	**<.001**
Any comorbidity	270 (51.8%)	138 (61.1%)	132 (44.8%)	
Dental disease	67 (12.9%)	42 (18.6%)	25 (8.5%)	**<.001**
Chronic kidney disease	53 (10.2%)	34 (15.0%)	19 (6.4%)	**<.001**
Gastrointestinal disease	50 (9.6%)	30 (13.3%)	20 (6.8%)	**.016**
Musculoskeletal disorder	49 (9.4%)	29 (12.8%)	20 (6.8%)	**.023**
Cardiac disease	29 (5.6%)	14 (6.2%)	15 (5.1%)	.7
Respiratory tract disease	22 (4.2%)	10 (4.4%)	12 (4.1%)	.83
Urinary tract disease	22 (4.2%)	8 (3.5%)	14 (4.8%)	.66
Diabetes mellitus	16 (3.1%)	7 (3.1%)	9 (3.1%)	1.0
Skin disease	11 (2.1%)	5 (2.2%)	6 (2.0%)	1.0
FIV or FeLV	4 (.8%)	2 (.9%)	2 (.7%)	1.0
Not further classified	40 (7.7%)	18 (8.0%)	22 (7.5%)	.87

Abbreviations: FeLV, feline leukemia virus; FIV, feline immunodeficiency virus.

Treatment modality	All cats (n = 270)	HT-group (n = 138)	NHT-group (n = 132)
Tablets given regularly	72 (26.7%)	33 (23.9%)	39 (29.5%)
Regular injections	29 (10.7%)	15 (10.9%)	14 (10.6%)
Diet	34 (12.6%)	17 (12.3%)	17 (12.9%)
Unspecified medication	45 (16.7%)	16 (11.6%)	29 (22.0%)
No treatment	85 (31.5%)	52 (37.7%)	33 (25.0%)
No answer	5 (1.8%)	5 (3.6%)	0

TABLE 3 Description of treatment in the 270 cats with comorbidities other than hyperthyroidism in the HT- and NHT-group.

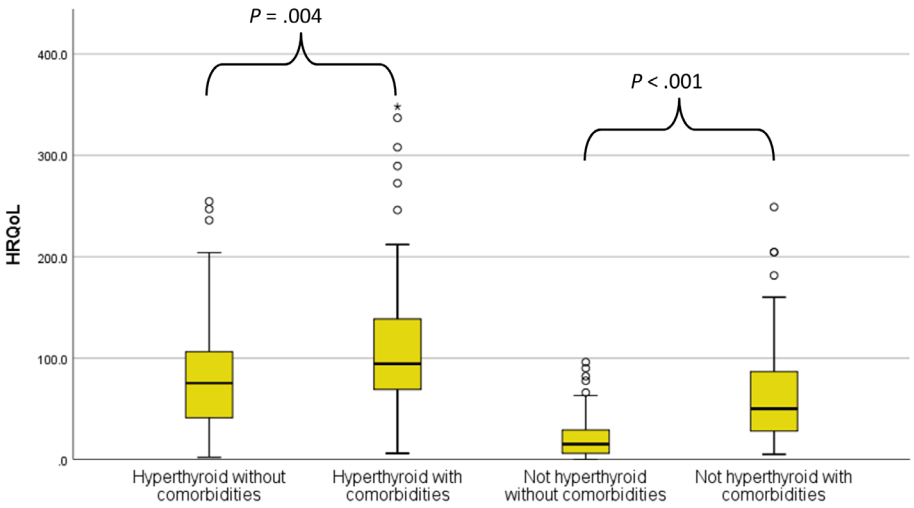

FIGURE 7 Box whisker plots depicting health-related quality-of-life (HRQoL) scores grouped by presence of hyperthyroidism and comorbidities. Boxes represent the interquartile range (IQR), the bold line within the box shows the median value, the whiskers denote the range extending out to 1.5 × IQR, and data points that were >1.5 × IQR are shown as circles with the asterisk representing an extreme value.

Assessment of interrater and intrarater agreement indicated reliability of owner completion of HyperthyroidismQoL-cat.

There was a high correlation between owners' overall assessment of the QoL of their cats and the HRQoL measured by the HyperthyroidismQoL-cat tool, suggesting that the questionnaire adequately reflects the HRQoL of these cats. Owners of hyperthyroid cats generally rated their cats QoL as poorer than owners of nonhyperthyroid cats. Similarly, hyperthyroid cats had significantly higher HRQoL scores in comparison to nonhyperthyroid cats, indicating poorer HRQoL in hyperthyroid cats. This shows that the HyperthyroidismQoL-cat is sensitive to detect and quantify the effect of hyperthyroidism on the HRQoL of affected cats, and that the

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TABLE 4 Assessment of the effect of age, time since diagnosis, treatment modality, treatment group and the presence of comorbidity on health-related quality-of-life (HRQoL) scores in cats with hyperthyroidism (n = 229), with significant *P*-values shown in bold letters.

Variable	Category	Number of cats	Median HRQoL score (range)	*P*-value
Age (years) n = 228[a]	7-10 years	25	78 (2-348)	.31
	11-14 years	102	81 (6-308)	
	>14 years	101	93 (11.5-337)	
Time since diagnosis n = 228	<3 months	21	90.5 (21-272.5)	.58
	4-6 months	21	81 (6-185)	
	7-12 months	47	89.5 (31-348)	
	1-2 years	68	85 (2-289.5)	
	2-4 years	53	88 (6-337)	
	>4 years	18	74 (13-197)	
Treatment n = 225	Iodine-reduced food	3	109 (59-204)	.09
	No treatment	7	104 (73-167)	
	Radioiodine therapy	32	77 (8-272.5)	
	Transdermal methimazole	36	106 (14-348)	
	Oral methimazole	145	87 (2-337)	
	Thyroidectomy	2	35 (32.5-37.5)	
Treatment grouped n = 225	No treatment	7	104 (73-167)	.16
	Curative	34	73 (8-272.5)	
	Noncurative	184	89 (2-348)	
Comorbidity n = 226	Yes	138	94 (6-348)	**.004**
	No	88	75 (2-254.5)	
Diabetes present n = 229	Yes	7	114 (74-289.5)	**.04**
	No	222	87 (2-348)	
CKD present n = 229	Yes	34	114 (13-289.5)	**<.001**
	No	195	81 (2-348)	

Note: The number of cats for which the presence/absence of the assessed factor was known is given for each variable.
[a]1 cat aged less than 7 years was excluded because such small group size of 1 was deemed unsuitable for statistical analysis.

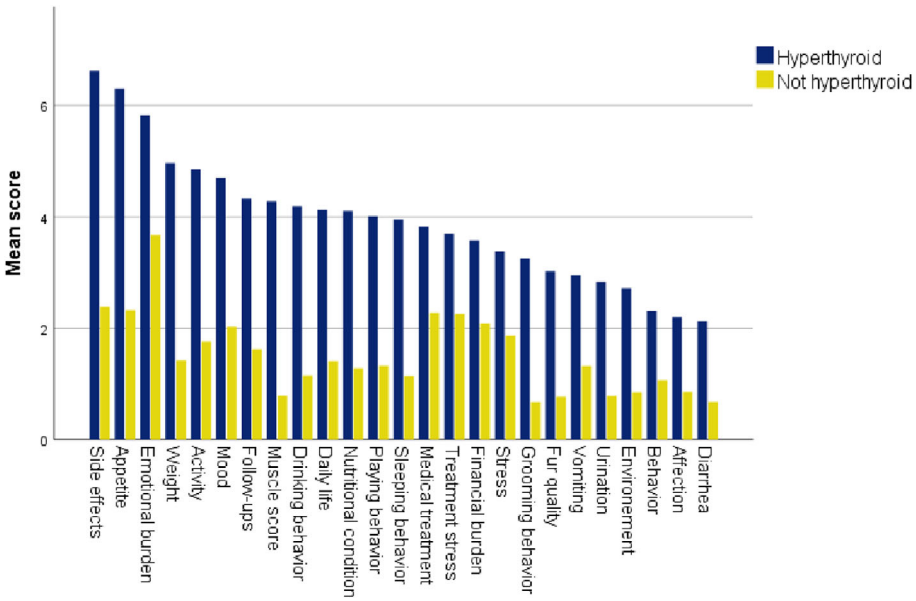

FIGURE 8 Column chart illustrating the mean score of each question included in the quality-of-life tool. Mean scores of hyperthyroid cats (n = 229) are represented by blue bars and those of nonhyperthyroid cats (n = 322) by yellow bars.

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disease has a negative effect on the HRQoL. Interestingly, certain questions related to clinical signs of hyperthyroidism commonly described in the literature, such as diarrhea and changed affection toward the owner,[2] were among the 3 items with the lowest mean scores while questions from the domain "owner" (side effects, emotional burden) were among the 3 items with the highest mean scores. Although this might indicate that the questionnaire places a rather high value on the "owner" domain, which does not necessarily reflect the HRQoL of the cat, the owner's distress can have a substantial effect on therapy decisions, including the decision to euthanize, and should certainly be considered.[32] Owner-related items also had a major effect on HRQoL assessment using other QoL tools such as the DIAQoL-pet used in diabetic cats.[15]

There was no difference in HRQoL scores regarding the age of the affected cats or time since diagnosis. This indicates that the HRQoL described by the HyperthyroidismQoL-cat is specific to hyperthyroidism irrespective of the age or stage of the disease. A large proportion of the cats (n = 138/229, 60.3%) with hyperthyroidism in this survey also suffered from another disease. Since hyperthyroidism mostly affects older cats, this is not unexpected. These comorbidities are also expected to have measurable influence on the HRQoL, which is reflected by the higher HRQoL score of hyperthyroid cats with a comorbidity than those suffering from hyperthyroidism only. Also, among nonhyperthyroid cats, those with another disease had higher HRQoL scores than those without any owner-reported pathological conditions. When looking specifically at conditions with similar clinical presentation to hyperthyroidism such as DM and CKD, there was no significant difference in the HRQoL of hyperthyroid cats when compared to those suffering from 1 of these conditions but not hyperthyroidism. This might be due to the small number of cats that suffered from either DM (n = 9) or CKD (n = 19) but not hyperthyroidism in the present study, making this analysis underpowered. This finding might also indicate that the HyperthyroidismQoL-cat tool is not specific for hyperthyroidism when considering diseases with similar clinical signs. Effect of other diseases might be difficult to avoid when designing HRQoL tools for specific conditions, as cats exhibit only a small range of clinical signs with any kind of disease, leading to a considerable overlap in clinical presentation of several conditions.[31] Previous studies concerning the development of disease-specific QoL tools in cats did not examine the influence of comorbidities, therefore, an influence of comorbidities on other validated tools cannot be excluded.[15,16,33] However, QoL tools not affected by the presence of concurrent disease (ie, specific to the disease of interest) do exist in veterinary medicine, for example, tool evaluating QoL in dogs with Cushing's disease.[18] This, however, is a condition with relatively specific clinical signs (polyuria, polydipsia, polyphagia, coat changes). Furthermore, the HyperthyroidismQoL-cat tool included items relevant to any disease requiring drug administration and owner's commitment. While the mean score of the questions "medical treatment" and "treatment stress" were only in the middle range of scores (ie, indicating moderate effect) achieved across the included items, the questions "side effects" and "follow-ups" had a rather high effect. These questions can increase the HRQoL score due to the presence of any disease, since side effects and follow-ups are not limited to hyperthyroidism. In clinical settings, however, disease specificity of a HRQoL tool might not be necessary as the place of such tools is not in aiding diagnosis, but in assessment of the influence of the specific disease and its management on the HRQoL of the cat (and owner). Furthermore, as the primary aim of using the HyperthyroidismQoL-cat tool is its use in disease monitoring over time, the effect of other comorbidities on the HRQoL score might be negligible, if they are stable. This, however, cannot be evaluated from the present study given its cross-sectional design. Assessment of HRQoL in addition to the objective parameters of disease control (eg, TT4 in hyperthyroid cats) facilitates holistic approach to disease management, which is particularly important when treating chronic conditions.[34] Inclusion of validated QoL-tools in decision making in companion animal medicine is an essential part of successful treatment.

Effect of treatment modality on HRQoL did not reach statistical significance, which was surprising as owner-centered questions also were included and were among those with the highest mean scores, indicating negative effect on QoL. We expected cats requiring daily medication to have poorer HRQoL when compared to cats who were treated by RAIT or thyroidectomy.[3] However, the outcome of RAIT or thyroidectomy in these cats was not assessed in the present study and it is possible that some cats remained hyperthyroid or became hypothyroid, which might have negatively affected HRQoL in at least a proportion of these cats. Furthermore, in some RAI-treated cats, not enough time might have elapsed between treatment and time of questionnaire completion to allow for RAIT to become effective. Due to the small number of cats that have received curative treatment (RAIT: n = 32; surgery: n = 2) in the present study, this analysis was underpowered to identify a possible true difference compared to those receiving noncurative treatment. Using the data of this study and assuming the same cross-sectional design, it is estimated that a minimum of 120 cats receiving curative treatment and 600 cats receiving noncurative treatment would be needed to detect a statistical difference with 80% power. Some human medicine studies reported similar findings, showing no difference in QoL between treatment modalities in hyperthyroid patients.[19,20] One study was able to show an improvement in QoL of hyperthyroid humans treated surgically when compared to medical treatment,[9] while another reported worse QoL in RAI-treated patients in comparison to those treated surgically or receiving antithyroid drugs.[35] Even after reaching euthyroidism, QoL in humans remains reduced for a long time in comparison to healthy population.[11,20] As the present study was cross-sectional, the HRQoL before and after treatment (either curative or palliative) could not be compared, but this would certainly be of interest.

The design of the HyperthyroidismQoL-cat tool makes it feasible to be used by practitioners as the calculations are rather easy and can be done with a computer program as well as on paper, and owners can complete the survey at home on their own time.[36] There was no recording of the time it took owners to complete the questionnaire, but its length is comparable to other published QoL tools.[33,37,38] However, a number of owners did not finish the survey, which might

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be because of the time needed for its completion. Another advantage of the questionnaire is the inclusion of 2 answer sets, allowing both qualitative and quantitative grading of each item. The resulting score is thus much more individualized, as not every clinical sign negatively affects every cat or its owner to the same extent.

This study has some limitations. As with any questionnaire-based studies, there is a risk of bias due to incorrect or altered recall of the respondents (recall bias).[39] Because owners were aware of the purpose of the study, they might have been tempted to choose answers that are more in line with their preconceived opinion on the HRQoL of their cat (demand characteristics), which can influence chosen answers.[40] An attempt was made to minimize the bias of demand characteristics by only asking for change, without negative or positive wording. Furthermore, most answers were received from owners who found out about the study from online sources, especially through social media. Therefore, groups with no access to internet are likely underrepresented, representing a sampling bias.[39] There might also be a sampling bias toward owners who were more likely to search online about their cat's condition and were more aware of their cat's behavior, clinical signs, and treatment. Since respondents did not receive any incentive for participation, responses from people not strongly interested in their cat might also be underrepresented. People who are not very interested in their cat and its disease are more likely to abandon the questionnaire, therefore leading to a nonresponse bias. A limitation of the tool itself is that it can be influenced by comorbidities and can therefore only be used as long as possible comorbidities remain stable. Another limitation of this study is the lack of information about the quality of control of hyperthyroidism at the time of questionnaire completion (ie, it is not known whether the cats were eu-, hypo- or hyperthyroid).

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CONFLICT OF INTEREST DECLARATION

Authors declare no conflict of interest.

OFF-LABEL ANTIMICROBIAL DECLARATION

Authors declare no off-label use of antimicrobials.

INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC) OR OTHER APPROVAL DECLARATION

Authors declare no IACUC or other approval was needed.

HUMAN ETHICS APPROVAL DECLARATION

Authors declare human ethics approval was not needed for this study.

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APPENDIX A

TABLE OF ALL QUESTIONS THAT WERE PUBLISHED ONLINE FOR THE ITEM REFINEMENT

Item	Question	Sub question	Answer sets
Owner related			
1. Daily life	Due to your cat's health condition and/or its therapy, do you feel restricted in your daily life?	How often do you feel restricted by this?	• Very often • Often • Sometimes • Rarely • Never
		How strongly are you affected by these restrictions?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
2. Absences[a,b]	Do you refrain from longer absences from home (vacations, visits) during which an external care of your cat would be necessary due to the state of health of your cat and/or its therapy?	How often do you feel restricted by this?	• Very often • Often • Sometimes • Rarely • Never
		How strongly are you affected by these restrictions?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
3. Emotional burden	Does your cat's health condition and/or its therapy impose an emotional burden on you?	How often do you feel emotionally burdened by this?	• Very often • Often • Sometimes • Rarely • Never
		How strongly do you feel affected by this?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
4. Risk of injury[a]	Is there an increase in injuries on your part (scratches, bites, etc.) when handling your cat (such as administering medication, playing, etc.)?	How often do these incidents occur?	• Very often • Often • Sometimes • Rarely • Never
		How burdened do you feel because of it?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
5. Financial burden	Does your cat's health condition and/or its treatment impose a financial burden for you?	How often do you feel burdened by this?	• Very often • Often • Sometimes • Rarely • Never
		How strongly are you burdened by this?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all

(Continues)

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Item	Question	Sub question	Answer sets
6. Medical treatment	Are you concerned about whether you are performing your cat's medical treatments correctly?	How often are you concerned about this?	• Very often • Often • Sometimes • Rarely • Never
		How strongly do you feel concerned about this?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
7. Side effect	Are you concerned about any side effects of the medical therapy that your cat could suffer from?	How often are you concerned about this?	• Very often • Often • Sometimes • Rarely • Never
		How strongly do you feel concerned about this?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
8. Follow-ups[c]	Are necessary medical follow-ups a burden for you?	How often do you feel burdened by this?	• Very often • Often • Sometimes • Rarely • Never
		How strongly are you burdened by this?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
Cat related: Gastrointestinal, dietary, urination			
9. Appetite	Have you noticed a change (increase or decrease) in your cat's appetite?	How often does your cat show a changed appetite?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is the change of your cat's appetite?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
10. Drinking behavior[c]	Does your cat show a change in its drinking behavior?	How often does your cat show this change in behavior?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is the change of your cat's drinking behavior?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
11. Weight[d]	Does your cat show signs of persistent weight loss?	Does this statement apply to your cat?	• Yes • No
		How pronounced is the weight change of your cat?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all

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Item	Question	Sub question	Answer sets
12. Nutritional condition	Does your cat show variations in its nutritional condition?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced are the changes in your cat's nutritional condition?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
13. Vomiting	Does your cat show vomiting?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How much do you feel this affects the quality of life of your cat?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
14. Diarrhea	Does your cat suffer from diarrhea?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How much do you feel this impact the quality of life of your cat?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
15. Urination[c]	Does your cat show a change in urination behavior?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How much has your cat's urination behavior changed?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
Cat related: Appearance			
16. Fur quality[d]	Is your cat's fur less shiny?	Does this statement apply?	• Yes • No
		How pronounced is this change in your cat's fur?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
17. Coat[a]	Does the coat of your cat look unkempt (scaly, matted, rough)?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is this change in your cat's coat?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all

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Item	Question	Sub question	Answer sets
18. Grooming behavior	Does your cat show decreased grooming behavior?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How strongly diminished is the grooming of your cat?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
19. Muscle score[d]	Does your cat show reduced strength/muscling?	Does this statement apply?	• Yes • No
		How strongly reduced is your cat in its strength/muscling?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
Cat related: Behavior and emotions[e]			
20. Mood	Do you feel that your cat's mood has altered through its health condition and/or its treatment?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is this change in your cat's mood?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
21. Affection	Has your cat's affection or attachment toward you changed?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is this change in your cat's affection or attachment?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
22. Stress	Does your cat seem stressed more frequently?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is this change in your cat's behavior?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
23. Sleeping behavior	Does your cat show an altered resting and sleeping behavior?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is this change in your cat's behavior?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all

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Item	Question	Sub question	Answer sets
24. Behavior	Is your cat increasingly withdrawn?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is this change in your cat's behavior?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
25. Treatment stress	Does your cat seem stressed due to a required medical therapy?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is this level of stress?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
Cat related: Activity[e]			
26. Playing behavior	Does your cat show a decrease in play behavior?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How strongly is the play behavior of your cat decreased?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
27. Environment	Does your cat show less interest in its environment?	How often does this statement apply?	• Very often • Often • Sometimes • Rarely • Never
		How strongly is the interest of your cat decreased?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all
28. Activity	Has your cat changed in its activity?	How often do you observe this change in behavior?	• Very often • Often • Sometimes • Rarely • Never
		How pronounced is the change in your cat's activity?	• Very strongly • Strongly • Fairly • Insignificantly • Not at all

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Item	Question	Sub question	Answer sets
General QoL			
	How would you rate your cat's quality of life in general?		• Very poor • Poor • Satisfying • Good • Very good

[a] Questions that were removed after statistical analysis of during item refinement.
[b] Questions that were reworded based on feedback from the focus group prior to making the survey available online.
[c] Questions that were added during item selection based on feedback from the focus group.
[d] Questions where one of the answer sets has been changed to yes or no based on feedback from the focus group prior to making the survey available online.
[e] The 2 domains that were merged together based on feedback from the focus group prior to making the survey available online.

APPENDIX B

TABELLE DER 25 FRAGEN WELCHE NACH DER STATISTISCHEN ANALYSE IN DER FINALEN UMFRAGE ENTHALTEN SIND

Item	Frage	Teilfrage	Antwortmöglichkeiten
Besitzer orientiert			
1. Alltag	Fühlen Sie sich auf Grund des Gesundheitszustandes Ihrer Katze und/oder deren Therapie in der Gestaltung Ihres Alltages eingeschränkt?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark fühlen Sie sich dadurch eingeschränkt?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
2. Emotionale Belastung	Ist der Gesundheitszustand Ihrer Katze und/oder deren Behandlung eine emotionale Belastung für Sie?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark fühlen Sie sich deswegen emotional belastet?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
3. Finanzielle Belastung	Stellt der Gesundheitszustand Ihrer Katze und/oder deren Behandlung eine finanzielle Belastung für Sie dar?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark ist die entstehende finanzielle Belastung?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht

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Item	Frage	Teilfrage	Antwortmöglichkeiten
4. Medizinische Behandlung	Machen Sie sich Sorgen darüber, ob Sie die medizinischen Behandlungen Ihrer Katze korrekt durchführen?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark fühlen Sie sich deswegen belastet?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
5. Nebenwirkungen	Machen Sie sich Sorgen darüber, dass Ihre Katze unter Nebenwirkungen einer medizinischen Therapie leiden könnte?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark fühlen Sie sich deswegen belastet?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
6. Kontrolluntersuchungen[a]	Stellen notwendige medizinische Kontrolluntersuchungen eine Belastung für Sie dar?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark fühlen Sie sich deswegen belastet?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
Katzen bezogen: Gastrointestinal, Diätetisch, Harnabsatzverhalten			
7. Appetit	Zeigt Ihre Katze einen veränderten Appetit?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie ausgeprägt ist die Veränderung des Appetits Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
8. Trinkverhalten	Zeigt Ihre Katze ein verändertes Trinkverhalten?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark hat sich das Trinkverhalten Ihrer Katze verändert?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
9. Gewicht[b]	Hat sich das Gewicht Ihrer Katze anhaltend verändert?	Trifft diese Aussage zu?	• Ja • Nein
		Wie stark hat sich das Gewicht Ihrer Katze verändert?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht

(Continues)

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Item	Frage	Teilfrage	Antwortmöglichkeiten
10. Ernährungszustand	Hat Ihre Katze Schwankungen in ihrem Ernährungszustand?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark ausgeprägt sind die Schwankungen des Ernährungszustandes Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
11. Übelkeit	Zeigt Ihre Katze Erbrechen?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark scheint dies die Lebensqualität Ihrer Katze zu beeinträchtigen?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
12. Durchfall	Leidet Ihre Katze an Durchfall?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark scheint dies die Lebensqualität Ihrer Katze zu beeinträchtigen?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
13. Harnabsatz[a]	Zeigt Ihre Katze eine Veränderung im Harnabsatzverhalten?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark hat sich das Harnabsatzverhalten Ihrer Katze verändert?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
Katzen bezogen: Erscheinungsbild			
14. Fellqualität[b]	Sieht das Fell Ihrer Katze verändert aus?	Trifft diese Aussage zu?	• Ja • Nein
		Wie stark ausgeprägt ist diese Veränderung des Fells Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
15. Fellpflege	Zeigt Ihre Katze ein vermindertes Fellpflegeverhalten?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark vermindert ist das Fellpflegeverhalten Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht

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Item	Frage	Teilfrage	Antwortmöglichkeiten
16. Bemuskelung[b]	Zeigt Ihre Katze eine verminderte Bemuskelung?	Trifft diese Aussage zu?	• Ja • Nein
		Wie stark ausgeprägt ist die Verminderung der Bemuskelung Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
Katzen bezogen: Verhalten und Aktivität			
17. Laune	Haben Sie das Gefühl, dass die Laune Ihrer Katze durch ihren Gesundheitszustand und/oder deren Behandlung verändert ist?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark ausgeprägt ist diese Veränderung Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
18. Zuneigung	Hat sich die Zuneigung Ihrer Katze Ihnen gegenüber vermindert?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark hat sich die Zuneigung Ihrer Katze verändert?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
19. Stress	Wirkt Ihre Katze vermehrt gestresst oder nervös?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark ausgeprägt zeigt sich der Stress/Nervosität Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
20. Ruheverhalten	Zeigt Ihre Katze ein verändertes Ruhe-und Schlafverhalten?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark ausgeprägt ist diese Veränderung des Verhaltens Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
21. Verhalten	Zieht sich Ihre Katze vermehrt zurück?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark ausgeprägt ist diese Verhaltensveränderung Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht

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Item	Frage	Teilfrage	Antwortmöglichkeiten
22. Stress durch Therapie	Zeigt sich Ihre Katze durch eine potentiell notwendige Therapie gestresst?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark ausgeprägt ist der Stress Ihrer Katze?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
23. Spielverhalten	Zeigt Ihre Katze ein verändertes Spielverhalten?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark hat sich das Spielverhalten Ihrer Katze verändert?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
24. Umwelt	Zeigt Ihre Katze ein verändertes Interesse an ihrer Umwelt?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark hat sich das Interesse Ihrer Katze an der Umwelt verändert?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
25. Aktivität	Hat sich Ihre Katze in ihrer Aktivität verändert?	Wie oft trifft diese Aussage zu?	• Sehr häufig • Häufig • Manchmal • Selten • Nie
		Wie stark hat sich die Aktivität Ihrer Katze verändert?	• Sehr stark • Stark • Etwas • Unwesentlich • Gar nicht
Allgemeine QoL			
Wie würden Sie die Lebensqualität Ihrer Katze allgemein beurteilen?			• Sehr schlecht • Schlecht • Befriedigend • Gut • Sehr gut

[a] Fragen, die bei der Auswahl der Items aufgrund des Feedbacks der Fokusgruppe hinzugefügt wurden.
[b] Fragen, bei denen einer der Antwortsätze aufgrund des Feedbacks der Fokusgruppe vor der Online-Bereitstellung der Umfrage in Ja oder Nein geändert wurde.

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APPENDIX C

DISPLAYING THE COUNTRIES OF RESIDENCE OF THE PARTICIPATING OWNERS (N = 551)

Survey language	German (n = 426/551, 77.3%)	English (125/551, 22.6%)
Country of residence	Germany (n = 315/426, 73.9%)	United States (n = 83/125, 66.4%)
	Switzerland (n = 85/426, 19.5%)	United Kingdom (n = 22/125, 17.5%)
	Austria (n = 19/426, 4.4%)	Canada (n = 5/125, 4.0%)
	Belgium (n = 1/426, 0.2%)	Australia (n = 3/125, 2.4%)
	France (n = 1/426, 0.2%)	Netherlands (n = 3/125, 2.4%)
	Italy (n = 1/426, 0.2%)	Slovenia (n = 2/125, 1.6%)
	Lichtenstein (n = 1/426, 0.2%)	Greece (n = 1/125, 0.8%)
	Luxembourg (n = 1/426, 0.2%)	Malta (n = 1/125, 0.8%)
	Spain (n = 1/426, 0.2%)	South Africa (n = 1/125, 0.8%)
	United Kingdom (n = 1/426, 0.2%)	Not disclosed (n = 4, 3.2%)

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