Item generation and design testing of a questionnaire to assess degenerative joint disease–associated pain in cats

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Objective—To determine the items (question topics) for a subjective instrument to assess degenerative joint disease (DJD)–associated chronic pain in cats and determine the instrument design most appropriate for use by cat owners.

Animals—100 randomly selected client-owned cats from 6 months to 20 years old.

Procedures—Cats were evaluated to determine degree of radiographic DJD and signs of pain throughout the skeletal system. Two groups were identified: high DJD pain and low DJD pain. Owner-answered questions about activity and signs of pain were compared between the 2 groups to define items relating to chronic DJD pain. Interviews with 45 cat owners were performed to generate items. Fifty-three cat owners who had not been involved in any other part of the study, 19 veterinarians, and 2 statisticians assessed 6 preliminary instrument designs.

Results—22 cats were selected for each group; 19 important items were identified, resulting in 12 potential items for the instrument; and 3 additional items were identified from owner interviews. Owners and veterinarians selected a 5-point descriptive instrument design over 11-point or visual analogue scale formats.

Conclusions and Clinical Relevance—Behaviors relating to activity were substantially different between healthy cats and cats with signs of DJD-associated pain. Fifteen items were identified as being potentially useful, and the preferred instrument design was identified. This information could be used to construct an owner-based questionnaire to assess feline DJD-associated pain. Once validated, such a questionnaire would assist in evaluating potential analgesic treatments for these patients. (*Am J Vet Res* 2010;71:1417–1424)

Results of retrospective studies[1–3] indicate that radiographic evidence of DJD is common in cats. One group found that 64 of 100 cats (mean age, 15 years) had radiographic evidence of what the authors termed appendicular joint osteoarthritis.[3] Another investigator found that 22% of 262 cats (mean age, 9.45 years) had radiographic evidence of appendicular joint osteoarthritis[2] when at least 1 synovial joint was included on the radiograph. A third study[1] found that 16.5% of 218 cats (mean age, 6.5 years) had radiographic evidence of appendicular osteoarthritis. In a prospective study,[4] the present authors' laboratory evaluated a randomly selected population of 100 cats (with ages evenly distributed over the range of 6 months to 20 years) and found that 93 cats had radiographic evidence of DJD in some part of the axial or appendicular skeleton (axial skeleton, 53 cats; appendicular skeleton, 92 cats). Results of other studies[5–8] suggest that DJD can be associated with signs of pain. However, there are no approved drugs in the United States or proven nondrug methods of providing pain relief to cats affected by DJD. One reason for this may be that there are no validated outcome measures to assess DJD-associated pain in cats. Clinical trials designed to test the efficacy of interventions intended

Abbreviations

ACVIM	American College of Veterinary Internal Medicine
ACVS	American College of Veterinary Surgeons
BCS	Body condition score
BPI	Brief pain inventory
CBPI	Canine brief pain inventory
DJD	Degenerative joint disease
NRS	Numerical rating scale
VAS	Visual analogue scale

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to decrease chronic pain in dogs with DJD have relied heavily on a combination of veterinarian assessment and gait analysis as measured by use of a force plate.[9–12] However, subjective veterinarian assessments do not correlate well with force plate data.[13,14] Some data suggest that owner assessments may correlate better with force plate results than do veterinarian assessments.[15] Furthermore, it has been suggested that overall athletic performance, especially in working dogs, cannot be properly assessed by use of veterinarian-performed orthopedic examinations alone.[16] These observations have prompted at least 3 groups to validate chronic pain assessment instruments for dogs that consist of questionnaires completed by the dogs' owners and designed to determine overall function and activity as it relates to signs of chronic pain.[17–22] Preliminary work by our laboratory with client-owned cats with obvious signs of pain associated with DJD indicated that owners were able to assess improvement in mobility attributable to the relief of musculoskeletal pain.[7] This finding suggested that it is possible to develop a chronic pain assessment instrument for feline DJD-associated pain. The main steps toward this goal are, in order, item generation, readability testing, reliability testing, and validity testing. The purpose of the study reported here was to perform item generation and design testing to create a subjective instrument to assess activity altered by chronic pain caused by DJD in cats.

Materials and Methods

The investigation consisted of 3 parts. Part I was item generation by use of cats at the extremes of activity impairment; that is, cats with obvious signs of pain associated with DJD and musculoskeletally normal cats with no signs of pain. Part II was item generation by use of focus groups and individual interviews of owners, veterinarians, and statisticians. Part III was evaluation of candidate instrument constructs.

Part I: item generation by use of cats with and without DJD—Cats (n = 1,640) in the patient database from a single practice were allocated into 4 age groups (0 to 5, 6 to 10, 11 to 15, and 16 to 20 years old). Within each age group, each cat was assigned a unique number and randomly ranked. The first 25 cats in each group whose owners were willing to participate in the study were included, so the study included 100 cats. After a detailed explanation of the study protocol, all owners provided written consent for their cats to participate in the study. The protocol was approved by the institutional animal care and use committee.

Once selected, each cat was evaluated at the North Carolina State University Veterinary Teaching Hospital and the owner completed a detailed questionnaire pertaining to the lifestyle, environment, diet, activity, and quality of life of the cat. Questions were chosen by the investigators and were a combination of personal opinion and opinions expressed in the literature and continuing education material.[2,5,23–28] Activity- and behavior-related items included questions about walking, running, ability to jump up and down, climbing and descending stairs, playing or interacting with family members, playing with other pets, rising from a resting position, grooming, use of the litter box, chasing objects, ability to stretch, eating, drinking, seeking seclusion, vocalizing on handling, resentment on handling, height of jumping up, height of jumping down, sleeping, restlessness, spontaneous vocalization, playing with toys, and aggression. A variety of formats including VAS and ranked descriptors were used by owners to indicate their cat's ability to perform these activities and rate their cat's behavior. Additionally, owners were asked to answer questions regarding litter box use, such as how many litter boxes were in the house, how often they were cleaned, the type of litter used (clumping, clay, or crystals), the kind of litter box (standard or covered), height of the step to get into the litter box (in inches), and whether the cat had to ambulate up and down stairs to use the litter box. Questions about urination and defecation habits were asked and included whether the urine and feces were covered with litter and whether urination or defecation was performed inside or outside of the litter box. Sleeping habits were assessed by asking questions about where the cat usually slept, the surface it slept on, the time spent sleeping, the sleep position, and the time spent sleeping without moving. Litter box and sleeping habits were assessed through direct and descriptive question formats. Questions about quality of life were asked in the following manner: owners were asked to write down the 5 activities that were most important for their pet's quality of life, then they were asked to give an importance score for each activity (the total of the 5 scores was required to be 100), and then they were asked to grade their pet's ability to perform each of these activities by use of a VAS system (score, 0 to 100). The total quality-of-life score was the sum of each importance score multiplied by the VAS score. The maximum quality-of-life score was thus 10,000.

In each cat, the following evaluations were performed: general physical examination, BCS performed by use of a 5-point system,[29] and orthopedic evaluation of the appendicular and axial skeleton. The orthopedic evaluation consisted of careful palpation of every joint to evaluate signs of pain and instability performed by the same assessor (BDXL). Additionally, the musculoskeletal and neurologic systems were examined for the presence of conditions other than joint pain that might affect mobility. During the orthopedic evaluation, the pain response to palpation of every joint and part of the axial skeleton was graded on the following scale: 0 = no resentment; 1 = mild withdrawal, mild resistance to manipulation; 2 = moderate withdrawal, body tenses, may orient to site, may vocalize or increase vocalization; 3 = orients to site, forcible withdrawal from manipulation, may vocalize, hiss, or bite; and 4 = tries to escape or prevent manipulation, bites or hisses, marked guarding of site.

Each cat was sedated for radiographic examination by use of a combination of ketamine (3 to 5 mg/kg), butorphanol (0.3 to 0.5 mg/kg), and medetomidine (10 to 15 µg/kg) administered IM. Doses were reduced or altered if considered clinically appropriate. Cats with cardiac murmurs (with or without clinical signs) were sedated with a combination of buprenorphine (30 µg/kg) and acepromazine (0.03 mg/kg) administered IM.

Orthogonal radiography of all joints and the vertebral column was performed by use of an indirect digital flat panel imaging system.[a] Radiographs were assessed for evidence of DJD by 2 American College of Veterinary Radiology diplomate radiologists (JB and APP) and 1 ACVS diplomate surgeon (BDXL) on the basis of criteria established by the same assessors and an additional board-certified radiologist (IDR). Digital radiographs were viewed independently by each assessor using color monitors[b] (24-inch liquid-crystal display, resolution of 1,920 X 1,200 pixels) with standard medical image viewing software.[c] Radiologic features that were considered indicative of the presence of DJD were joint effusion, osteophytes, enthesophytes, joint-associated mineralization, sclerosis, subchondral bone erosions or cysts, and intra-articular mineralization. A 5-point scale was used for grading of the severity of each of the radiographic changes identified (0 = normal, 1 = trivial, 2 = mild, 3 = moderate, and 4 = severe). Following this, a global 11-point subjective radiographic DJD score from 0 to 10 (0 = no radiographic abnormalities identified; 10 = ankylosis) was assigned to each joint on the basis of radiographic changes and their severity. This global score was used in subsequent data manipulation. The axial skeleton was evaluated by dividing the vertebral column into cervical, thoracic, lumbar, and lumbosacral areas. Each segment was evaluated for osteophytes, spondylosis, disc-associated degeneration (endplate sclerosis, erosion, disc mineralization, or disc narrowing), and subluxation. The same 5-point grading scale as used for joint abnormalities was used for each of these vertebral abnormalities, and the same 11-point global DJD score was used to rate each of the 4 vertebral segments. For each appendicular joint and segment of the axial skeleton, the median global DJD score of the 3 assessors for each joint and vertebral segment was calculated and used in defining the groups for item generation. Following radiography, while the cats were still sedated (approx 20 minutes following administration of sedative drugs), the orthopedic examinations were repeated by the same investigator to detect any concomitant orthopedic diseases, such as cranial cruciate ligament rupture, joint instability, or joint luxation, that would contribute to decreased mobility.

From the data obtained, cats were selected for 1 of 2 extreme groups: healthy cats with no radiographic signs of DJD and no signs of pain on manipulation of any joint or part of the axial skeleton and cats with the most severe radiographic evidence of DJD, in which signs of pain were also detected during joint manipulation. This was accomplished by adding the global radiographic DJD score for all joints and all vertebral segments (maximum value, 200) and then sorting the data first based on the total DJD score (ie, the cats were ranked in the spreadsheet based on the total DJD score) and then by use of the sum of the pain scores for every joint and vertebral segment. Visual inspection of the data revealed 2 obvious extreme groups of about 25 cats each at each end of the sorted data. Therefore, the first and fourth quartile groups were considered the 2 extreme groups: a high-total DJD/total pain group and a low-total DJD/total pain group. In a second procedure, DJD and pain data were first summarized as present or not for each joint and vertebral segment. Each joint was scored yes (1) or no (0) for presence of DJD, signs of pain, and DJD and signs of pain concomitantly (1 = DJD or pain; 0 = no DJD or no pain). By use of this assignment, the cats were sorted (ranked) in the spreadsheet by the total number of joints that had both radiographic evidence of DJD and signs of pain on manipulation of that joint or vertebral segment. This allowed definition of 2 groups: a high-combined group and a low-combined group. Data from both approaches were analyzed separately to identify the activities and items that were significantly different between the 2 groups.

A statistical analysis was then performed to determine which items (questions) were most able to distinguish between the groups. Normality assumptions were not violated, and a 2-sample *t* test was performed to test for a significant difference between both sets of high and low groups. Because the high and low groups differed in age, logistic regression analysis was performed to evaluate the activities that were different between the groups after controlling for age. Values of $P < 0.05$ were considered significant.

Similar items with significant differences between the high and low groups identified by either sorting method were condensed to decrease the number of items that might form part of an instrument.

Part II: item generation by use of focus groups and individual interviews of owners—Individual interviews with 30 cat owners (who had not been involved in part I) and 3 focus groups, which included 5 cat owners each (7 of whom had been involved in part I), were conducted. Thirty cat owners were interviewed by the same investigator (HZ), and the interview format was standardized. The topics discussed were similar to those described by Brown et al[17]: characterization of clinical signs, the best words used to describe the clinical signs, and clinical signs that were considered by owners to be associated with musculoskeletal pain; severity of clinical signs, including the best ways to describe the severity and variation in severity; time of onset, duration, and frequency of clinical signs, temporal consistency during the day and night, and the best words to describe the timing; patterns of behavior, changes in posture, and ability to engage in activities and interact with people and other pets; and quality of life and the impact chronic pain has on it. Additional information was obtained by use of floating prompts (eg, asking an owner to expand upon a comment). The inclusion criterion for the selection of the owners involved in this part of the study was to own at least 1 cat. The 3 focus groups were organized, facilitated, and recorded by 3 investigators (HZ, ATS, and BDXL) who were present in all the meetings and used the aforementioned question topics to conduct standardized discussions. The responses from all 45 cat owners were analyzed, and the most frequently mentioned topics as well as most frequently used terms to describe the issues addressed during the interview were used to refine and consolidate the significant items revealed in part I of the study.

Part III: evaluation of candidate instrument constructs—A preliminary instrument modeled on the

CBPI[17,18] was constructed; it included 20 questions, with 15 relating to how chronic pain interferes with the patient's function (interference factor), 4 relating to apparent pain intensity (severity factor), and 1 relating to overall quality of life. All questions regarding the severity factor were identical to those on the CBPI,[17,18] based on the assumption that pain severity may be species independent.

Six versions of the questionnaire were created, all by use of the same questions but with different format designs. The designs were as follows: A) 11-point NRS asking how pain interferes with activities and behavior, B) 11-point NRS asking directly about the ability to do an activity or asking directly about a specific behavior, C) horizontal VAS asking how pain interferes with activities and behavior, D) vertical VAS with descriptors along the line (does not interfere, hardly ever interferes, sometimes interferes, often interferes, or completely interferes), E) vertical VAS with the same descriptors as in D but reversed, and F) descriptive rating scale with 5 descriptors (from left to right: does not interfere, hardly ever interferes, sometimes interferes, often interferes, and completely interferes). In all versions, "normal" or "does not interfere" was placed on the left or top, except for versions B and E in which this was reversed. Fifty-three cat owners, recruited from a specialty feline practice and different from those interviewed in part II and who had not been involved in part I; 19 veterinarians (2 residents, 2 diplomate ACVS orthopedic surgeons, 1 ACVIM diplomate neurologist, 6 ACVIM diplomate internal medicine specialists, 1 ACVIM diplomate oncologist, 3 ACVS diplomate soft tissue surgeons, and 6 exclusively feline practitioners); and 2 PhD statisticians were provided with the 6 instruments and interviewed about the instrument designs. The same investigator (HZ) interviewed all participants by asking the following questions: which scale is easiest to use; how easy is the scale to use (very easy, easy, neither easy nor difficult, or difficult); are there any questions that should be left out; if so, which; are there any modifications to any of these scales that might be useful; and if so, what?

Results

Part I—Twenty-five cats in each age group were successfully recruited and included in the study. Of the 100 cats recruited, 18 were purebred cats and 82 were domestic shorthair or longhair cats. Overall mean ± SD age was 9.42 ± 5.07 years, and mean ± SD body weight was 5.13 ± 1.64 kg. There was a wide weight range (2.08 to 10.16 kg). The median (minimum, maximum) BCS was 3 (1, 5). Of 100 cats, the overall median total DJD score (addition of the global scores for all joints and vertebral segments) was 12 and the median total pain score (addition of the pain scores for all joints and vertebral segments) was 4. Ninety-three cats had radiographic evidence of DJD in at least 1 site, and subjectively, there was a range of cats from those that were clinically normal to those that appeared obviously impaired by musculoskeletal pain. There were no cats with diseases such as cruciate ligament rupture, joint instability, or joint luxation that might have resulted in impaired mobility or pain. Following screening of the cats for other diseases that may impair mobility, the cats were ranked by the sum of their global radiographic DJD and pain scores. Of the 25 cats each in the upper and lower quartiles, 3 cats from each group were not included because of high total pain scores despite low total radiographic DJD scores or low total pain scores despite high total radiographic scores. Therefore, 2 groups of 22 cats each were defined, with the high-total DJD/total pain group including cats with values that were substantially greater than those of the total cohort (the initial group of 100 cats) median values and the low-total DJD/total pain group including cats with values that were substantially less than those of the total cohort median values. Median DJD and pain scores for the high-total DJD/total pain group were 31 and 12, respectively, whereas for the low-total DJD/total pain group, scores were 3 and 0, respectively. The high-total DJD/total pain group included 15 spayed females and 7 castrated males with a median age of 14.06 years (range, 5.05 to 19.89 years). The low-total DJD/total pain group included 14 spayed females and 8 castrated males with a median age of 4.66 years (range, 1.04 to 12.46 years). Median body weights were 4.75 and 4.97 kg for the high and low groups, respectively. Median BCS was 3 for both groups (range, 1 to 5 for the high group and 1 to 5 for the low group). Apart from age, there were no differences between the groups with respect to sex distribution, weight, or BCS. The groups were considered appropriate for item generation.

The median number of joints in each of the 100 cats that had both radiographic evidence of DJD and pain response to palpation was 1 (range, 0 to 8). After sorting the data by use of this criterion, 2 groups of 22 cats each were identified: those with the highest number of joints with both DJD and signs of pain (high-combined), and those with the lowest number of joints with both DJD and signs of pain (low-combined). Median number of affected joints was 3.5 (range, 0 to 8) and 0 (range, 0 to 1) for the high-combined and low-combined groups, respectively. The high-combined group comprised 16 spayed females and 6 castrated males with a median age of 15.12 years (range, 5.5 to 19.89 years) and median body weight of 4.38 kg (range, 2.08 to 9.80 kg). The low-combined group comprised 13 spayed females and 9 castrated males with a median age of 4.92 years (range, 1.03 to 12.45 years) and median weight of 4.76 kg (range, 2.95 to 6.44 kg). Median BCS was 3 for both groups (range, 1 to 5 for the low-combined group and 1 to 5 for the high-combined group). Apart from age, there were no differences between the groups with respect to sex distribution, weight, or BCS. These groups were considered appropriate for item generation.

Although the 2 methods of sorting yielded quartile groups that differed slightly in individual members, analysis resulted in identical significantly relevant activities and behaviors. As such, the results refer to high and low groups.

Significant differences in the owner answers to the VAS questions were identified for 17 of the 28 topics between the low and high groups (**Table 1**). Significant differences existed between the groups in the categories of covering urine with litter and the amount of time spent sleeping. These questions were not asked by use of a VAS format. Fewer of the high group cats covered

Table 1—Mean ± SD scores of 44 cat owners who used a VAS to rate the ability of their cats to perform various activities.

Activity	Low group	High group	*P* value
Walking*	99.5 ± 1.3	83.7 ± 20.5	< 0.001
Running*	100.0 ± 0.0	77.5 ± 27.8	< 0.001
Ability to jump up*	100.0 ± 0.0	66.5 ± 30.2	< 0.001
Ability to jump down*	100.0 ± 0.0	65.4 ± 29.9	< 0.001
Climbing stairs*	100.0 ± 0.0	77.7 ± 18.2	< 0.001
Descending stairs*	100.0 ± 0.0	73.5 ± 18.3	< 0.001
Playing or interacting with family members	91.9 ± 19.0	84.9 ± 27.8	0.336
Playing with other pets*	90.2 ± 27.9	51.8 ± 44.1	0.002
Rising from a resting position*	100.0 ± 0.0	86.9 ± 19.6	0.003
Grooming*	94.0 ± 19.4	83.5 ± 24.2	0.121
Use of litter box	93.8 ± 21.3	92.1 ± 13.0	0.754
Chasing objects*	1000 ± 0.2	70.8 ± 32.3	< 0.001
Ability to stretch*	99.9 ± 0.6	93.5 ± 10.1	0.006
Eating*	98.1 ± 9.0	88.1 ± 18.6	0.029
Seeking seclusion	83.9 ± 21.0	73.8 ± 24.8	0.015
Vocalizing on handling	64.5 ± 36.0	59.8 ± 37.6	0.673
Resentment on handling	83.9 ± 18.8	81.2 ± 21.8	0.671
Aggressiveness on handling	90.4 ± 16.9	89.6 ± 17.2	0.874
Height of jumping up*	95.5 ± 15.2	59.2 ± 32.1	< 0.001
Height of jumping down*	97.0 ± 13.8	62.8 ± 29.1	< 0.001
Sleeping*	17.1 ± 6.0	2.1 ± 14.5	< 0.001
Restlessness	97.4 ± 10.7	90.2 ± 20.9	0.161
Spontaneous vocalization	65.3 ± 30.5	61.0 ± 26.5	0.622
Playing with toys*	97.2 ± 10.8	56.0 ± 36.5	< 0.001
Aggression	89.5 ± 25.0	81.0 ± 15.8	0.188
Height of jumping up (feet)†	4.9 ± 1.1	3.6 ± 1.8	0.110
Height of jumping down (feet)†	4.5 ± 1.2	3.3 ± 1.9	0.114
Overall quality of life*†	9,915.5 ± 209.4	9,295.5 ± 1,218.2	0.023

Cats in the low group had low radiographic scores for DJD and no signs of pain associated with DJD; cats in the high group had high radiographic scores for DJD and severe signs of pain associated with DJD.
*Items included in the instrument designs tested in part III. †Items accessed by use of direct questions, not by use of the VAS system.

urine with litter, compared with the low group, and the high group cats slept more than the cats in the low group. Combining similar question topics resulted in 12 instrument items that were incorporated into the tested instrument designs.

Part II—In the individual interviews, owners identified 39 topics they believed might be associated with chronic pain. The most frequently mentioned (by 3 or more individuals) topics or terms owners associated with clinical signs of chronic musculoskeletal pain and the number of owners who listed them were as follows: decreased movement (n = 15), vocalization (13), difficulty jumping (12), decreased activity (11), decreased interaction (with owner and other pets; 10), decreased appetite (9), time of onset after long rest (7), hiding (7), quiet or lethargic (7), difficulty using the litter box (6), changes in posture (6), not playing with toys (5), does not like to be touched (5), restlessness (5), behavioral abnormalities (5), increased interaction (owner and pets; 4), changes in the position the cat lies in (4), increased sleeping (3), and lack of grooming (3).

Topics considered by owners to be associated with quality of life and the number of owners who listed them were as follows: ability and willingness to eat (n = 16), willingness to interact (15), having a safe, quiet, and stimulating place to live (8), ability to move around (6), ability and willingness to drink (6), being fed (5), normal routine (4), ability to use litter box (4), being healthy (4), ability to play with toys (3), having plenty of water (3), willingness to go outside (3), being active (3), ability to sleep well (2), being comfortable (2), ability to groom themselves (1), ability to climb stairs (1), ability to chase objects (1), ability to jump (1), being brushed (1), being owned (1), being given affection (1), having other pets to interact with (1), and being kept indoors (1).

All owners said that they found it difficult to identify or describe slight pain. Additional signs mentioned in focus groups that were considered by at least 33% of the owners to be associated with chronic musculoskeletal pain included discomfort when being held, grunting when jumping down, weakness, difficulty rising from a resting position, and absence of so-called bursts of energy. The bursts of energy were referred to differently among cat owners as cat madness, full moon, cat frenzy, night crisis, happy cat, psycho cat, cat frolic, cat craziness, cat is on crack, hyper, devil is in him, frenzy, crack high, spastic, and matrix day. Most of the focus group members also indicated that signs of slight pain are difficult to discern.

From the individual interviews and focus groups, an additional 3 topics were identified and used in the instruments in part III. The topics were ability to stretch, willingness to interact with family members, and overall level of activity. This yielded 15 items to test in part III.

Part III—Thirty-three of 53 (62%) cat owners chose the 5-point descriptive scale (design F) as the easiest to use, whereas 9, 4, 3, 3, and 1 owners selected designs A, B, C, D, and E, respectively. Among the veterinarians and statisticians, 8 (38%) selected the 5-point descriptive scale (design F), whereas 4, 4, 3, 1, and 1 selected D, C, B, A, and E, respectively.

Owners considered all instrument versions to be very easy or easy to fill out, with the sole exception that 1 owner rated design D as neither easy nor difficult. Of the 42 people (including cat owners and veterinarians) who thought the F scale was the easiest design 24 considered it very easy and 17 classified it as easy to fill out.

Unsolicited comments were also considered. Of 74 assessors, 14 (7/21 veterinarians and statisticians and 7/53 owners) spontaneously indicated that direct questions about activities and behavior, instead of interference questions, were preferable. Other spontaneous recommendations included having an option termed "not applicable" for each of the questions (10/74 respondents) and having the instrument organized in a more logical order with activities grouped together and behaviors grouped together (8/20 respondents) and that having an option termed "normal" on the far left side and "abnormal" on the far right side of the scale was the most appropriate design (68/74 respondents).

Discussion

Axial[1,3,5,7,30] and appendicular[1–3,5,7,31,32] DJD are thought to be common in domestic cats, and recent studies[5–7] suggest that this DJD is painful. The present study reports the first steps in creating a validated subjective owner assessment instrument for the measurement of feline DJD-associated pain.

The steps used to create an effective and reliable questionnaire for human subjects have been extensively described,[33–35] and similar work has more recently been performed in veterinary medicine.[17,19,21] Although the details vary, the main steps in producing a valid instrument are item generation followed by readability, reliability, and validity testing.[17,36,37] Item generation is an important stage because it defines the question topics. The 2 main approaches that have been used in canine medicine are generation of items through focus group meetings and expert input[17,21] and generation of items through use of affected and unaffected groups and evaluation of the differences between them.[19] The present study used a combination of the 2 approaches. To define the 2 extreme groups, the authors used radiographic and physical examination. It is accepted in human and canine medicine that radiographic signs of DJD do not correlate with clinical signs or signs of pain.[38–40] This is also likely in cats. A previous study[7] in the authors' laboratory revealed discordance between radiographic signs of DJD and the finding of signs of pain during palpation of the affected joints. Another group suggested that 34% of joints judged to have signs of pain on manipulation during a clinical examination did not have any radiographic signs of osteoarthritis.[5] For these reasons, we used 2 methods of sorting cats into extreme groups: use of total global DJD scores plus total global pain scores and use of the number of joints or vertebral segments that had both signs of pain on manipulation and radiographic evidence of DJD. By use of these methods, we feel confident that we were able to select a group with no signs of musculoskeletal pain and a group with substantial musculoskeletal pain. The groupings based on these criteria fit with our clinical impression of the cats.

Although the cats were similar in all respects, the 2 groups used for item generation differed significantly in age. It had been hoped to identify aged-matched groups of cats with and without DJD-associated signs of pain, with each group containing a variety of ages. However, the observation that almost all of the randomly selected cats had DJD somewhere in the skeleton and the fact that pain is difficult to assess in cats led to the use of 2 easily identified extreme groups, even though they were not age matched. With the current knowledge of DJD-associated pain in cats, it would be extremely difficult to identify clinically normal cats and cats with obvious DJD-associated signs of pain that were age matched. The age difference between the groups was an obvious weakness of the present study. When the data were controlled for age and a logistic regression analysis performed, only 1 activity (height of jumping up) was significantly different between groups. However, the present study was only used to identify questionnaire items that appear to be valid. At worst, if the difference in age between the 2 groups is important, too many items will have been included as important. Subsequent testing of any constructed instrument will help to determine whether the activities and behaviors identified as candidate items are valid or are just age-associated changes in activity.

The cats used in the study were a random sample of cats from a single feline specialty practice, which may have introduced bias. Owners sufficiently motivated to travel to a cat-only clinic may be more aware of behavioral changes in their cats than are typical clients of most primary care clinics; this may have increased the activity and behavioral differences between the groups. However, the owners were told only that the study was related to a musculoskeletal health screening and were not influenced by the interviewer when answering the battery of questions. The questions used in the screening questionnaire (to generate the items) were decided upon by the investigators, who drew from personal experience, and also by review of the literature and continuing education seminar proceedings.[5,23–25,27,28,41] Accordingly, there was a degree of bias in the questions initially asked and, therefore, likely bias in the final data. However, the items that were significantly different between the groups were similar to the activities identified by Clarke and Bennett[5] as being associated with painful DJD and were similar to the activities being assessed by owners in previous work from this group.[7]

Focus groups and individual interviews were used to minimize the likelihood that any activities or behaviors possibly associated with musculoskeletal pain would be ignored. Additionally, these interviews were conducted to identify terms and words that would make the questionnaire easier to understand because some common medical terms, such as lameness, are not fully understood by cat owners. One result of the use of focus groups was the inclusion of 3 extra topics in the questionnaire: ability to stretch, willingness to interact with family members, and overall level of activity. Owners indicated that both an increase and decrease in willingness to interact with owners can be seen with signs of chronic pain, yet this was included in the questionnaire because the opportunity to indicate increased interaction as well as decreased interaction was available. It is interesting that when owners were asked about what aspects of their cats' lives constituted a good quality of life, only 15 of the 82 answers given appeared to directly and obviously relate to activities involving movement. It may be that being able to move is not important for a cat's quality of life, or it may be that owners do not perceive it as important. Further work is needed in this area, particularly if the veterinary profession is convinced that musculoskeletal pain that is inhibiting activity should be alleviated.

Once items were generated, the next stage was to present the items in an appropriate format. We evaluated owner and veterinarian preferences among 6 formats and found a clear preference for a simple descriptive scale, with the scale running from left to right, normal to abnormal, similar to the Helsinki chronic pain index described by Hielm-Björkman et al.[19,20] Although not surprising, this finding was, in some respects, disappointing, as we had hoped that the 11-point NRS (as used in the CBPI[17,18]) or the VAS would be preferred because these scales have been suggested to be more sensitive.[42–44] In human studies,[43,45,46] however, there is no consensus on the optimum number of response alternatives in self-reported pain rating scales. Indeed, it has been suggested that patients can only communicate the level of their own pain by use of 4 to 6 points of discrimination.[44] This issue probably becomes even more problematic in proxy reporting scales, where it has even been suggested that there are, as yet, no valid scales for the assessment of chronic pediatric pain because the behavioral changes are too subtle to evaluate.[47] To the authors' knowledge, there are no studies evaluating the optimal number of response levels for owner assessments of pain in animals. Furthermore, in the present study, owners reported great difficulty in detecting mild signs of pain in cats, which would be another reason to use a more contracted scale in this questionnaire. Further research is needed to determine the optimal number of response levels for the proxy assessment of feline DJD-associated pain.

We modeled our initial questionnaire on the CBPI. This instrument distinguishes dogs with signs of DJD pain from clinically normal dogs and dogs with signs of osteosarcoma-induced pain from clinically normal dogs.[17,18,48] Most cat owners interviewed found it difficult to answer direct questions about pain in their cats. Additionally, a large number of the interviewees felt it was difficult to answer questions about how pain interferes with function in their cat. They were more comfortable answering questions that directly addressed the degree of function and activity. The so-called interference questions used in the CBPI were modeled after a human instrument, the BPI. Results of the present study were similar to the results of a study[49] evaluating the level of concordance between proxy and patient ratings by use of the BPI. In that study,[49] the authors found poor to moderate agreement for questions relating to how pain interferes with a function, suggesting that it may be difficult for proxies to assess the level of interference of various functions by pain. However, the CBPI, modeled after the BPI, has worked well in the clinical proxy assessment of chronic DJD-associated pain in dogs.[18] Dog owners might be better suited to answer questions about how pain is interfering with their pets' activities than are cat owners. This may relate to the way dogs are included in family activities, possibly heightening the awareness of how pain is interfering with the activity. The study reported here has identified question topics and an instrument design that may be useful in the construction of a proxy (owner-directed) questionnaire to assess musculoskeletal pain in domestic cats.

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a. Canon Medical CXDI-50G Sensor, Eklin Medical Systems, Santa Clara, Calif.
b. Dell Ultrasharp 2407WFP, Dell, Round Rock, Tex.
c. eFilm 2.1.2, Merge Healthcare, Milwaukee, Wis.

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