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# Development of a behaviour-based measurement tool with defined intervention level for assessing acute pain in cats

G. Calvo*, E. Holden*, J. Reid*, E. M. Scott†, A. Firth‡, A. Bell*, S. Robertson§ and A. M. Nolan¶

*School of Veterinary Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow G61 1QH

†School of Mathematics and Statistics, College of Science and Engineering, University of Glasgow, Glasgow G12 8QQ

‡Vets Now Emergency, Dunfermline, FIFE KY11 8SG

§College of Veterinary Medicine, Michigan State University, East Lansing, MI 48824, USA

¶School of Life, Sport and Social Sciences, Edinburgh Napier University, Edinburgh EH11 4BN

**Objectives:** To develop a composite measure pain scale tool to assess acute pain in cats and derive an intervention score.

**Methods:** To develop the prototype composite measure pain scale-feline, words describing painful cats were collected, grouped into behavioural categories and ranked. To assess prototype validity two observers independently assigned composite measure pain scale-feline and numerical rating scale scores to 25 hospitalised cats before and after analgesic treatment. Following interim analysis the prototype was revised (revised composite measure pain scale-feline). To determine intervention score, two observers independently assigned revised composite measure pain scale-feline and numerical rating scale scores to 116 cats. A further observer, a veterinarian, stated whether analgesia was necessary.

**Results:** Mean ±sd decrease in revised composite measure pain scale-feline and numerical rating scale scores following analgesia were 2·4 ±2·87 and 1·9 ±2·34, respectively (95% confidence interval for mean change in revised composite measure pain scale-feline between 1·21 and 3·6). Changes in revised composite measure pain scale-feline and numerical rating scale were significantly correlated (r=0·8) (P<0001). Intervention level score of ≥4/16 was derived for revised composite measure pain scale-feline (26·7% misclassification) and ≥3/10 for numerical rating scale (14·5% misclassification).

**Clinical Significance:** A valid instrument with a recommended analgesic intervention level has been developed to assess acute clinical pain in cats that should be readily applicable in practice.

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## INTRODUCTION

The cornerstone of effective pain management is the availability of valid, reliable and responsive pain assessment tools. Validity (content, criterion and construct) provides evidence that the instrument is able to measure that which it was designed to measure, and responsiveness demonstrates that the instrument is sensitive enough to detect differences in health status that are clinically important. In clinical veterinary practice, the usefulness of a pain assessment instrument is markedly enhanced if the score can be linked to an intervention level, that is informative as to whether an animal requires analgesic treatment (Reid *et al.* 2007). Additionally, an instrument should have utility. Even if an instrument is valid and reliable, it may not be useful if it requires lengthy training, is time-consuming to administer or if scoring is complex (Streiner 1993).

Few pain scales have been developed for the cat. These include the Colorado State University Feline Acute Pain Scale (Colorado State University Animal Cancer Centre, Veterinary Medical Centre 2006) and the French Association for Animal Anaesthesia and Analgesia Pain Scoring System n.d. (4A-Vet, Vérérinaire Anesthésie Analgésie Douleur Animale) for dogs and cats, neither of which can claim to be both valid and reliable. More recently a multidimensional composite pain scale (MCPS) for assessing acute postoperative pain in cats was developed by Brondani *et al.* (2011) and subsequently translated into English (Bondani *et al.* 2013). Although criteria for utility are unlikely to be met, both language versions have been shown to be valid, reliable and responsive with an intervention level derived when used in cats undergoing ovariohysterectomy.

The psychometric approach to scale design, well established in human medicine for the measurement of complex and intangible constructs such as pain and quality of life, encompasses an established process of item selection, questionnaire construction and testing for validity, reliability and responsiveness. The Glasgow composite measure pain scale (CMPS) for the assessment of acute pain in the dog was the first tool in veterinary medicine designed using psychometric principles (Holton *et al.* 2001). Subsequently a short form (CMPS-SF) was derived for routine clinical use where the emphasis was on ease of use and speed of completion (Reid *et al.* 2007) and an intervention level was determined to aid clinical decision-making. The aim of this study was to develop a similar scale for the cat to assess acute pain, arising from a broad range of clinical conditions, and to derive an intervention level score, called the CPMS-feline (CMPS-F).

## MATERIALS AND METHODS

Following development of the prototype CMPS-F (see below) two studies were carried out simultaneously in two locations. Study 1 – *Validity Testing*, proved evidence of construct validity and study 2 – *Derivation of an Analgesic Intervention Level*, identified an analgesic intervention level for both the CMPS-F and numerical rating scale (NRS), with concurrent criterion validity also determined. Analysis of study 1 and user feedback led to revision of the scale (rCMPS-F). In the revision process, statements were combined and no information was lost, making possible the derivation of rCMPS-F scores from CMPS-F scores in studies 1 and 2, allowing analysis of pooled data in study 2.

### Development of a prototype scale (CMPS-F)

A psychometric approach was adopted to ensure content validity as described previously in dogs (Holton *et al.* 2001, Morton *et al.* 2005). Words describing cats in acute pain were collected from 30 individuals (13 veterinary surgeons, 10 veterinary nurses, 2 breeders, 2 rescue workers and 3 owners), each of whom completed a questionnaire consisting of two parts. First they were asked to list all the words they would use to describe a cat in acute pain in the following categories: posture, comfort, vocalisation, attention to any painful area, demeanour/response to people, mobility and response to touch. The second part of the questionnaire listed the descriptive words in each category that appeared in the dog acute pain instrument and respondents were asked to indicate whether these words applied to the cat.

One hundred and fifteen words were considered for inclusion in the prototype cat acute pain tool. Subsequent consideration by an expert group of veterinary pain specialists reduced that number to 40, which were then grouped into six behavioural categories: vocalisation, activity/posture, attention to wound, response to people, response to touch and demeanour (Appendix 1). The categories were placed in this sequence in order to follow a defined protocol for interaction with the cat. Finally, the words within each category were ranked in order of increasing pain intensity using a technique of paired comparisons. Six hundred and thirty English-speaking veterinary surgeons from 23 countries responded to an online survey, in which they were presented with all possible combinations of word pairs and asked which one of each pair represented the most pain. These results informed the ordering of items within each category and provided a scoring mechanism based on ranks.

To fulfil completion of the questionnaire, observers were asked to choose the word in each category that best described the observed cat and the final score was the sum of these scores from all categories.

### Revision of the CMPS-F

Analysis of the CMPS-F data from 25 cats (study 1) indicated questions 1 and 3 were contributing little to the total score (see Results section). These findings suggested that these questions were not sensitive indicators of pain, or alternatively that these behaviours did not occur commonly. Furthermore, user feedback indicated difficulties with interpretation in these categories. A revised version, rCMPS-F (Appendix 2), was created as follows. Question 1 was reduced from four descriptors to two composite descriptors, while retaining all the words; "silent, purring, meowing" and "crying, growling, groaning" combined into another, so that relevant information was not lost. Question 3 was reduced to two descriptors; "ignoring any wound or painful area" and "attention to wound". The remainder of the CMPS-F was not altered. The consequence of these changes resulted in the total score of 22 being reduced to 16.

### Study 1 – validity testing

Construct validity was determined by testing the hypothesis that appropriate analgesic treatment would produce an improvement in pain state and reduce pain scores. Concurrent criterion validity was assessed by comparing the test scores with scores derived simultaneously from an NRS.

Cats (n=25) hospitalised for surgery, traumatic or medical conditions within either of two participating centres and deemed by the attending veterinary surgeon to be requiring analgesic treatment were recruited to the study. No restrictions in patient status, age or breed were made. All cats were scored for sedation using a simple descriptive scale (SDS) modified from Lascelles *et al.* (1994) and those with a sedation score of 2 or 3 excluded (n=0) to ensure that residual anaesthetic drugs did not interfere with the assessment procedure.

A veterinary nurse scored pain using the CMPS-F, while a second veterinary surgeon observed the cat's response. Blinded to the CMPS-F score, this veterinary surgeon allocated a pain score for the cat using an 11-point NRS: 0 representing no pain and 10 representing worst possible pain. An analgesic [methadone (Comfortan; Dechra), morphine (Morphine Sulphate; Wockhardt) or buprenorphine (Vetergesic; Alstoe Animal Health) was then administered in accordance with the practice/hospital protocol irrespective of the pain score allocated, so cats with pain scores of zero still received analgesia as per the attending clinician instructions. Within 2 hours the same nurse and veterinary surgeon repeated the scoring procedure. At that time the veterinary surgeon also recorded a clinical judgment as to whether the cat's change in pain was clinically relevant (n=16). Following feedback from users and discussions with an expert panel this question was subsequently replaced with an SDS to evaluate clinical change and veterinary surgeons were asked if the cat's pain status was much improved, improved, unchanged, worse or much worse (n=7).

rCMPS-F scores were derived from CMPS-F scores. Statistical analysis included analysis of the change in pain score (after–before analgesia) using paired analysis, a general linear model (with change in pain score after analgesia as response) and pain score before and other potential variables as covariates to explore the variability (and hence sensitivity) of the pain scoring system.

### Study 2 – derivation of an analgesic intervention level

Cats (n=116) undergoing postoperative care or having been admitted for any acutely painful trauma or medical condition in multiple locations (small animal general practices and university veterinary schools) were recruited to the study. No restrictions were placed on the breed, age or sex of the cats, or on the type of surgical procedure, trauma or medical condition; however, all cats were evaluated for sedation as before and any with a score greater than 1 excluded (n=0).

Analgesia was administered according to the standard clinical practice by veterinary surgeons carrying out treatment orders, routine postoperative examinations, or responding to a nurse's concern that a cat was in pain. Before analgesia administration, a veterinary nurse scored pain in cats (n=57) using the CMPS-F. Thereafter, blinded to the CMPS-F score, the veterinary surgeon allocated a pain score using an 11-point NRS as described previously and then responded to the question *"Do you think this animal requires analgesia? Yes/No"*. A further population of cats (n=59) were scored for pain in an identical manner using the revised tool (rCMPS-F). Scores from the first 57 cats were converted to rCMPS-F scores.

Statistical analysis of data from all 116 cats comprised descriptive statistics to show how pain scores varied for cats considered to require analgesia compared with those that did not. Formal analysis involved Wilcoxon, Mann-Whitney U tests and 95% confidence intervals (CIs) for medians. Linear discriminant analysis was used to identify the optimum pain score cut-off to maximise the number of cats correctly assigned to their clinician-allocated group (in need of analgesia, not in need of analgesia). Statistical significance was set at $P<0{\cdot}05$.

## RESULTS

### Revision of the CMPS-F

Analysis of the CMPS-F data from 25 cats (study 1) indicated that questions 1 and 3 were contributing little to the total score, with 80% of cats being awarded a score of 0 for question 1 (vocalisation) and 88% of cats being awarded a score of 0 for question 3 (attention to wound). These findings suggested that these questions were not sensitive indicators of pain, or alternatively that these behaviours did not occur commonly. A revised version, rCMPS-F (Appendix 2), was subsequently created. To evaluate the utility of the rCMPS-F for assessing pain, a further 20 cats were scored. User feedback and determination of the frequency of use of each descriptor indicated that no further changes were necessary.

### Study 1 – validity testing

Demographic details of all 25 cats are presented in Table 1. The median pre-analgesia CMPS-F and NRS scores were 8/22 and 6/10 compared with median post-analgesia scores of 3/22 and 3/10 respectively. Following conversion of the scores from CMPS-F to rCMPS-F, the median pre-analgesia score was 8/16 compared with a median post-analgesia score of 3/16. The mean ±sd changes in rCMPS-F and NRS scores following analgesia administration were 2·4 ±2·87 and 1·9 ±2·34 respectively. The rCMPS-F declined on average between 1·21 and 3·6 [95% CI for mean change (pre–post) following analgesia]. There was a statistically significant correlation of 0·8 ($P<0{\cdot}0001$) between the changes in rCMPS-F and NRS (Fig 1).

**Table 1. Validation study (study 1) demographics (n=25 cats)**

| Age | Gender | | Breed | | Analgesia status | | Analgesia administered | | Time between scoring (before and after) |
|---|---|---|---|---|---|---|---|---|---|
| Mean: 5 years 8 months (8 weeks to 19 years) | Male neutered | n=7 | Pedigree | n=1 | Naive | n=17 | Buprenorphine 0·001 to 0·002 mg/kg | n=15 | Mean: 74 minutes |
| | Male | n=1 | Domestic longhair | n=2 | Analgesia within previous 12 hours | n=8 | Methadone 0·2 to 0·3 mg/kg | n=9 | |
| | Female neutered | n=12 | Domestic shorthair | n=22 | | | Morphine 0·2 to 0·3 mg/kg | n=1 | |
| | Female | n=5 | | | | | | | |

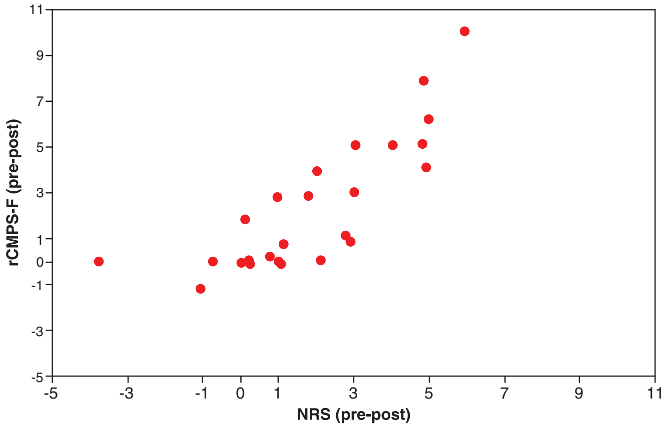


**FIG 1. Scatterplot of the change in NRS and rCMPS-F scores in cats following analgesia administration; N=25 cats**

Of the 18 cats, where the change in analgesia status was described as clinically relevant or not the question was answered in 16. Of these, in 12 (75%) the change was deemed clinically relevant with a mean ±sd decrease in score of 4·17 ±3·49 and in the remaining 4 it was not, mean ±sd decrease in score of 1·75 ±1·71. However, the difference between the groups was not clinically significant (P=0·094). Details of these and the remaining seven cats are presented in Table 2.

### Study 2 – derivation of an analgesic intervention level

Observers comprised veterinary nurses (general, emergency and critical care, and specialist disciplines) and veterinary surgeons with varying levels of expertise (interns, residents and European/American boarded specialists).

Demographic details and surgical status for the 57 cats scored with the CMPS-F and the 59 cats scored with the rCMPS-F are shown in Tables 3 and 4 respectively. Cats identified as requiring analgesia (n=60) had a median pain score of 6 (range: 0 to 15), and for those not requiring analgesia (n=56), the median score was 2 (range: 0 to 10). For the NRS, equivalent values were 4 (range: 0 to 10) and 1 (range: 0 to 9) respectively. Figure 2a, b shows the distribution of NRS and rCMPS-F scores respectively for all cats in the study. On the basis of these results, an intervention level score of 4 or higher was proposed for the rCMPS-F (26·7% misclassification) and 3 or higher for the NRS (14·5% misclassification). Figure 3 shows the relationship between the NRS and rCMPS-F with a correlation value of 0·68 (P<0·01).

**Table 2. Study 1 pre-analgesia and post-analgesia CMPS-F scores and clinical relevance (n=25)**

| Cat number | Pre-analgesia CMPS score | Post-analgesia CMPS score | Clinically relevant Y/N | Change in pain status |
|---|---|---|---|---|
| 1 | 6 | 1 | Y | |
| 2 | 13 | 9 | N | |
| 3 | 3 | 4 | N | |
| 4 | 3 | 3 | Not recorded | |
| 5 | 1 | 1 | Y | |
| 6 | 4 | 2 | N | |
| 7 | 11 | 1 | Y | |
| 8 | 8 | 7 | Y | |
| 9 | 0 | 0 | N | |
| 10 | 8 | 4 | Y | |
| 11 | 8 | 8 | Y | |
| 12 | 12 | 9 | Y | |
| 13 | 11 | 8 | Y | |
| 14 | 9 | 5 | Y | |
| 15 | 10 | 10 | Not recorded | |
| 16 | 8 | 2 | Y | |
| 17 | 14 | 3 | Y | |
| 18 | 9 | 6 | Y | |
| 19 | 0 | 0 | | Improved |
| 20 | 10 | 2 | | Improved |
| 21 | 1 | 0 | | Much improved |
| 22 | 8 | 8 | | Unchanged |
| 23 | 2 | 2 | | Worse |
| 24 | 0 | 0 | | Improved |
| 25 | 5 | 0 | | Improved |

## DISCUSSION

Following the success of the behaviour-based Glasgow CMPS-SF for dogs, now generally accepted as a clinical standard for the measurement of acute pain in that species, a cat tool was constructed using similar psychometric methodology.

Content validity of the CMPS-F was established by the psychometric methods used during scale construction. As the scale items were not altered in the revision of the scale, content validity was unchanged in the rCMPS-F.

The psychometric approach encompasses an established process of item selection, questionnaire construction and testing for validity, reliability and responsiveness. Item selection resulted in a final list of 40 word descriptors grouped into six behavioural categories. Many of the items in the CMPS-F and rCMPS-F were similar to those described in the Colorado State University (CSU) Feline Acute pain scale and the UNESP-Botucatu MPCS (Brondani *et al.* 2013) and the behavioural categories – vocalisation, activity/posture, attention to wound, response to people, response to touch and demeanour – were common to these scales also. Thus, the rCMPS-F has good overlap and commonality with other tools in general use, providing further evidence for its content validity.

Other similarities between the scale reported here and the UNESP-Botucatu scale include the ranking of the items within each category according to the pain intensity and the provision of a protocol which ensures consistency of the assessment procedure.

Concurrent criterion validity establishes the effectiveness of the scale's measurement through comparison with a pre-existing gold standard applied simultaneously. However in the absence of a gold standard for the measurement of pain, Holton *et al.* (1998) suggested that, of the scales available, the NRS is the most appropriate choice. A statistically significant correlation of 0·8 (P<0·0001) between the changes in rCMPS-F and NRS scores pre- and post-analgesia in study 1 confirmed concurrent criterion validity. In study 2 the correlation was lower (0·68), but still achieved statistical significance.

**Table 3. Intervention level CMPS-F (study 2) demographics (n=57 cats)**

| Age | Gender (status unknown in three cats) | | Breed | | Analgesia status (status unknown in one cat) | | Previous surgery | | |
|---|---|---|---|---|---|---|---|---|---|
| Mean: 6 years 3 months (4 months to 18 years) | Male neutered | n=26 | Pedigree | n=6 | Analgesia within previous 12 hours | n=23 | Yes | n=14 | n=9 (sedation score of zero) n=5 (sedation score of 1) |
| | Male | n=5 | Domestic longhair | n=3 | | | No | n=9 | |
| | Female neutered | n=18 | Domestic shorthair | n=48 | Naïve | n=33 | Yes | n=6 | n=4 scored before surgery (sedation score of zero) n=2 scored following surgery (sedation score of zero) |
| | Female | n=5 | | | | | No | n=27 | |

**Table 4. Intervention level rCMPS-F (study 2) demographics (n=59 cats)**

| Age | Gender (status unknown in three cats) | | Breed | | Analgesia status | | Previous surgery | | |
|---|---|---|---|---|---|---|---|---|---|
| Mean: 5 years 5 months (9 weeks to 22 years) (age unknown in four cats) | Male neutered | n=25 | Pedigree | n=8 | Analgesia within previous 12 hours | n=36 | Yes | n=27 | n=15 (sedation score of zero) n=12 (sedation score of 1) |
| | Male | n=2 | Domestic longhair | n=9 | | | No | n=9 | |
| | Female neutered | n=27 | Domestic shorthair | n=42 | Naive | n=23 | Yes | n=2 | n=1 (sedation score of zero) n=1 (scored 25 hours before surgery with no sedation score recorded) |
| | Female | n=1 | | | | | No | n=20 | |

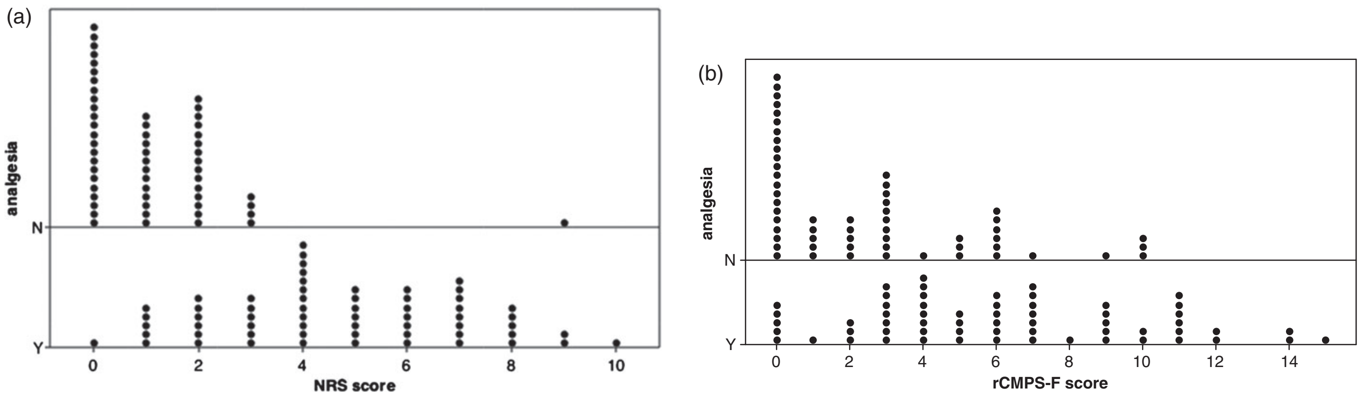


**FIG. 2. (a) Distributions of NRS scores for cats in intervention level study 2 (n=116); analgesia required (Y or N). (b) Distribution of rCMPS-F scores for cats in intervention level study 2 (n=116); analgesia required (Y or N)**

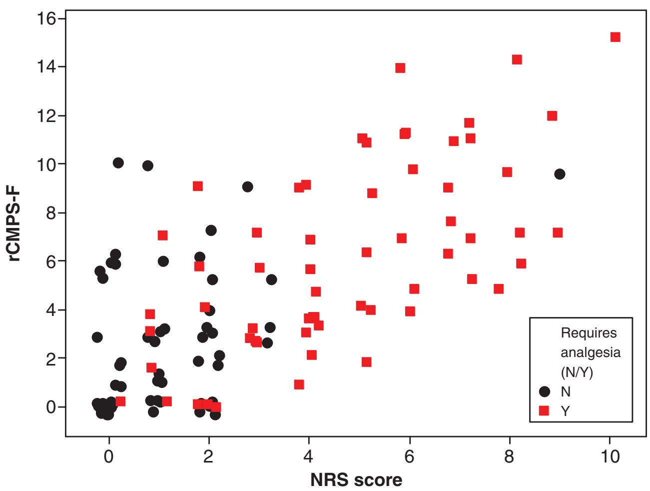


**FIG 3. Scatterplot of rCMPS-F and NRS scores for 116 cats in intervention level study 2**

Construct validity can be demonstrated in a variety of ways including the creation of hypotheses regarding the scale items, which are then supported or discredited through experiment. Hypotheses used for testing construct validity of pain scales include (1) the prediction of change in pain scores following the administration of proven analgesics and (2) "known groups" validity where the instrument should be able to distinguish correctly between groups that would be expected to have different scores. In study 1, the median CMPS-F scores changed from 8/22 pre-analgesia to 3/22 post-analgesia. It is interesting to note that these values did not change when the scores were converted to rCMPS-F, lending weight to the fact that the revisions to the original CMPS-F were appropriate. There was a mean change in rCMPS-F scores of 2·4 ±2·87 with 95% CI for mean change (pre–post) following analgesia of 1·2 to 3·6, thus proving the hypothesis 1. Hypothesis 2 was upheld in study 2 when the tool demonstrated a statistically significant difference in pain scores between those cats that required analgesia and those that did not.

In general, when clinicians reported whether the change pre and post-analgesia (study 1) was clinically significant, this was supported by the change in pain scores, providing some evidence for responsiveness of the scale. However, because of the small numbers clinical significance was not reached.

In study 2, intervention levels of 4/16 and 3/10 were derived for the rCMPS-F and NRS respectively. To the authors' knowledge an intervention level has not been reported for the NRS and as the scale remains in use in veterinary practice this represents a useful clinical advancement.

Linear discrimination analysis resulted in a misclassification rate of 26·7% for the rCMPS-F which was poorer than that of the NRS (14·5%). The data from this study were interesting as 10 of the cats had relatively high rCMPS-F scores (>9/16), driven largely by high corresponding scores in the demeanour/general impression category; five cats had scores of 2 and five had scores of 4 for the individual general impression category, yet low NRS scores were identified as not requiring analgesia. Perhaps, when using the NRS, observers attributed any change in demeanour to temperament rather than pain and accordingly awarded a lower score. Also, the veterinary surgeon making the judgment as to whether the cat required analgesia did so immediately after using the NRS. Consequently, this judgment, intended as a global impression, may have been influenced by the NRS score.

Brondani *et al.* (2013) used similar methods to determine validity (criterion and construct), responsiveness of the English version of their scale and to define an intervention level. However there were marked differences in experimental design compared with the studies described here. All 58 cats underwent a strictly standardised soft tissue procedure (ovariohysterectomy) of moderate severity and scoring was performed by observers trained in anaesthesia. Five observers scored videotapes and three scored in a hospital clinical environment. According to Brondani *et al.* (2013), the MCPS is a valid, reliable, responsive scale for assessing acute pain in cats undergoing ovariohysterectomy when used by anaesthesiologists and anaesthetic technicians. However it may not perform as well in a wider population of cats suffering a diverse range of painful conditions, both medical and surgical.

In contrast, the rCMPS-F was designed to be used in a clinical environment where acute pain would arise from a varied source including postsurgical, trauma and medical cases and where its assessment would be undertaken by observers of varying levels of experience; hence the inclusion of a broad range of cases and observers.

User feedback was positive regarding ease of use of the rCMPS-F and the time taken for the completion and computation of scores was short, indicating good utility. This is in contrast to the UNESP-Botucatu which in addition to being more time-consuming contains blood pressure measurement that requires the use of specialised equipment and technical expertise and so limits its usefulness. According to Teasdale and Jennett (1974), for a scale to be generally accepted as universal, it must be practical to use in a wide range of locations and by staff without special training.

In summary, the rCMPS-F has been shown to be a valid scale for the measurement of acute pain in cats in general veterinary practice with some evidence for its responsiveness presented. Users should consider the administration of analgesia if scores are equal to or greater than 4/16. Further development of the scale will include the incorporation of a facial expression component (Holden *et al.* 2014) with the intention of improving sensitivity of the scale.

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## Conflict of interest

None of the authors had financial or personal relationships with other people or organisations that could inappropriately influence or bias the content of this paper.

## References

Brondani, J. T., Luna, S. P. & Padovani, C. R. (2011) Refinement and initial validation of a multidimensional composite scale for use in assessing acute postoperative pain in cats. *American Journal of Veterinary Research* **72**, 174-183

Brondani, J. T., Mama, K. R., Luna, S. P., *et al.* (2013) Validation of the English version of the UNESP-Botucatu multidimensional composite pain scale for assessing postoperative pain in cats. *BMC Veterinary Research* **9**, 143

Colorado State University Animal Cancer Centre, Veterinary Medical Centre. (2006) Feline Acute Pain Scale. Accessed December 8, 2012

French Association for Animal Anaesthesia and Analgesia Pain Scoring System. (n.d.) 4A-Vet, Vérérinaire Anesthésie Analgésie Douleur Animale. Accessed December 8, 2012

Holden, E., Calvo, G., Collins, M., *et al.* (2014) Evaluation of facial expression in acute pain in cats. *Journal of Small Animal Practice* **55**, 615-621

Holton, L. L., Scott, E. M., Nolan, A. M., *et al.* (1998) Comparison of three methods used for assessment of pain in dogs. *Journal of American Veterinary Medical Association* **212**, 61-65

Holton, L. L., Reid, J., Scott, E. M., *et al.* (2001) Development of a behavior- based scale to measure acute pain in dogs. *Veterinary Record* **148**, 525-531

Lascelles, B. D. X., Butterworth, S. J. & Waterman, A. E. (1994) Postoperative analgesic and sedative effects of carprofen and pethidine in dogs. *Veterinary Record* **134**, 187-191

Morton, C., Reid, J., Scott, E., *et al.* (2005) Application of a scaling model to establish and validate an interval level pain scale for assessment of acute pain in dogs. *American Journal of Veterinary Research* **66**, 2154-2166

Reid, J., Nolan, A. M., Hughes, J. M. L., *et al.* (2007) Development of the short form Glasgow composite measure pain scale (CMPS-SF) and derivation of an analgesic intervention score. *Animal Welfare* **16**, 97-104

Streiner, D. L. (1993) An introduction to multivariate statistics. Canadian Journal of Psychiatry **38**, 9-13

Teasdale, G. & Jennett, B. (1974) Assessment of coma and impaired consciousness. A practical scale. Lancet **2**, 81-84

## APPENDIX 1: CMPS-F

Glasgow composite measure pain scale for acute pain in cats: CMPS–Feline
Choose the most appropriate expression from each section and total the scores to calculate the pain score for the cat, if more than one applies choose the higher score

*Look at the cat in its cage*

Is it?

| | |
|---|---|
| Silent or purring | 0 |
| Meowing | 1 |
| Crying/growling | 2 |
| Groaning | 3 |

| | |
|---|---|
| Curled up with tail extended or loosely wrapped | 0 |
| Licking lips | 1 |
| Restless/cowering at back of cage | 2 |
| Tense/crouched | 3 |
| Rigid/hunched | 4 |

| | |
|---|---|
| Ignoring any wound or painful area | 0 |
| Rubbing any wound or painful area | 1 |
| Scratching any wound or painful area | 2 |
| Licking any wound or painful area | 3 |
| Chewing/biting any wound or painful area | 4 |

*Approach the cage, call the cat by name & stroke along its back from head to tail –*

Does it?

| | |
|---|---|
| Approach and respond to stroking by arching back with tail up (may also stand on tiptoes) | 0 |
| Approach, but not respond to stroking | 1 |

Is it?

| | |
|---|---|
| Unresponsive | 2 |
| Aggressive | 3 |

*If it has a wound or painful area, apply gentle pressure 5cm round the site. In the absence of any painful area apply similar pressure round the hind leg, above the knee*

Does it?

| | |
|---|---|
| Do nothing | 0 |
| Swish tail/flatten ears | 1 |
| Cry/hiss | 2 |
| Growl | 3 |
| Bite/lash out | 4 |

General impression

Is the cat?

| | |
|---|---|
| Happy and content | 0 |
| Disinterested/quiet | 1 |
| Anxious/fearful | 2 |
| Dull | 3 |
| Depressed/grumpy | 4 |

Pain Score …/22

## APPENDIX 2: REVISED CMPS-F (RCMPS-F)

Glasgow composite measure pain scale for acute pain in cats: CMPS – Feline
Choose the most appropriate expression from each section and total the scores to calculate the pain score for the cat, if more than one expression applies choose the higher score

LOOK AT THE CAT IN ITS CAGE

| | |
|---|---|
| **Question 1** | |
| Is it? | |
| Silent / purring / meowing | 0 |
| Crying/growling / groaning | 1 |
| **Question 2** | |
| Relaxed | 0 |
| Licking lips | 1 |
| Restless/cowering at back of cage | 2 |
| Tense/crouched | 3 |
| Rigid/hunched | 4 |
| **Question 3** | |
| Ignoring any wound or painful area | 0 |
| Attention to wound | 1 |

APPROACH THE CAGE, CALL THE CAT BY NAME & STROKE ALONG ITS BACK FROM HEAD TO TAIL

| | |
|---|---|
| **Question 4** | |
| Does it? | |
| Respond to stroking | 0 |
| Is it? | |
| Unresponsive | 1 |
| Aggressive | 2 |

IF IT HAS A WOUND OR PAINFUL AREA, APPLY GENTLE PRESSURE 5 CM AROUND THE SITE. IN THE ABSENCE OF ANY PAINFUL AREA APPLY SIMILAR PRESSURE AROUDN THE HIND LEG ABOVE THE WOUND

| | |
|---|---|
| **Question 5** | |
| Does it? | |
| Do nothing | 0 |
| Swish tail/flatten ears | 1 |
| Cry/hiss | 2 |
| Growl | 3 |
| Bite/lash out | 4 |
| **Question 6** | |
| General impression | |
| Is the cat? | |
| Happy and content | 0 |
| Disinterested/quiet | 1 |
| Anxious/fearful | 2 |
| Dull | 3 |
| Depressed/grumpy | 4 |

Pain Score …/ 16