Pain assessment in animals

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Attitudes to pain in animals have changed dramatically over the past two decades, with marked advances in its treatment. However, while the importance of measuring animal pain in a valid and reliable manner has been acknowledged for some time, veterinary scientists have been slow to recognise the important contribution of the psychometric approach to the construction of measurement instruments. Well established in human medicine, psychometric methods, which ensure that the end product is valid, reliable and, where required, responsive to clinical change, are the 'gold standard' in instrument design. In addition to discussing the particular challenges veterinary scientists face when designing instruments to measure pain in animals, this article describes the psychometric approach and, using the dog as an example, demonstrates how this approach can be used to produce scientifically robust pain scales for non-human species.

Pain

Pain is a complex multi-dimensional experience involving sensory and affective (emotional) components. In other words, 'pain is not just about how it feels, but how it makes you feel' and it is those unpleasant feelings that cause the suffering we associate with pain. It is a uniquely personal experience, which means that it is impossible for us to appreciate how it is perceived by another person or animal, but most scientists now believe that we should assume animals suffer pain in a similar way to ourselves. Some would go even further. In 1985 Rollin suggested that pain produces more suffering in animals than it does in people because animals do not understand why it occurs and Robertson (2002) added that an animal's inability to anticipate relief from pain also contributes to that additional suffering.

At its simplest, pain is classified as either acute or chronic. Acute pain is generally associated with tissue damage or the threat of this and serves the vital purpose of rapidly altering behaviour in order to avoid damage or minimise further damage, and to optimise the conditions in which healing can take place, stopping when healing is complete. In contrast, chronic pain persists beyond the expected course of an acute disease process and, in people, as well as having an effect on physical wellbeing, tends to have a significant impact upon the psychology of the sufferer, often resulting in fear, anger, anxiety or depression, all of which affect the patient's quality of life (QOL). Quality of life is a general term, but when QOL is altered as a result of ill health and/or medical interventions then the more specific term health-related quality of life (HRQL) is used. The complexity of the chronic pain experience has a bearing on its measurement, such that many of the instruments now used to measure human chronic pain are concerned primarily with measuring, not the pain per se, but rather its effect on the patient's HRQL.

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Importance of measuring animal pain

Our ability to measure pain in a valid and reliable manner is essential to meet the growing demand for evidence-based veterinary medicine and to recognise, treat and manage pain more effectively in animals. Many veterinarians now recognise the importance of treating acute pain in the post-operative period, not just from a humanitarian point of view, but also because it reduces morbidity.

As companion animals live longer there has been an increase in the incidence of painful chronic conditions such as osteoarthritis and the authors have shown that chronic pain may have a similar negative effect in animals as it does in people, thus affecting the animal's HRQL (Wiseman-Orr and others 2004, Wiseman-Orr and others 2006). Treatment options for chronic pain are complex and response to treatment is subject to much individual variation. Accordingly the veterinarian must monitor health status effectively in order to tailor treatment to the individual. In recent years the treatment of tumours in companion animals has become a viable alternative to euthanasia and while very few animals with cancer appear to be clinically

Fig 1: Great Dane with osteosarcoma of left distal radius. Photography courtesy of Jo Morris, University of Glasgow

painful other than if there is bone pain (Fig 1) (Jo Morris, personal communication), increased survival is often achieved by the aggressive use of treatment protocols that may adversely affect the animal both during and after treatment. In support of this the authors have demonstrated that lymphoma has a significant negative impact on the HRQL of dogs suffering from this condition (unpublished results).

Irrespective of the type of pain, or its source, the key to assessing clinical change and the efficacy of treatment in order to guide clinical decision making, including the appropriateness of euthanasia, is being able to measure that pain in such a way that we can have confidence in the derived measure. Similarly in clinical trials, often conducted on a multicentre basis, outcome measures that judge the effectiveness of one treatment compared with another, or none, must be valid and reliable.

Challenges of measuring pain

Developing an instrument that is scientifically robust and fit for purpose is undoubtedly the greatest challenge in measuring pain, irrespective of whether the instrument is designed for use in animals or people. Challenges more specific to veterinary medicine, such as the impossibility of self-reporting by the animal, species and breed differences are dealt with later in this article.

Pain measurement

The role of measurement is to assign numerical values to the attribute of interest. William Thomson, Lord Kelvin of Glasgow, famously said that 'when you cannot measure it, when you cannot express it in numbers…you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be'. This hints at the rigorous thinking that the development of any measurement instrument demands, made even more difficult in the case of pain measurement by the fact that the goal is to measure pain's affective component (how it makes you feel). In the past two decades the medical profession has recognised the importance, however difficult, of valid and reliable measurement of how people are feeling. Psychometric methods originally established by psychologists and psychiatrists to measure abstract concepts that cannot be measured in a conventional sense, such as intelligence and personality, have been applied to the measurement of pain. Pain measurement instruments take the form of structured questionnaires with formal scoring methodology, which are generally completed by the patient. However for those who, like our animal patients, are incapable of self-report, such as infants or cognitively impaired adults, instruments are designed for completion by a proxy or an observer.

Compared with acute pain, designing instruments to measure chronic pain is a more challenging task because of the way chronic pain interacts with a patient's social, psychological and physical well-being. Accordingly, many of the instruments now used to measure human chronic pain are concerned primarily with measuring the effect of the pain on the patient's HRQL.

Instruments to measure pain and HRQL can be discriminative or evaluative. The former are used to measure differences between patients at a point in time, an example of which would be to distinguish people who are healthy from those who are unhealthy. Evaluative instruments on the other hand measure differences in the same patient over time and these are frequently used to determine any clinical change when a patient is under treatment. They can be generic (designed to be used in a variety of contexts) or they can be disease specific. Disease specific instruments may be more responsive to clinical change, but generic instruments can be valuable indicators of a range of impacts associated with disease and its treatment, and may be the only option when a patient is suffering from more than one condition. Disease specific instruments often have a generic core with an additional set of items that address the specific impacts of that disease.

Psychometric methodology

The psychometric approach requires that measurement instruments demonstrate the psychometric properties of validity, reliability and, usually, responsiveness to change, before being adopted for clinical use, and offers a range of methods for such evaluation. The processes necessary for the creation and testing of psychometric instruments are well established and may be described in three phases.

- Phase 1 involves the specifying of measurement goals, the identification of the patient population, and the development of a pool of potential items (questions) for inclusion in the instrument.
- Phase 2 involves the selection of suitable items from the item pool, and that selection is subjected to expert validation. A formal scoring mechanism

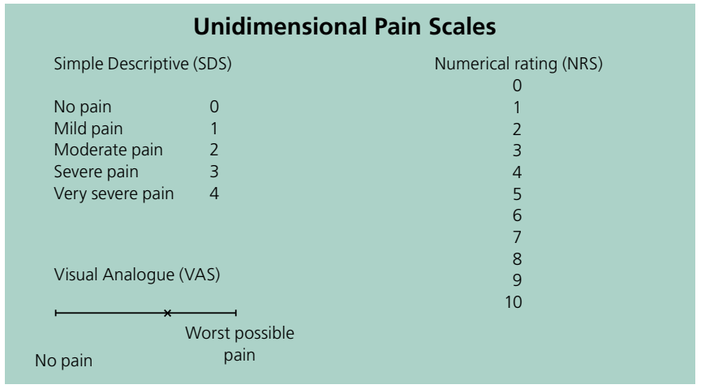


Fig 2: The Simple Descriptive Scale (SDS), Numerical Rating Scale (NRS) and Visual Analogue Scale (VAS) used to measure pain intensity

is devised. The validated collection of items is then incorporated into an instrument, with suitable consideration given to layout, response options provided for items, instructions to the respondent and other details of administration. The resulting prototype is then pre-tested to ensure that the target respondent can use the instrument correctly.

- Phase 3 involves field-testing the instrument, in order to evaluate its psychometric properties.

Psychometric properties

Validity

Validity (criterion, content and construct) is the most fundamental attribute of an instrument because it provides evidence that the instrument is able to measure what it was designed to measure.

- Criterion validity is the agreement of a new instrument with some existing `gold standard'; however, in the case of animal pain and HRQL no such gold standard exists and so other forms of validity must be sought.
- Content validity focuses on the appropriateness and completeness of the items within the instrument and is deemed to be present when those items cover all the relevant aspects being measured without including any extraneous features. The simplest form of content validity is face validity, which uses expert opinion to establish whether, 'on the face of it', the items appear relevant to and encompassing of the tested attribute(s).
- Construct validity is demonstrated when hypotheses regarding the attribute(s) in question are supported by use of the instrument; for example, we might hypothesise that, following surgery, pain will decrease with time and if that is reflected by the scores obtained with the instrument then evidence for the construct validity of that instrument has been provided.

Reliability

Reliability is a measure of whether an instrument can measure accurately and repeatedly what it is intended to measure, so that measurements of individuals on different occasions when their condition is unlikely to change, or made by different observers at the same time, produce the same or similar results. If an instrument is to be used by an independent observer, then inter-rater reliability — when two or more observers concurrently applying the instrument to the same subject should provide similar scores — is an important kind of reliability.

Responsiveness

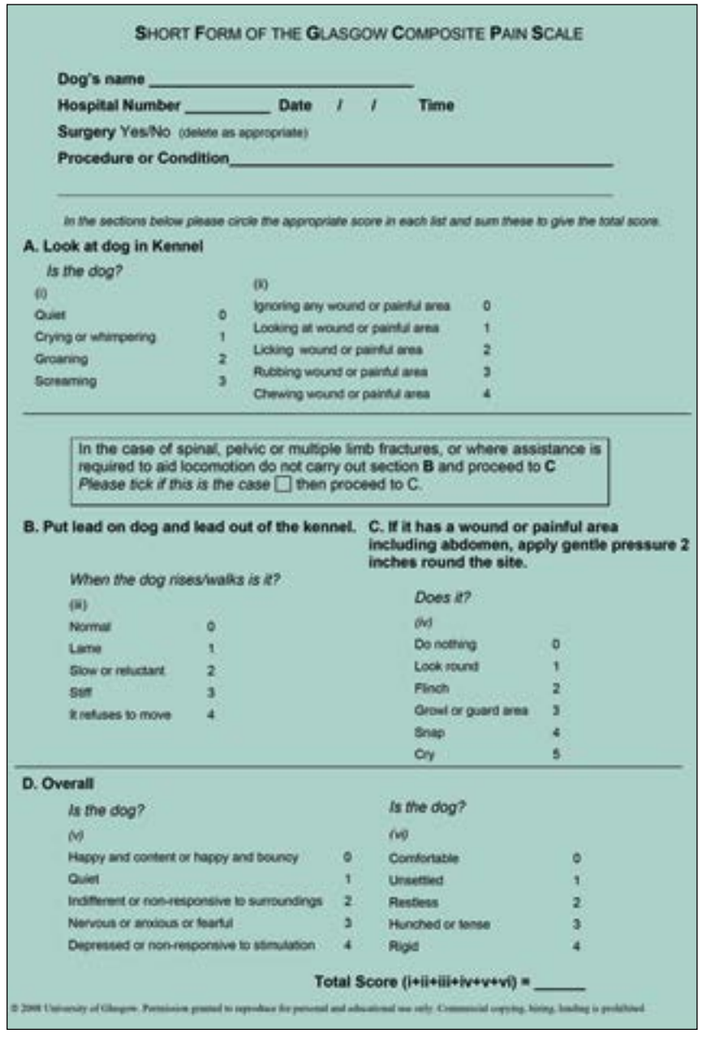
Responsiveness is the property that ensures that the instrument is sensitive enough to detect differences in health status that are not only statistically important, but are also important to the clinician or to the patient. In the case of pain, if a pain scale can detect relatively small changes in pain state before and after analgesic administration, that is an indication that it is responsive.

In addition to possessing the fundamental properties of validity, reliability and responsiveness, a good clinical instrument must also be practical and easy to use and interpret. Even if a measure is valid and reliable, it may not be acceptable to the user if it requires lengthy training, is time-consuming to use or if scoring is complex.

Use of a proxy

Although the gold standard measure of human HRQL is the self-report, for those who are incapable of self-report, such as infants or cognitively impaired adults, instruments are designed for completion by an observer who knows the subject well. Similarly, animals must rely on an observer to assess their subjective experiences. Veterinarians and animal nurses see animals in acute pain every day and so are well placed to interpret acute pain behaviours. Traditionally, acute pain assessment in a veterinary context has relied on the use of simple unidimensional scales such as the simple descriptive scale (SDS), the numerical rating scale (NRS), and the visual analogue scale (VAS) (Fig 2). These scales invite the user to record a global score for pain intensity that is purely subjective in nature. Furthermore, when using these subjective scales, the observer's judgment can be affected by factors such as age, gender, personal health and clinical experience. For example, when scoring a dog that has undergone surgery for cruciate ligament repair, a veterinarian who has undergone similar surgery him or herself may be inclined to score the pain more severely than one who has not. Similarly, women tend to award higher pain scores than men. Particularly important is the fact that, where more than one observer is involved in assessing acute pain in a single individual, as often happens in a busy clinical setting, the use of a proxy rater inevitably introduces some degree of inter-observer variability, limiting the reliability of the resulting scores.

In the case of chronic pain in dogs, however, studies have highlighted the importance of using the owner as the proxy rater since with chronic pain, in comparison with acute pain, subtle behavioural disturbances may only be apparent outside a clinical setting (within which they may be masked by fear, excitement or anxiety associated with being in an unfamiliar environment) and changes in behaviour may be so gradual that they are apparent only to someone very familiar with the individual animal. Where the owner is the only person providing observations inter-observer variability is clearly not an issue.



SHORT FORM OF THE GLASGOW COMPOSITE PAIN SCALE

Dog's name _____

Hospital Number _____ **Date** / / **Time**

Surgery Yes/No (delete as appropriate)

Procedure or Condition_____

In the sections below please circle the appropriate score in each list and sum these to give the total score.

A. Look at dog in Kennel

Is the dog?

(i)

Quiet	0
Crying or whimpering	1
Groaning	2
Screaming	3

(ii)

Ignoring any wound or painful area	0
Looking at wound or painful area	1
Licking wound or painful area	2
Rubbing wound or painful area	3
Chewing wound or painful area	4

In the case of spinal, pelvic or multiple limb fractures, or where assistance is required to aid locomotion do not carry out section **B** and proceed to **C**
Please tick if this is the case ☐ then proceed to C.

B. Put lead on dog and lead out of the kennel.

When the dog rises/walks is it?

(iii)

Normal	0
Lame	1
Slow or reluctant	2
Stiff	3
It refuses to move	4

C. If it has a wound or painful area including abdomen, apply gentle pressure 2 inches round the site.

Does it?

(iv)

Do nothing	0
Look round	1
Flinch	2
Growl or guard area	3
Snap	4
Cry	5

D. Overall

Is the dog? (v)		*Is the dog?* (vi)	
Happy and content or happy and bouncy	0	Comfortable	0
Quiet	1	Unsettled	1
Indifferent or non-responsive to surroundings	2	Restless	2
Nervous or anxious or fearful	3	Hunched or tense	3
Depressed or non-responsive to stimulation	4	Rigid	4

Total Score (i+ii+iii+iv+v+vi) = _____

Fig 3: The short form of the Glasgow Composite Measure Pain Scale (CMPS-SF) used to measure acute pain in dogs

Box 1: Descriptive statement that accompanies the CMPS-SF scores

The short form composite measure pain score (CMPS-SF) can be applied quickly and reliably in a clinical setting and has been designed as a clinical decision making tool. It was originally developed for dogs in acute pain. It includes 30 descriptor options within six behavioural categories, including mobility. Within each category, the descriptors are ranked numerically according to their associated pain severity and the person carrying out the assessment chooses the descriptor within each category that best fits the dog's behaviour/condition. It is important to carry out the assessment procedure as described on the questionnaire, following the protocol closely. The pain score is the sum of the rank scores. The maximum score for the six categories is 24, or 20 if mobility is impossible to assess. The total CMPS-SF score has been shown to be a useful indicator of analgesic requirement and the recommended analgesic intervention level is 6/24 or 5/20.

Species, breed and individual differences

Behavioural disturbances have long been recognised as potential indicators of the presence of pain in animals, and in recent years these have been used to develop a range of 'composite' instruments such as the instruments developed in Glasgow for measurement of canine acute and chronic pain (Holton and others 2001, Reid and others 2007 and Wiseman-Orr and others 2004, 2006). Constructed using the psychometric methods described above (or similar), such instruments are designed to take account of the multidimensional nature of pain and to be more objective and so more reliable than the SDS, NRS and VAS.

However, it is important to bear in mind that each species manifests its own unique pain-related behaviours or behavioural disturbances, often rooted in the evolutionary process (eg, selection pressures may have ensured that prey species do not 'advertise' an increased vulnerability to predators) and so these cannot simply be translated to another species. Consequently, a behaviour-based pain scale for the dog is not directly transferable to the cat, although the methodology used to construct each instrument is generic and can be applied to any species.

Over the past two decades the focus of human pain measurement has moved on from 'how it feels' to 'how it makes you feel' and, in a veterinary context, the importance to its welfare of how the animal feels is now widely recognised. However, how an animal feels about its situation will vary with its breed, age and individual circumstance. For example, the opportunity of a long romp on a windswept beach is likely to be perceived in one way by an energetic young Labrador retriever and may be perceived entirely differently by an elderly Cavalier King Charles spaniel that has been raised as a 'lap dog'. This has implications for the practical interpretation of scores obtained using any instrument and, where possible, age and breed population 'norms' should be available for comparison.

Available tools

Many instruments to measure pain in animals have been developed on an ad hoc basis, but now there is growing support for rigorous methods to be applied to the development and testing of pain measures for use in veterinary medicine in order to deliver valid and reliable pain measurement tools. In this regard adoption of the psychometric approach is increasing. An example of an instrument development that has made use of psychometric methodology is the Glasgow Composite Measure Pain Scale (CMPS–SF), a clinical decision making instrument that measures acute pain in dogs (Reid and others 2007). This is available for download from the web under free licence at www.gla.ac.uk/departments/painandwelfareresearchgroup/downloadacutepainquestionnaire

It takes the form of a structured questionnaire completed by an observer following a standard protocol, which includes assessment of spontaneous and evoked behaviours, interactions with the animal and clinical observations (Fig 3 and Box 1).

A number of questionnaire instruments designed to measure chronic pain and HRQL in companion animals are available. It is important that when faced with a range of instruments to choose from, veterinary

Box 2: Engaging awareness in measurement of chronic pain

Using a rigorous psychometric approach to instrument design, which ensures its scientific soundness, the Glasgow Pain And Welfare Group has developed a paper based prototype instrument to measure chronic pain in dogs through its effect on HRQL. Details of its development (Wiseman-Orr and others 2004) and subsequent validation (Wiseman-Orr and others 2006) were fully reported. A large number of questionnaire items (109) were obtained through extensive interviews with dog owners, and use the language chosen by dog owners to describe the subtle behavioural changes they observe in their pets.Further research and development has resulted in a 46 item generic measure of HRQL: a measure of wellbeing. A further innovation has been to develop a web based version of this instrument. This allows dog owners to complete the instrument with ease in the home environment, and allows responses to be captured and scores generated automatically and instantaneously. Currently undergoing field testing, the system does not replace a visit to the vet, but is expected to provide peace of mind for owners between annual health checks. It will promote more active engagement of owners in the care of their pets, thus providing a novel opportunity for practices to enhance client relationships, and their business, through regular and meaningful communication with clients.

practitioners should satisfy themselves that, for the one they choose, there is sufficient published evidence to support its appropriate construction, validity, reliability and responsiveness — the key properties of a scientifically robust measurement instrument.

Conclusion

The development of instruments to measure pain and HRQL is a time-consuming and complex undertaking, but it is essential. Paraphrasing Albert Einstein, 'some things can be made simple, but only so much so before they lose meaning'. By adopting a rigorous methodological approach to constructing pain measurement instruments that assures their validity, veterinary practitioners can be more confident of managing and treating pain of all origins in animals under their care.

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Quiz: Pain assessment in animals

(1) For the following statement, select the answer that best completes the sentence. When used to measure acute pain in the dog, the visual analogue scale (VAS) is:

a. a multidimensional scale
b. effective at measuring the affective dimension of the pain
c. designed to measure pain intensity
d. used effectively to measure chronic pain
e. consistently reliable

(2) For the following statement, select the answer that best completes the sentence. The signs of chronic pain in animals:

a. are best assessed by the veterinary surgeon or nurse
b. stop when healing is complete
c. reflect the impact of the pain on the animal's quality of life
d. are more obvious than those of acute pain
e. are the same in all species

(3) If two similarly qualified male vets and two female vets are asked to assess post-surgical pain in the same dog simultaneously, which of the following outcomes might you expect?

a. The scores are likely to be the same.
b. The men will tend to give higher pain scores than the women
c. The mens' scores will vary more than those of the women
d. Inter-observer variability may be reduced by the use of a composite measure pain scale
e. A unidimensional scale would give the most reliable pain scores

(4) For the following statement, select the answer that best completes the sentence. An instrument to measure pain in animals that is reliable is one that:
a. measures what it was intended to measure
b. will give the same result when applied on different occasions to the same animal when that animal's pain status is unchanged
c. will distinguish between different groups of animals, for example, a group of well dogs from a group of ill dogs
d. is easy to use
e. can detect differences in pain status

Answers
(1) c, (2) c, (3) d, (4) b.