Pain, like many phenomena within human sensory experience, cannot be measured by external means and a patient report must be used. Pain measurement scales exploit aspects of the patient report that can yield reproducible data relating to the severity of the patient’s pain and the effects of treatment.

A clinically useful pain scale must be easy for both patients and healthcare professionals to use and interpret whilst maintaining validity across a variety of disease states and cultures.

**Simple pain scales**

Simple pain scales are widely used in clinical practice and research. In postoperative pain, it is best to measure pain on movement rather than at rest.

**Verbal rating scales**

Verbal rating scales (VRS) aim to stratify pain intensity according to levels of severity represented by commonly used adjectives. Such scales may be simple and consist of as few as 3 levels, associated with adjectives such as ‘mild’, ‘moderate’ and ‘severe’. More levels can be used, but problems tend to arise due to interpatient differences in the interpretation of the adjectives used.

VRS are widely applied and there is no doubt that a 3 or 4 level scale is the easiest for patients to use. They are useful for audit measurement where the stratification of data allows standards to be defined clearly. For example, when measuring the efficacy of epidural analgesia in the postoperative period, health professionals and patients alike would accept that a ‘severe’ pain rating would represent an unsatisfactory outcome.

VRS may be used as tools in clinical research, but their semi-quantitative nature makes them less suitable for this purpose. The data they yield are not suitable for parametric tests of statistical significance and, therefore, non-parametric techniques (see below) must be used. Non-parametric tests are robust, but generally require larger sample sizes and tests of a more quantitative nature are preferred.

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**Numerical rating scales**

Numerical rating scales (NRS) take the two extremes of the pain experience (for example, ‘no pain’ and ‘worst pain imaginable’) and assign numbers to levels of pain in between. It is assumed that each number represents a proportional increase in the pain severity (Fig. 1).

NRS are robust and reproducible pain scales. They are simple for patients to understand and there is evidence that the elderly find them easier to use than visual analogue scores (see below). Recording data from the scores is also straightforward as numbers can simply be read off the marked scales.

NRS, like VRS, generate discontinuous data that are unsuitable for parametric statistical techniques. In practice, this potential problem is frequently overlooked without major consequences. A more intractable problem is that the use of specific anchoring points within the scale, that is the use of digits, reduces their capacity to detect subtle changes. In reality, variability within and between patients tends to mask this effect. However, visual analogue scales (VAS) avoid this problem.

**Fig. 1** Numerical rating pain scale.

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**Key points**

- Pain can only be measured by patient report
- The verbal rating scale for pain is easy to use and has been widely adopted for clinical use
- In postoperative pain, it is best to measure pain on movement rather than at rest
- Pain relief scales may be more sensitive, particularly in chronic pain
- Chronic pain is best assessed by multidimensional measures

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Visual analogue scales

Visual analogue scales (VAS) are similar in concept to NRS in that anchor points are used to represent the extremes of pain experience. The patient then makes a mark across a line of standard length and the distance along the line is used as the pain measurement (Fig. 2). VAS have been widely and successfully used in pain research. The simple approach of marking the line gives robust and culturally independent data that avoid the problems of anchoring and number/word preferences that are associated with both VRS and NRS.

VAS may be applied in the great majority of clinical and experimental pain settings. They yield continuous data, making analysis easier than with VRS or NRS. In addition, data such as standard deviation and standard error can be quoted in a meaningful context, making it easier to define treatment effects. Most patients find the VAS easy to use. Nevertheless, both the very young and very elderly patient may find alternatives easier to complete.

Pain relief scales

The techniques described above may be all that is required for many clinical situations, especially in the acute pain setting. However, a number of researchers have emphasised the importance of measuring ‘pain relief’ associated with either a drug or an intervention. The easiest way of doing this is to assess pain scores before and after the intervention. The problem with this approach is that patients with chronic pain may report levels of pain that reflect learned pain behaviours and pain scores may change little with therapeutic interventions, although specific inquiry as to the amount of relief provided by the intervention may show a sizeable effect. This approach has been criticised for being a form of ‘leading’ questioning, but the concept probably does have a degree of validity. Any pain scale can be used to measure pain relief, although the scales for pain and pain relief should not be presented to the patient on the same sheet of paper.

Multidimensional pain scales

Simple pain scales yield data that are a composite of the patient’s pain experience. As such, they can not separate the many factors associated with pain. For example, a 25-year-old patient with deep partial thickness burns to both hands and a 60-year-old patient with an acute myocardial infarction may both rate their pain as 9/10 on a NRS. However, such a measurement tells the clinician nothing of the sense of overwhelming dread that often accompanies a myocardial infarction or the anxiety about the ability to earn a living associated with the hand injury. This multidimensional nature of pain can only really be analysed by specific inquiry.

The McGill Pain Questionnaire

The McGill Pain Questionnaire (MPQ) was developed by Melzack and colleagues in the early 1970s. The original questionnaire included a series of verbal rating scores belonging to three domains, namely sensory, affective and evaluative. A further ‘miscellaneous’ domain was added at a later stage. Other information recorded included the patient-reported distribution of pain and a simple NRS to describe the present pain intensity.

The MPQ was an attempt to produce a standard measurement tool that would assess many of the different phenomena that might be reported as pain. The MPQ can be a useful clinical research tool, but is cumbersome and time-consuming for all parties and many patients often do not understand the words used. Explanation of the terms by an investigator invalidates the measure. With these problems in mind, a short form of the MPQ was devised, based around a heavily edited subset of words from the MPQ. Rather than asking the patient to choose a word to represent the pain severity, each word in the short form MPQ is associated with a five-point VRS that the patient completes. Once again, the validity of the scale is dependent on the patient’s conception of the adjectives used.

 Syndrome specific pain scales

Problems with use of a tool such as the MPQ can sometimes be avoided by developing a specific measurement tool to examine a particular pain syndrome. Examples of this are the Neuropathic Pain Scale (NPS), developed by Galer and colleagues and the Oswestry Scale, for use in back pain. Neuropathic pain has
features and qualities that are generally not seen in other pain states. The NPS aims to separate the severity of each of these features by means of a series of NRS. There is little attempt to separate psychological distress from the scale.

The Oswestry Scale places less emphasis on reported pain and more on the displayed functional limitations placed upon the patient by their back pain. This concept is of major importance in evaluating the patient with chronic pain. As stated above, patients with chronic pain rarely show dramatic resolution of their symptoms and often, the goal must be to achieve stable or slightly improved pain reporting with an improvement in physical, psychological and social function.

Adjunctive measurements in pain

The multidimensional nature of the pain experience has already been described. In the acute pain setting, measures of psychological distress and social function are rarely assessed although they may be important. For example, high levels of trait anxiety tend to lead to increased pain reporting. In the chronic pain environment, they become vital. Perhaps the three most important dimensions in the patient’s presentation requiring detailed assessment are mood (anxiety and depression), quality of life and pain beliefs.

Assessments of mood

Abnormal levels of anxiety and depression are common in patients with chronic pain. Assessment of these abnormalities enables clinicians to prioritise treatments for individual patients. For example, the severely depressed patient with pain from advanced cancer is unlikely to respond to therapies based solely around opioid analgesia and may require adjuvant antidepressants and psychotherapy before an improvement in pain is seen.

A formal psychiatric/psychological evaluation is the most effective method of assessing mood disorder. However, most professionals involved in the management of patients with chronic pain are not trained in such techniques and recourse to an evaluative questionnaire is usually appropriate. Scales such as the Zung self-rated depression score, the Beck Anxiety and Depression Inventories and the Hospital Anxiety and Depression scale are all sensitive and in common use.

Quality of life

Quality of life (QOL) assessments aim to give a measure of the overall impact of a disease state on a patient’s life when compared with individuals without disease. A number of measures are available but the best known is probably the Short Form–36 questionnaire which is a truncated version of a more detailed questionnaire piloted over 20 years ago in the US Medical Outcomes Survey. The SF–36 assesses physical functioning, bodily pain, physical role, mental health, emotional role, social functioning, vitality and general health.

Regrettably, whilst the SF–36 has a number of applications in chronic disease, assessment of QOL in chronic pain does not appear to be one of them. This is possibly due to the extremely poor QOL of patients in chronic pain who have been shown to have a lower QOL than patients with heart disease, diabetes or cancer. Other QOL measures have been examined, but none offers the practicality and reproducible data required for everyday clinical use and their use in research remains an area of much controversy.

Pain beliefs

Unlike QOL measures, pain beliefs can be assessed readily using screening tools such as the Survey of Pain Attitudes. Such data provide valuable information as to the perceptions patients hold regarding their illness and their own roles in improving their health. Such measures are probably underused in clinical practice.

Assessment of pain in children

The assessment of pain in young children poses particular difficulties. Children over the age of around 7 or 8 years can usually report their pain in the same way as adults but, below this age, alternative measurement tools may be required to determine the intensity of pain. A scale intended for use by children must capture their imagination and be fun to use, as well as being reproducible.

Neonates, infants and toddlers (birth to 3 years)

It used to be assumed that neonates were incapable of experiencing pain due to an immature, poorly myelinated nervous system. This idea is no longer tenable. Indeed, fetal intrahepatic vein needling has been shown to elicit a stress response as early as 23 weeks postconceptual age. Clearly, it is impossible to use any kind of self-response based scoring system in neonates in this age group. Effective pain scoring systems must rely on behavioural variables such as facial expression and crying, or physiological variables of which cardiovascular parameters provide the most objective index. However, changes in these values after a noxious input or a painless, but distressing, stimulus may be similar. A variety of tools of varying complexity have been validated for neonatal use such as the Objective Pain Scale and the Clinical Scoring System. Although older children in this group can often identify the locality of the painful stimulus, they tend to report severity of pain at the extremes of the range.
Young children (3–7 years)

Above the age of 3 years, many children have sufficiently well-developed skills of language and understanding to report on the position and intensity of pain as long as this is done in words they can understand and providing the range of choices is limited to 4 or 5. Thus, a simple verbal rating score may be employed. Alternatively, the ‘Faces Scale’ (Fig. 3) system works well at this age. This is a series of cartoon faces ranging from smiling broadly to crying inconsolably. However, younger children sometimes think they are always supposed to find the happiest face and do not relate it to their pain intensity! A more detailed system using a series of photographs of children’s faces of increasing pain intensity can be employed (the ‘Oucher’ system). This can be useful over a wide age range, but needs matching to cultural background. Alternatively the ‘Poker Chip Tool’ uses red plastic poker pieces to represent ‘pieces of hurt’ and allows children to choose from 1 (a little bit of hurt) to 4 (a lot of hurt). This scale has been subjected to some validation. Visual analogue scales can be used in some children from around the age of 5 years. However, they do not understand the 100 mm line easily and better results can often be gained using a colour graduation system and making the line vertical like a thermometer.

Older children (7 years +)

Above this age, children and adolescents can usually use conventional visual analogue scales and can begin to give a reliable verbal report on quality of pain.

Analysis of pain measurements

Many of the scales described above generate complex and interdependent data sets that require specialist statistical advice for appropriate analysis. Simpler measures such as VRS, NRS and VAS may be analysed using relatively simple tests and knowledge of these tests will also help in study design.

VRS, especially when the scale is confined to only 3 levels, can be summarised in contingency tables and either $\chi^2$ or exact tests used, depending on the numbers involved. Where a VRS is divided into several levels or a NRS is used, a non-parametric equivalent of the $t$-test such as the Mann Whitney test or the Wilcoxon rank sum test (for paired data) is appropriate. VAS generate continuous data and $t$-tests can be used as long as less than 25% of the data are at extreme ends of the range. If there are doubts about the validity of a $t$-test then a non-parametric equivalent can be used as above.

Single measurements of pain intensity are not especially useful and most studies will measure pain over a specified time interval making repeated measurements. The tests described above can not be used repeatedly across this time period for a number of reasons. Repeated measures analysis of variance techniques can be used but are complex and fraught with pitfalls. An easier method is to use the repeated measures from each patient to generate a pain/time graph. Measuring the area under the curve gives a summary measure for each patient that can be analysed easily by a single statistical test.

Key references


See multiple choice questions 5–8.