

Children's self-reports of pain intensity: Scale selection, limitations and interpretation

Carl L von Baeyer PhD RDPsych

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Most children aged five years and older can provide meaningful self-reports of pain intensity if they are provided with age-appropriate tools and training. Self-reports of pain intensity are an oversimplification of the complexity of the experience of pain, but one that is necessary to evaluate and titrate pain-relieving treatments. There are many sources of bias and error in self-reports of pain, so ratings need to be interpreted in light of information from other sources such as direct observation of behaviour, knowledge of the circumstances of the pain and parents' reports. The pain intensity scales most commonly used with children – faces scales, numerical rating scales, visual analogue scales and others – are briefly introduced. The selection, limitations and interpretation of self-report scales are discussed.

Key Words: *Child; Measurement; Pain intensity; Pain scale; Self-report*

Les autoévaluations d'intensité de la douleur par les enfants : la sélection des échelles, leurs limites et leur interprétation

À partir de cinq ans, la plupart des enfants peuvent fournir une autoévaluation valable de l'intensité de leur douleur si on leur fournit des outils et des explications adaptés à leur âge. Les autoévaluations de l'intensité de la douleur sont une sursimplification de la complexité de l'expérience de la douleur, mais elles s'imposent pour évaluer et titrer les traitements analgésiques. Il existe de nombreuses sources de biais et d'erreurs dans les autoévaluations de la douleur, et c'est pourquoi elles doivent être interprétées à la lumière de l'information tirée d'autres provenances, telles que l'observation directe du comportement, des connaissances et des circonstances de la douleur ainsi que le compte rendu des parents. Les échelles d'intensité de la douleur les plus utilisées chez les enfants, soit les échelles des visages, les échelles d'évaluation numérique, les échelles visuelles analogiques et d'autres, sont présentées brièvement. La sélection, les limites et l'interprétation des échelles d'autoévaluation sont présentées.

NEITHER A WASTE OF TIME NOR A GOLD STANDARD

A tough audience of pediatric anaesthesiologists recently told me, "We don't need to measure pain – we cure it." In their view, using pain scales with children is a waste of time. On the other hand, there has recently been a campaign to promote subjective pain scores as a 'gold standard' or as the 'fifth vital sign' (1,2).

Both of these polarized views are probably overstated. Subjective reports of pain often work extremely well in capturing qualities of experience, but it is necessary to recognize that they are subject to personal response biases, reflect the person's appraisal of the consequences of the pain report and require certain cognitive skills (3,4). Self-report pain scores are not vital (essential for life), a sign (objective physical finding) or a gold standard (a criterion against which other measures should be judged). However, it has been shown that regular pain measurement improves pain management (5,6). Children's self-reports of pain intensity are a valuable source of information, but their interpretation must be considered together with observation of behaviour, reports by parents, clinical data and information on the child's social environment (7-9). Estimates of pain intensity based on these other sources may not always correlate highly with children's self-report of pain (10), and may reflect different perspectives of the pain experience (11).

The following brief review addresses the main practical issues in selection of age-appropriate self-report tools and the

interpretation of self-report pain intensity scores. A more specific systematic review of self-report measures has recently been completed; it recommends a set of outcome measures of pain severity for pediatric clinical trials (12).

A NECESSARY OVERSIMPLIFICATION

Pain is highly complex and multidimensional. Describing pain only in terms of its intensity is like describing music only in terms of its loudness. Pain intensity scores are inherently an oversimplification because they neglect features such as the location, sensory quality, and affective and cognitive aspects of the experience of pain. However, pain intensity scores serve a very useful purpose in sensitively evaluating the effects of pain-relieving and pain-producing interventions (13). Thus, pain intensity scores can be seen as a necessary oversimplification.

Comparisons of different pain-producing and pain-relieving conditions can be conducted across time within persons, or across groups of patients. Because pain treatment may be effective without eliminating all pain, a simple dichotomous estimation (pain/no pain) is not adequate to capture such effects; a graded scale is needed. Pain intensity scores constitute a core outcome domain in randomized, controlled trials of pain-relieving treatments (14).

PAIN SCALES FOR CHILDREN

The principal types of scales that have been used to measure pain intensity in children are listed in Table 1.

Departments of Psychology and Pediatrics, University of Saskatchewan, Saskatoon, Saskatchewan

Correspondence: Dr Carl L von Baeyer, Department of Psychology, University of Saskatchewan, 9 Campus Drive, Saskatoon, Saskatchewan S7N 5A5. Fax 306-966-6630, e-mail carl.vonbaeyer@usask.ca

TABLE 1
Types of pain scales used with children

Type of scale (references)	Approximate minimum age (years)	Pediatric validation research to date
Adjective scales (28)	9	Minimal or none
Numerical rating scales (56-58)	8	Minimal or none
Visual analogue scales (26,27,59)	6	Extensive
Faces scales (18-20,39,60)	4	Extensive
Colour scales (61,62)	4?	Minimal or none
Pieces of Hurt (29)	3	Some

Note: Not all children at the suggested minimum age will be able to make valid use of the scale. As many as three-quarters of normally developing three-year-olds may not understand a graded self-report task even with an age-appropriate tool

Numerical rating scales

Numerical rating scales (NRS) (15) involve asking for estimates of pain using numbers representing increasing pain severity. Such scales, particularly the NRS-11 (which is scored 0 to 10), have not been adequately tested in research with child participants; nevertheless, they are the scales most frequently used for children older than eight years of age because they have the advantage of requiring no equipment (and perhaps because they are commonly used with adults). They do, however, require numeracy, the ability to think and express oneself in quantitative terms, and verbal communication skills. Young children may provide numbers on an NRS that are idiosyncratic and unreliable because, although they may be able to count, they have not yet developed an understanding of the quantitative significance of numbers (16,17).

Faces scales

Faces scales require selecting a picture of a face that represents one's pain intensity (Figure 1). They fall into two categories: drawings (18,19) and photographs (20). An advantage of the drawings is that they can be readily and inexpensively reproduced by black and white photocopying. The drawings lack specific ethnic or gender features, so they may be applicable to broader demographic groups than the photographic scales which portray real boys and girls of selected ethnic groups. Faces scales may not require the ability to seriate or estimate quantities, because the task can be handled by simply matching how one feels to one of the faces, which is presumed to be easier than quantitative estimation (21). Generally, children prefer faces scales to visual analogue scales (VAS) when given a choice (22-24).

VAS

VAS require selecting a point on a line representing the dimension of pain intensity. They have been extensively researched and they show good sensitivity and validity for most children at age seven years and older (25,26). The Coloured Analogue Scale (27) (Table 2) is a VAS that uses a mechanical slider to indicate pain intensity. It has been particularly well investigated, but unlike some other scales it requires the purchase and possible sterilization of a plastic tool. Paper-based VAS require an extra step in measuring the line.

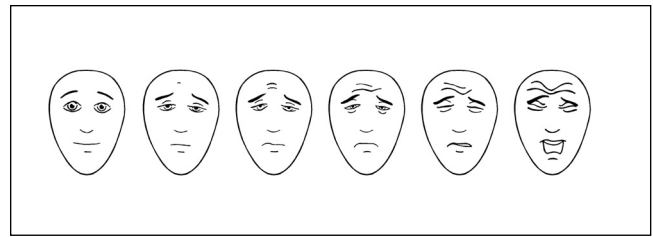


Figure 1) The Faces Pain Scale – Revised (18). Scored 0, 2, 4, 6, 8 and 10. Available with instructions in many languages at <www.painsourcebook.ca>. Reprinted with permission. © 2001 International Association for the Study of Pain

TABLE 2
The author's selection of four self-report pain intensity scales based on criteria in Table 3

Recommended age range (years)	Scale
9 to adult	Numerical Rating Scale: "Please tell me how much it hurts using a number from 0 to 10. Zero means no pain and 10 is the most pain." Most convenient tool because it requires no equipment, but it is not well researched with children.
5 to 17	Coloured Analogue Scale (27)*
4 to 12	Faces Pain Scale – Revised (18)†
3 to 6	Pieces of Hurt (29,63)‡

*The Coloured Analogue Scale can be ordered at <https://secure.jnjcanada.com/painscale/eng/default.asp?fuseaction=order>; †See Figure 1. The Faces Pain Scale – Revised can be found at <http://painsourcebook.ca/pdfs/ppsf92.pdf>; ‡Instructions on Pieces of Hurt can be found at <http://www.painresearch.utah.edu/cancerpain/attachb7.html>

Adjective scales

Adjective scales involve selecting a word out of a set of descriptors of pain intensity (28). These scales require verbal fluency at a high school level and have not been investigated extensively with children.

Pieces of Hurt

The Pieces of Hurt tool (also known as Poker Chip Tool) (29) quantifies pain intensity by using four poker chips to represent amounts of pain. Children indicate how much hurt they have by referring to one poker chip as a little bit of hurt, two as a little more hurt, three as more yet, and four as the most hurt they could ever have. The Pieces of Hurt tool has been used as a comparison tool to support the criterion validity of other pain tools, such as the pain ladder and the VAS (30,31).

Colour scales

The colour scales (unlike the Coloured Analogue Scale, which is a VAS) require the child to select crayons and draw colours matching different levels of pain severity. Very little research has been done with the colour scales. They take more time to administer than any of the other scales and are now rarely seen in clinical use.

AGE AND ABILITY TO SELF-REPORT PAIN

The approximate proportions of children at different ages who are able to provide self-reports of pain, given that they have been trained in the use of an age-appropriate tool, are shown in Figure 2.

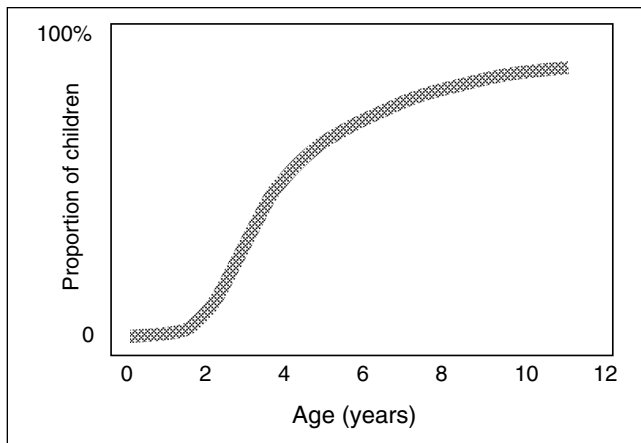


Figure 2) An estimate of the proportion of children at different ages who are able to provide reliable self-report of pain when given an age-appropriate scale under optimal conditions. © CL von Baeyer, 2004

A pain scale designed for children should ideally have many or all of the features identified in Table 3. Among these features, a strong evidence base is particularly important. Indications that children are able to apply a pain scale in a consistent (reliable) and valid way come from the following five lines of evidence. The references provide examples.

1. Correlations of pain self-report ratings with other validated self-report and observational pain scales administered at the same time (18,27).
2. Accurate ranking of hypothetical no pain, moderate-pain, and high-pain events presented in pictures or stories (32).
3. Increased pain ratings in response to painful clinical or experimental procedures (33).
4. Decreased pain ratings in response to analgesic interventions or less painful ways of performing a procedure (34,35).
5. Decreased pain ratings over successive days or hours of postoperative or postinjury recovery (36,37).

ANCHOR EFFECTS

The term ‘anchor effect’ refers to the influence of surrounding conditions or prior experience on the estimation of a quantity. For example, a 50 g weight feels heavier after holding a 10 g weight than it does after holding a 100 g weight. The anchors that are verbally described on most pain scales are at the lower end of the scale, representing no pain, and at the upper end of the scale, representing some theoretical maximum. Pain ratings on faces scales are influenced by whether the lower anchor face is smiling or not (38,39). There has been little research into what children think of when they are told that the upper end of the scale represents “the worst pain you can imagine”, or “the biggest hurt”. Although some scales provide a top anchor such as “worst possible pain”, this is considered difficult for young children because it requires an understanding of the abstract concept of possibility (16). A child who thinks of the worst possible

TABLE 3
Desirable features of a pain scale

Reasonably valid and reliable, as established by research
Developmentally and culturally appropriate to patients (ie, within the child's cognitive and language skills)
Easily and quickly understood by patients who have minimal formal education
Well-liked by patients and clinicians
Quickly and easily explainable to patients
Easily used with the patient to set pain management goals or comfort-function goals
Places low burden on clinician (ie, quick and easy to score and record)
Inexpensive and easy to obtain, reproduce and distribute to clinicians, patients and their families
Readily available (eg, on the Internet)
Easily disinfected (or in the case of photocopied scales, inexpensive enough to discard after use)
Available with instructions in various languages

Adapted from references 64 and 65

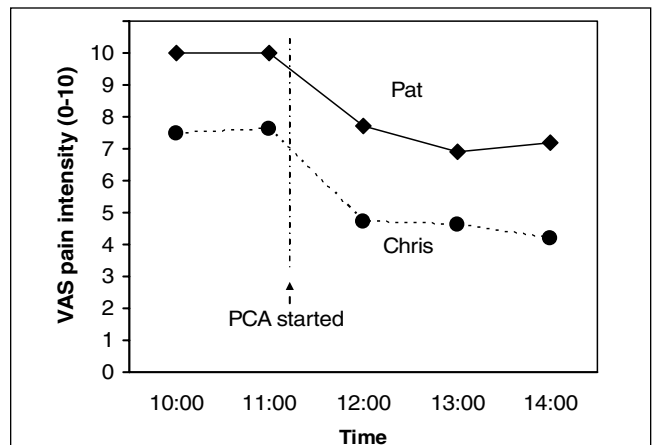


Figure 3) Pain trajectories for two hypothetical postsurgical patients. One cannot conclude that Pat is experiencing more pain than Chris, but the analgesics appear to be helping both patients. PCA Patient-controlled analgesia; VAS Visual analogue scale. © CL von Baeyer, 2006

pain as the needle that he is experiencing at that moment may give a higher rating than another child who is concurrently aware of other, much more severe, forms of pain.

INTRAINDIVIDUAL VERSUS INTERINDIVIDUAL COMPARISONS

Figure 3 shows the pain trajectories (on a VAS) over time for two hypothetical postsurgical patients. One cannot conclude that Pat necessarily is experiencing more pain than Chris, because one cannot assume that they are construing the pain scales, and specifically the anchors, in the same way. However, the analgesic appears to be relieving pain to some extent in both cases; thus, these intraindividual comparisons provide guidance for continuation and adjustment of the treatment.

PAIN RATINGS IN PRESCHOOL-AGE CHILDREN

Special considerations apply to children of preschool age. Young children who have not yet experienced school are not used to being asked questions by strangers. They are also not experienced in giving quantitative ratings or estimates. Questions such as "Are you tired?" or "Are you hungry?" are generally treated as yes or no questions by people caring for children; graded estimates of such internal states are rarely requested. The language used in asking young children about pain must be kept simple; for example, children do not spontaneously use the word 'pain' before age six although they use the word 'hurt' from age 2.5 years (40).

Moreover, it has been shown that young children who do not understand a question will often construct an answer anyway, based on their current understanding of the situation. Many children younger than five years of age have a marked tendency to use only the extremes of scales; in other words, they treat the scale as dichotomous rather than graded (41). Other response sets or biases include giving the same answer to all questions, and responding in an upward or downward sequence to successive questions (eg, pointing to faces scaled 0, 2, 4, 6 and 8). Recent studies (42) revealed that these response biases can be detected in up to three-quarters of three-year-olds in response to pain rating questions. A child's lack of understanding of the request for a pain rating may not become evident on the basis of a single rating, because these response sets may be detected only with repeated questions.

Children's self-reports of pain may be affected by their perception of the consequences of the rating. If a child thinks that she is going to get an extra needle after reporting pain, then she is likely to suppress or minimize her report. On the other hand, if the report of pain has desirable consequences, such as being allowed to stay home from school if the pain is severe, then higher self-ratings may be given. Many other cognitive, social and cultural factors influence pain ratings (eg, previous painful experiences, temperament, presence of an audience, family and community norms for pain expression), making them idiosyncratic and difficult to interpret (43-45).

THE MINIMUM CLINICALLY SIGNIFICANT DIFFERENCE AND THE PAIN TREATMENT THRESHOLD

A few studies (37,46) have addressed the question of how large a difference in pain scores is clinically significant. If a child's pain diminishes from 8 to 7 following intervention, does that represent a success in treatment? Estimates of the minimum clinically significant difference depend on the type of pain, the starting pain level and other factors, but they tend to be in the 10% to 20% range. In other words, a change of one face on the Faces Pain Scale – Revised, or a change of 10 mm to 20 mm on a 100 mm VAS, would be the smallest meaningful change (37,46).

The pain treatment threshold (formerly termed 'drug request point' [47]) provides another ipsative (self-referenced) standard against which to compare self-report scores. The pain treatment threshold is the pain score above which a patient would want analgesia. Many children report pain worse than their pain treatment threshold during postoperative recovery (48), indicating that their pain is poorly managed.

SELECTING, ADMINISTERING AND INTERPRETING A PAIN SCALE

Here are some practical points of advice concerning assessment of children's pain using self-report scales.

1. Pick a tool appropriate for the child's age (Table 1) that has as many desirable features as possible (Table 3). A selection of four self-report scales covering the pediatric age range is shown in Table 2.
2. If possible, introduce the child to the scale when he or she is not in pain, because it will be more difficult to explain the tool if the child's concentration is impaired.
3. With very young children, and with those who are unable to understand the self-report task due to cognitive impairment or high levels of distress, use observational measures (8,49-52).
4. Offer the child a chance to practice with the scale by rating hypothetical situations that would produce low and high levels of pain, eg, opening a birthday present versus stepping on a sharp nail.
5. When possible, obtain successive pain ratings over time, and observe their covariation with pain-relieving interventions as well as with events known to increase pain, such as needles.
6. Obtaining pain scores should not be seen as a substitute for talking with patients. Their narrative should always be obtained to provide context for the pain scores.
7. Take charted pain scores into account when planning treatment.
8. When discrepancies arise among pain scores provided by the child, parent and clinician, these differences can often be resolved through discussion, so that pain management can be guided by the best estimate of the pain severity.

Measurement of children's pain by self-report has previously been reviewed (12,53-55) and the reader is encouraged to access more detail through these publications. The present brief review has been limited to self-reports of pain intensity, and has not covered other important aspects of pain management. For example, a child may prefer to accept a moderate degree of pain if it means having a mind unclouded by strong opioids. Other dimensions of the pain experience, such as its affective impact (distress and fear), the way it is cognitively construed and dealt with (catastrophizing, perceived control and coping), and the functional disability it produces (reduced activity and missing school), all should be assessed along with pain intensity. However, formal psychometric methods for measuring these other variables are more complex and less well known than the simple unidimensional pain intensity scales.

SUMMARY

Self-report measures have often been underutilized in assessing children's pain. They can be used in conjunction with observer reports of pain and can provide a valuable indication of treatment outcome in both clinical and research contexts. Pain management is improved when pain is regularly and reliably

measured (5,6). Tools designed for children's self-report of pain, such as those listed in Table 2, do require more research, but can provide effective guidance for pain management practice.

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