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# Pain Measurement in Children

The measurement of pain in children has advanced greatly in the last decade. This survey will outline current approaches to the assessment of pain in children and the problems that have kept pain measurement from contributing as it should to the care of children in pain. Pain can be measured by self-report (what children say), biological markers (how their bodies react), and behavior (what children do). Because pain is a subjective event, self-report is best if it is available. Unfortunately, in many infants, young children, or children with cognitive or physical impairments, self-report is not available and behavioral or biological measures must be used.

**Self-report**

Children as young as two years can report pain, although at this age they are not able to rate intensity. Children at any age may deny pain if the questioner is a stranger, if they believe they are supposed to be brave, if they are fearful, or if they anticipate receiving an injection for pain.

Nevertheless, it is worthwhile to ask preschool children about their pain. Questioning should be patient and use words familiar to the child ("Do you have any hurt?" or "Is there an ‘owie’ or ‘boo-boo’ in your tummy?"). It is often helpful to have parents assist. For example, one might ask: "Ms. Smith, how should I ask Marie about her pain? What do you say in your family?"

**Children at any age may deny pain if the questioner is a stranger, if they believe they are supposed to be brave, if they are fearful, or if they anticipate receiving an injection for pain.**

Children four or five years old can use standardized measures. Hester’s[1] Poker Chip Tool is well validated and works well in this age group because it is concrete. Four poker chips are placed in front of the child and the chips are described as pieces of hurt. The first chip is described as "just a little hurt," the second is "a little more hurt," the third chip is "more hurt," and the fourth chip is "the most hurt you could have?" The child is asked "How

many pieces of hurt do you have?" The response is then confirmed. For example, the questioner might say "Oh, that means you have a little hurt."

Face scales can often be used in this age group. Fig. 1 shows two[2,3] of many scales that are available. Children are asked to indicate their pain by pointing to one of the faces. Usually the child is trained by asking how he or she would feel following some minor pain and then a more severe pain.

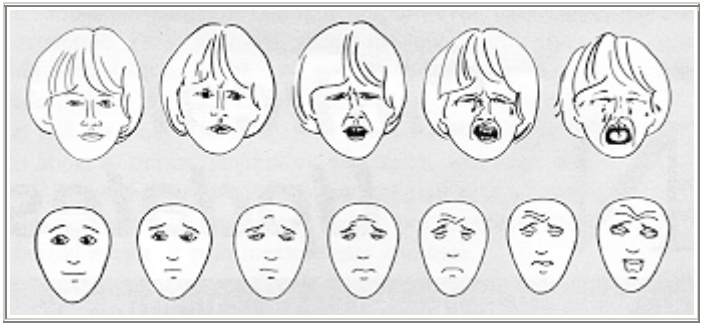

**Figure 1. (top)** Faces scale from Kuttner and LePage (1989);
**(bottom)** faces scale from Bieri, Reeve, Champion, and Addicoat (1990).

Six- or seven-year-olds can use word-graphic rating scales[4]. Children are asked to indicate how much pain they have on a line with five verbal anchors (Fig. 2). At this age, children can use 0-10 or 0-100 scales, with 0 being "no pain" and 10 or 100 being "the worst possible pain." Similarly, a 10-cm-long line with anchors of "no pain" and "the worst possible pain" (a visual analogue scale) can be used. The data do not suggest that any one scale of this type is better than another.

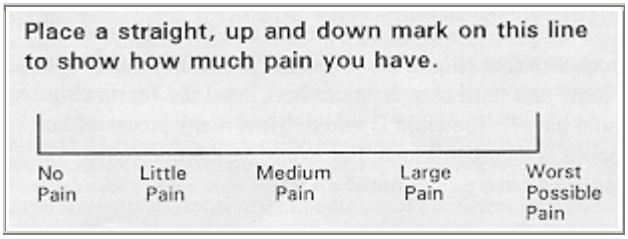


**Figure 2.** Word graphic rating scale from Tesler, Savedra, Holzemer and Wilkie (1991).

## Biological Measures

Heart rate initially decreases and then increases in response to short, sharp pain[5]. Vagal tone[6] and heart rate variability[7], such as during breathing, have been used as indices of pain and distress. No studies have evaluated heart rate as a measure for longer-term pain, although heart rate is not substantially elevated during postoperative pain in older children[8]. Ill and premature babies have less predictable responses. Heart rate is an easy and generally valid measure of short, sharp pain. Unfortunately, there appear to be no biological measures that can be recommended for use as a clinical pain measure for longer-term pain.

Arterial oxygen saturation is widely monitored in anesthesia and critical care and is frequently available in the neonatal intensive care unit (NICU). Oxygen saturation decreases during painful procedures such as circumcision, lumbar punctures, and intubation, but can occur for other reasons or just during handling of neonates. Children may have normal oxygen saturation despite significant pain over a long period.

Surgery or trauma triggers the release of stress hormones (corticosteroids, catecholamines, glucagon, and growth hormone) into the blood. This cascade may facilitate healing but can have disastrous results in the sick neonate. Anand[9] has detailed the stress response of premature and full-term infants to surgery. The stress response is blunted by opioids, probably by several actions at the hypothalamic and pituitary level. The stress response is more than a measure of pain. Although useful in the research context, these measures have not been applied to assess clinical pain.

Cortisol release, widely studied in infants and children, is not specific to pain and occurs in many adverse situations. Plasma cortisol levels rise significantly during circumcision[10]. However, sick premature babies may have unstable levels, and small changes during painful procedures may not be detectable. Cortisol changes with routine inoculation in healthy infants[11], but the response depends on a complex interaction of age, behavior, and baseline values. This complexity precludes cortisol as a clinical pain measure, even for short sharp pain.

**Heart rate is an easy and generally valid measure of short, sharp pain. Unfortunately, there appear to be no biological measures suitable for use as a clinical pain measure for longer-term pain.**

**Behavior**

Vocalization, facial expression, and body movement are typically associated with pain. Inferring pain from behavior is fraught with difficulties, however, because there are frequent discordances between pain behavior and self-report, the "gold standard" for pain. The concordance between behavior and self-report of pain is often best for brief, sharp pain, such as pain from a needle[12].

Behavioral measures of longer-lasting pain are less well developed. Three behavioral scales have been developed for measuring postoperative pain in infants and children. The Children's Hospital of Eastern Ontario Pain Scale (CHEOPS)[13] rates six behaviors (crying, facial expression, verbal expression, torso position, touch, and leg position).

The seven-item Toddler-Preschool Postoperative Pain Scale[14] includes items on vocal expression, facial expression, and bodily expression. The 10-item, Postoperative Pain Score[15] rates 10 behaviors: sleep, facial expression, cry, motor activity, excitability, flexion, sucking, tone, consolability, and sociability. Four scales have combined behavior and biological markers to measure postoperative pain. The Objective Pain Scale[16] reports on five areas: blood pressure, crying, movement, agitation, and verbal evaluation or body language. This scale correlates between .89 and .98 with the CHEOPS. The COMFORT

Scale[17] measures alertness, calmness/agitation, respiration, physical movement, blood pressure change, heart rate change, muscle tone, and facial tension. CRIES[18] is a five-item scale that includes: crying, oxygen requirement, increased vital signs, expression, and sleeplessness. Finally, the Premature Infant Pain Profile[19] uses behavioral state, heart rate change, oxygen saturation change, brow bulge, eye squeeze, and nasolabial furrow to measure pain.

All of these scales have promise but they have not been fully validated, especially for pain that occurs hours after the child has left the recovery room, as both behavior and biological markers revert toward normal[20]. At this time, no scale has been shown superior to the others and it is likely that they will yield similar measurements.

More subtle measures of behavior such as the Neonatal Facial Action Coding System[21] may be more sensitive to long-lasting pain, although facial action coding has only been demonstrated valid in sharp pain in neonates. The Neonatal Facial Action Coding System consists of 10 facial actions that coders identify from videotapes. Facial movements observed in response to heel lance were: brow bulge, eye squeeze, nasolabial furrow and lip part, taut tongue, mouth stretch, and chin quiver.

The Douleur Enfant Gustave Roussy (DEGR) scale[22] is a 15-item behavioral rating scale designed to measure longer-term pain in pediatric oncology patients aged two to six years. Three subscales assess pain behavior such as protecting the affected area; psychomotor alterations, such as slowing down or withdrawal; and anxiety behaviors, such as restlessness and irritability. The scale has evidence of validity and satisfactory inter-rater reliability but clearly measures anxiety and depression as well as pain.

Nurse or parent ratings of children's pain using a visual analogue scale, a numerical rating, or a faces scale are often useful in the clinical setting because the scales are easy to use and appear valid. Correlations between adult ratings of children's pain and children's own ratings of their pain are good[5,12].

In summary, behavioral measures are excellent for measuring short, sharp pain but may not be as effective for measuring longer-lasting pain.

**Organization of Measurement**

Clinicians should develop a routine strategy for asking about pain and recording it in the child's clinical record. Pain diaries and pain flow sheets are two ways to organize pain measures. Parents or children can use pain diaries to record pain three or four times a day over a series of days. Fig. 3 is an example of a pain diary. Pain flow sheets are used to record pain routinely in the clinic or hospital. A pain flow sheet can improve care by increasing analgesic usage[23]. Pain flow sheets should be completed routinely and be subject to quality assurance monitoring.

Fill in this form at breakfast, lunch, dinner and bedtime each day.

**Name: _____ Week beginning: _____**

| Day | Time | Intensity Rating | Other Symptoms | Medications | Possible Cause |
|---|---|---|---|---|---|
| Sunday | Breakfast | | | | |
| | Lunch | | | | |
| | Dinner | | | | |
| | Bedtime | | | | |
| Monday | Breakfast | | | | |
| | Lunch | | | | |
| | Dinner | | | | |
| | Bedtime | | | | |
| Tuesday | Breakfast | | | | |
| | Lunch | | | | |
| | Dinner | | | | |
| | Bedtime | | | | |
| Wednesday | Breakfast | | | | |
| | Lunch | | | | |
| | Dinner | | | | |
| | Bedtime | | | | |
| Thursday | Breakfast | | | | |
| | Lunch | | | | |
| | Dinner | | | | |
| | Bedtime | | | | |
| Friday | Breakfast | | | | |
| | Lunch | | | | |
| | Dinner | | | | |
| | Bedtime | | | | |
| Saturday | Breakfast | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Lunch | | | | |
| | Dinner | | | | |
| | Bedtime | | | | |

Intensity Ratings
0 - No headache
1 - Headache - I am only aware of it if I pay attention to it
2 - Headache - but I can ignore it at times
3 - Headache - I can't ignore it but I can do my usual activities
4 - Headache - It's difficult to concentrate, I can only do easy activities
5 - Headache- such that I can't do anything

**Figure 3.** Example of a headache diary.

## Barriers to Pain Measurement

As indicated above, substantial gaps exist in measures of longer-lasting pain that do not rely on self-report. Ill neonates and handicapped children are at particular risk for inadequate pain measurement. Both populations are at high risk of pain from primary disease treatment (including procedures and surgery) and from the underlying disorder itself. New, more creative methods to measure pain must be developed if we are to overcome these problems. A related measurement issue is that pain relief must be weighed against side effects to determine the best treatment.

Other aspects of the child's condition, such as fear or anxiety, nausea, vomiting, insomnia, exhaustion, dyspnea, depression, loneliness, boredom, and fear that pain heralds recurrent disease, will make pain worse. Possibly, descending pain inhibitory mechanisms may not function as effectively when the child is exhausted. These factors do not simply exaggerate the report of pain, they also increase the perception and physiological response to pain. Attention to these issues will make pain management more effective. Unfortunately, there has been little work on measurement of these phenomena.

More serious challenges at this time are, however, political and economic. These problems reflect the low priority given to pain control in the health care system. Political problems include lack of policies about pain measurement in children at risk for pain, lack of medical education about pain, and myths about addiction, respiratory depression, and other side effects. Economic barriers include lack of staff time allocated to pain assessment and treatment, and failure to support more specialized means of pain measurement and care.

**A clear standard of care has emerged that requires the routine measurement of pain in children who are at risk for pain.**

All clinicians have the responsibility to provide the accepted standard of care to their patients. Clinicians who fail to provide the standard of care are liable for ethical or legal sanction. Institutions that fail to act to ensure that the standard of care is maintained are also liable. To our knowledge, there has not yet been any ethical or legal action for failure to measure pain in children. This may occur soon. A clear standard of care has emerged that requires the routine measurement of pain in children who are at risk for pain, for example, following surgery and during active phases of diseases such as cancer, sickle cell disease, or rheumatoid arthritis. A clear indication that measurement of pain is a standard that must be met are the guidelines for acute[22] and cancer pain[23] management published by the Agency for Health Care Policy and Research of the United States.

## Conclusions

Technical problems with measurement of pain in children under six years of age arise because accurate self-report is not available. However, political and economic barriers are equally important problems. Even now, routine measurement by self-report and caregiver rating could determine pain severity and enhance pain treatment. The children in our care deserve the best possible treatment; pain measurement can help provide it.

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### References

1. Hester NO. Nurs Res 1979; 28:250–255.
2. Kuttner L, LePage T. Can J Behav Sci 1989; 21:198–209.
3. Bieri D, et al. Pain 1990; 41:139–150.
4. Tesler MD, et al. Res Nurs Health 1991; 14:361–371.
5. Johnston CC, Strada ME. Pain 1986; 24:373–382.
6. Porter FL, Parges SW, Marshall RE. Child Dev 1988; 59:495–505.
7. McIntosh N, Van Veen L, Brameyer H. Pain 1993; 52:71–74.
8. O'Hara M, et al. J Pediatr Orthop 1987; 7:78–82.
9. Anand KJ. Pain Research, and Clinical Management, Vol. 5, Pain in Neonates. Elsevier, Amsterdam, 1993, pp. 39–66.
10. Gunnar MR, et al. Psychoneuroendocrinology 1981; 6:269–275.
11. Lewis M, Thomas D. Child Dev 1990; 61:50–59.
12. Fradet C, et al. Pain 1990; 40:53–60.
13. McGrath PJ, et al. Adv Pain Res Ther 1985; 9:395–402.
14. Tarbell SE, Cohen T, Marsh JL. Pain 1992; 50:273–280.
15. Attia J, et al. Anesthesiology 1987; 67:A532.
16. Norden J, et al. Anesthesiology, 1991; 75:A934.
17. Ambuel B, et al. J Pediatr Psychol 1992; 17:95–109.

18. Krechel SW, Bildner J. Pediatr Anesth 1995; 5:53–61.
19. Stevens B, et al. Clin J Pain, in press.
20. Beyer JE, McGrath PJ, Berde, CB. J Pain Symptom Manage 1990; 5:350–356.
21. Grunau RV, Craig KD. Pain 1987; 28:395–410.
22. Gauvain-Piquard A, et al. J Pain 1987; 31:177–188.
23. Carr DB, et al. Acute Pain Management: Operative or Medical Procedures, and Trauma, Rockville, MD, Department of Health, and Human Services, 1992, AHCPR Publ. No 92-0032.
24 Jacox A, et al. Management of Cancer Pain, Rockville, MD, Department of Health, and Human Services, 1994, AHCPR Publ. No. 94-0592.

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