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A Systematic Review of Faces Scales for the Self-report of Pain Intensity in Children

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Pediatrics 2010;126;e1168; originally published online October 4, 2010;
DOI: 10.1542/peds.2010-1609

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abstract

CONTEXT: Numerous faces scales have been developed for the measurement of pain intensity in children. It remains unclear whether any one of the faces scales is better for a particular purpose with regard to validity, reliability, feasibility, and preference.

OBJECTIVES: To summarize and systematically review faces pain scales most commonly used to obtain self-report of pain intensity in children for evaluation of reliability and validity and to compare the scales for preference and utility.

METHODS: Five major electronic databases were systematically searched for studies that used a faces scale for the self-report measurement of pain intensity in children. Fourteen faces pain scales were identified, of which 4 have undergone extensive psychometric testing: Faces Pain Scale (FPS) (scored 0–6); Faces Pain Scale–Revised (FPS-R) (0–10); Oucher pain scale (0–10); and Wong-Baker Faces Pain Rating Scale (WBFPRS) (0–10). These 4 scales were included in the review. Studies were classified by using psychometric criteria, including construct validity, reliability, and responsiveness, that were established a priori.

RESULTS: From a total of 276 articles retrieved, 182 were screened for psychometric evaluation, and 127 were included. All 4 faces pain scales were found to be adequately supported by psychometric data. When given a choice between faces scales, children preferred the WBFPRS. Confounding of pain intensity with affect caused by use of smiling and crying anchor faces is a disadvantage of the WBFPRS.

CONCLUSIONS: For clinical use, we found no grounds to switch from 1 faces scale to another when 1 of the scales is in use. For research use, the FPS-R has been recommended on the basis of utility and psychometric features. Data are sparse for children below the age of 5 years, and future research should focus on simplified measures, instructions, and anchors for these younger children. *Pediatrics* 2010;126:e1168–e1198

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KEY WORDS

pediatric pain, self-report, children, systematic review, faces pain scale

ABBREVIATIONS

VAS—visual analog scale
CAS—color analog scale
FPS—Faces Pain Scale
FPS-R—Faces Pain Scale–Revised
WBFPRS—Wong-Baker Faces Pain Rating Scale

www.pediatrics.org/cgi/doi/10.1542/peds.2010-1609

doi:10.1542/peds.2010-1609

Accepted for publication Aug 5, 2010

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*

The assessment and measurement of pain in pediatric populations have been examined and debated in the literature for more than 2 decades.[1–4] Pediatric pain measures are essential for determining the effectiveness of pain management. As Hain[5] acknowledged, just as a child receiving antihypertensive medications should have regular blood pressure measurements taken, a child receiving analgesia should have regular pain measurements recorded.

Pain-intensity measures are regularly applied but often used inconsistently in clinical trials.[6] Three approaches have been established to measure pain in children: (1) self-report[6]; (2) observational/behavioral[7]; and (3) physiologic.[8,9]

Self-report measurement tools include visual analog scales (VASs), numerical rating scales, faces scales,[10] color analog scales (CASs), and the pieces-of-hurt (poker chip) scale. These tools have been reviewed extensively.[6,10–12] Faces scales are generally preferred by children to other self-report measures when offered the choice,[11,13] as detailed in "Reported Preference of the Faces Pain Scale."

Because pain is primarily an internal experience not directly accessible to others, children's self-report should be the primary source of information on pain intensity when possible, on the basis of age, cognitive and communicative abilities, and situational factors. Parents' and nurses' perceptions of children's pain are based on their overt behavioral expression of pain and on the context; thus, they are not the same as children's self-reports of their internal experience of pain.[4] Most children aged 5 years and older, and many 3- and 4-year-olds, can provide meaningful self-report of pain if age-appropriate tools are used.[10] In other health studies that used children's self-report measures, there was general agreement that information should be obtained from both parents and children whenever possible, and although there may be discrepancies, neither should be dismissed.[14–16] This concurs with opinion that, ideally, observational and/or physiologic measures should be used in conjunction with self-report measures and with knowledge of the context.[5,10]

Perfectly reliable and valid measurement of pain intensity by self-report is unattainable. Specifically, a gold-standard self-report pain scale for use with all children is not available.[5,6,10,17,18] Children's self-reports of pain are influenced by developmental, social, and contextual influences.[11] The use of self-report pain scales has yet to be established for children with cognitive impairments.

Faces pain scales are popular self-report measures of pain intensity in acute, procedural, and recurrent pain that are simple to use and less abstract than visual analog and numerical scales. Few studies have attempted to assess chronic pain in children by using these measures. Also, they may be used with children from 4 to 12 years of age or older.[10] Numerous faces scales have been developed for this population, and despite reviews of the literature on the self-report pain instruments for children,[6,10] it remains unclear whether 1 of the faces scales is better for a particular purpose with regard to validity, reliability, feasibility, and preference. Given the wide range of options for the self-report measurement of pain using a faces pain scale, researchers and clinicians would benefit from understanding the properties of these instruments to help choose the best tool for their purpose.

The objectives of this study were to (1) describe the faces pain scales that have been evaluated for reliability and validity in children, (2) describe and summarize the psychometric properties of the most commonly used faces pain scales used in children, (3) compare the validated faces pain scales that are used with children, and (4) address the preference and clinical utility of validated faces pain scales.

METHODS

Search Strategy for Identification of Studies

We conducted literature searches by using the Ovid search platform in the following databases: Medline, Embase, Cochrane Database of Systematic Reviews and Cochrane Controlled Trials Register (CCTR), and in EBSCOHost in the Cumulative Index to Nursing and Allied Health Literature (CINAHL) database from their inceptions up to April 3, 2010.

We used the following subject headings and text words specific to each database and used the words "pain," "faces," "facial," "Oucher," and "pain" and limited the search to studies that included children aged 0 to 18 years.

Strategy for Selection of Articles for Review

Articles were included if they were research studies that reported on any psychometric property of a faces pain scale for the self-report measurement of pain intensity in children and adolescents or if they were research studies that used a faces pain scale as an outcome measure such that psychometrics could be secondarily evaluated. Studies were excluded if (1) they used a sample population of <20 children, (2) they were reviews, guidelines, commentaries, or published abstracts, (3) they used faces pain scales to measure pain solely within adult populations, (4) the type of faces scale administered was not stated, (5) there was reference to a particular faces scale but depiction was of another different scale, (6) they used modified versions of original faces pain scales (because of the difficulty in comparing the modified version to the original scale), (7) the faces pain scale was used as a measurement of anxiety or distress, or (8) the faces pain scale focused solely on pain affect, because our aim was to review faces scales for pain intensity.

Using the search strategies, we retrieved a total of 1267 references. Figure 1 illustrates the flow of studies. There were 394 duplicate publications. An author (Ms Tomlinson) reviewed the remaining 873 unique references, and by using the above-listed inclusion/exclusion criteria, a total of 274 articles were retrieved. A total of 127 studies were included for review.

Classification of Psychometric Properties of Faces Pain Scales Examined

To assist in classifying the studies examined, 3 of the authors (Ms Tomlinson and Drs von Baeyer and Sung) developed a system to assist in the review process (Table 1). We chose to evaluate the following psychometric properties: construct validity; reliability; and responsiveness. For construct validation, we examined convergent construct validity in studies that used another self-report scale and determined that a correlation coefficient of at least 0.7 (good-to-excellent correlation[19]) provided a minimal basis for validity. (Further aspects of convergent validation, not summarized in this review, are addressed in "Discussion.") Another aspect of validation, known as group validity, is derived by examining studies that showed a statistically significant difference in scores between groups hypothesized to have differing amounts of pain and studies that showed statistically significant discrimination of painful versus nonpainful pictures or vignettes. We used clinical judgment to set thresholds for adequate test-retest reliability ($r > 0.5$) and correlation between self-reports and global observational estimates of pain intensity ($r > 0.4$). Finally, we evaluated responsiveness by examining statistically significant increases in scores to pain-increasing events or stimuli such as a painful pro-

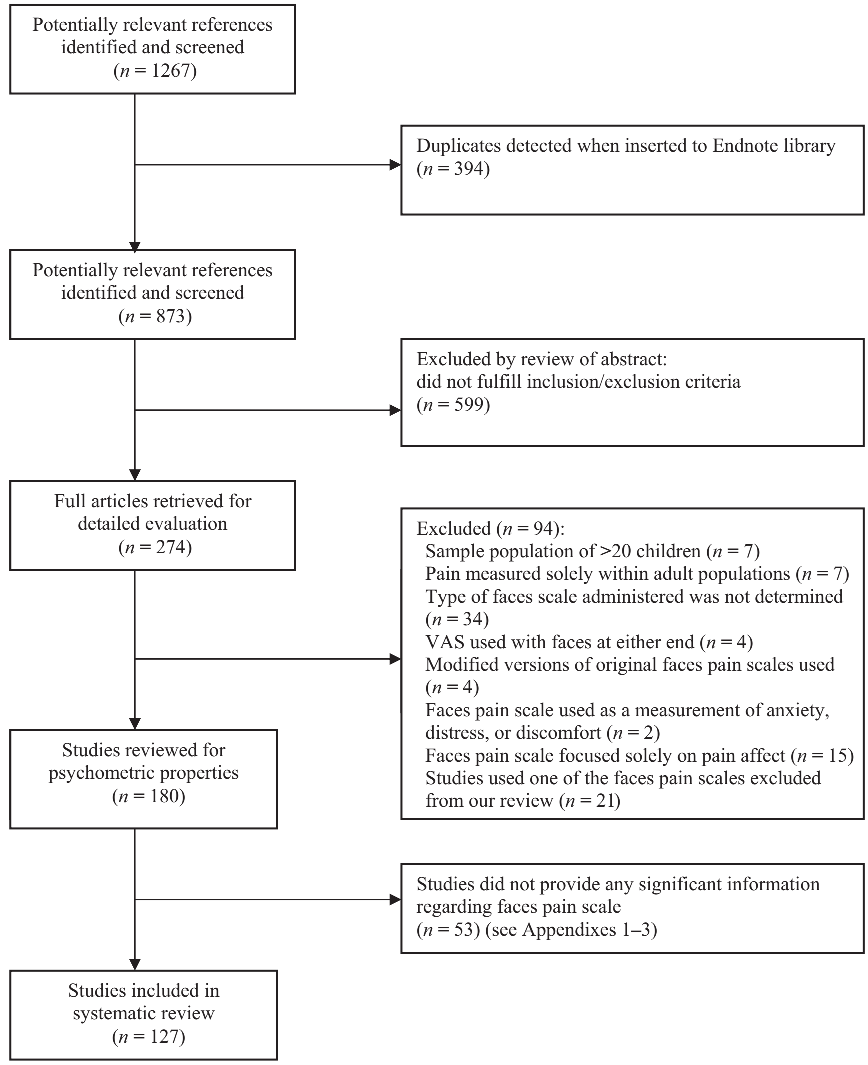

FIGURE 1
Flow diagram of study identification and selection.

TABLE 1 Classification of Psychometric Properties

I. Convergent construct validity
Correlation $r > 0.7$ with another self-report pain scale given at the same time
II. Known group validity
a. Differences in score between 2 comparable but different groups ($P < .05$)
b. Accurate discrimination of painful vs non-painful pictures or vignettes ($P < .05$)
III. Reliability
a. Test-retest reliability, $r > 0.5$
b. Correlation between self-report and observational scores, $r > 0.4$
IV. Responsiveness
a. To pain-increasing events or stimuli such as a painful procedure ($P < .05$)
b. To pain-decreasing events such as administration of analgesic (or passage of time after surgery or procedure) ($P < .05$)

cedure and significant decreases in scores to pain-decreasing events such as administration of analgesic (or passage of time after an operation or procedure).

RESULTS

Scales Excluded From the Review

We identified 14 faces pain scales reported in the literature. However, 10 of these scales have had minimal or no evaluation of their psychometric properties reported.[20–29] These scales are summarized in Table 2.

Scales Included in the Review

Four faces pain scales have undergone extensive psychometric testing and have been used in the assessment of both acute and disease-related pain in children: the Faces Pain Scale (FPS)[30]; the Faces Pain Scale–Revised (FPS-R)[31,32]; the Oucher pain scale[33,34]; and the Wong-Baker Faces Pain Rating Scale (WBFPRS).[35]

The FPS consists of a series of horizontal gender-neutral faces that depict a neutral facial expression of "no pain" at the left to "most pain possible" expression at the right. The FPS has 7 faces (scored 0–6); the FPS-R modified the FPS to include 6 faces (Fig 2A), which permitted the scale to be placed on the widely accepted 0-to-10 scoring metric.[36]

The Oucher is a photographic faces scale of 6 vertical faces scored from 0 to 10 (Fig 2B). This scale has an adjacent numerical scale scored from 0 to 100 for older children. Different versions of the scale are available for white, black, Hispanic, and Chinese patients.

The WBFPRS is a horizontal scale of 6 hand-drawn faces, now scored from 0 to 10, that range from a smiling "no hurt" face on the left to a crying "hurts worst" face on the right (Fig 2C). Summaries of these main faces pain scales are provided in Table 3.

Psychometric Properties of the Identified Faces Pain Scales

Table 4 lists the studies that have used the FPS ($n = 26$)[30,37–61] and the FPS-R ($n = 22$)[12,13,31,62–80] along with the psychometric classification identified for the purpose of this review. Table 5 lists those studies that used the Oucher pain scale ($n = 29$),[33,81–108] and Table 6 includes studies that used the WBFPRS ($n = 56$).* The majority of studies used faces scales to measure acute, procedural, and recurrent pain. All studies in the review included only children who were not cognitively impaired. Study reports that did not provide contributory information, including those that used faces scales for observational or parent-proxy report rather than self-report ($n = 53$), are listed in Appendices 1, 2, and 3.

Table 7 provides a summary of psychometric data available from the reviewed studies and summarizes studies in which the data support construct validity, reliability, and responsiveness as well as studies from which the data do not support these psychometrics when using our a priori defined criteria shown in Table 1. When examined, convergent construct validity is apparent in the majority of studies. Known group validity was also reported often; however, negative evidence for this was reported for several studies. However, results of equivalency studies designed, for example, to compare 2 analgesics may not show any difference in pain scores, but that does not mean the measure does not work. Test-retest reliability was assessed in a few studies but must be considered with caution, because acute and recurrent pain is assumed to change over time rather than to remain stable.

*Refs 35, 44, 56, 65, 69, 81, and 109–158.

Comparisons Between the Validated Faces Pain Scales Used With Children

Few articles have addressed comparative study of the validated faces pain scales. Only 4 articles were found to have an objective of comparing faces pain scales[44,56,65,81] (see Tables 3–5).

Chambers et al[44] compared 5 different faces scales. Seventy-five children, aged 5 to 12 years, and 75 parents participated. After venipuncture the children were shown the 5 different faces scales in random order without normal accompanying written instruction or information. Verbal instruction was provided, and the children were asked to point to the face that showed the amount of pain experienced. Parents were blinded to the child's score and independently scored their child's pain experience. Higher pain ratings were obtained by using the 2 scales that had smiling "no-pain" faces[22,35] compared with the other scales with neutral no-pain faces with children and parents. Some parents had difficulty in separating general distress and amount of pain that their child experienced, and for each of the 5 scales, parents seemed to overestimate the level of their child's pain in comparison to their child's self-report.[44]

In another study, Chambers et al[56] used the same 5 faces scales and added the CAS with postoperative children. Seventy-eight children, aged 5 to 13 years, participated after minor surgery. Parents/guardians and children's postoperative nurses also participated. Results for parents and nurses were comparable to those from the previous study in which pain scores were generally higher with the 2 scales with the smiling no-pain left anchor[22,35] compared with the neutral no-pain left anchor face scales. In children, higher ratings were obtained by using the WBFPRS, whereas the results of other scale ratings did not differ

TABLE 2 Summary of Faces Pain Scales That Have Received Limited Psychometric Testing in Use With Children

Study	Description of Scale	Psychometric Testing	Comments
Le Baron and Zeltzer[21] (1984)	5 cartoon-type faces, numbered 1–5 from left to right (1 represents neutral "no-pain" face; 5 represents crying "extreme-pain" face); displayed horizontally	Tested in 601 children aged 6 to <10 y to rate pain (hurting) or anxiety (scared) before, during, and after bone marrow aspiration; descriptions of how they felt were also obtained; compared faces scale with observer ratings on a scale of 1–5	Correlations between observer and self-report were more consistent on anxiety ratings than on pain ratings
Maunuksela et al[22] (1987)	5 basic, circular representations of human faces, numbered 5–1 from left to right (5 represents crying "severe-pain" face; 1 represents smiling "no-pain" face)	Tested in 141 children, aged 4–17 y, after surgical procedures; compared with observer behavioral assessment of pain intensity and other VAS; had previously shown responsiveness with 60 children, aged 4–10 y, in a study of the efficacy of EMLA before IV cannulation[171]; efficacy of IV prodrug acetaminophen in 87 children, aged 6–13, after orthopedic surgery; 4-point verbal scale was also administered[172]; measured pain associated with migraine attacks and treated with nasal sumatriptan or placebo in 83 children aged 8–17 y[173]	Convergent validity between pain scales and good internal consistency were reported; scale demonstrated responsiveness
Tree-Trakarn et al[23] (1987)	6 cartoon-type faces, placed on an inclining slope of numerical linear scale from 0–10; faces ranged from a smiling "no-pain" face at 0 to crying "most-severe-pain" face at 10; these faces were added to aid children in identifying a score	Tested in 40 boys, aged 3–12 y, after circumcision to compare the use of lidocaine gel analgesia to placebo gel; construct validity was studied in 110 children aged 4–12 y to grade postoperative pain compared with an observer 4-grade descriptive scale[174]	Minimal reporting on validity and reliability; correlation to unvalidated descriptive scale observed; the weakest correlation was seen in children aged 8–12 y; used to compare analgesic effect of epidural sufentanil with epidural fentanyl[175]
Kuttner and LePage[27] (1989)	Consists of 10 drawn faces in 2 horizontal rows of 5 faces; the top road represents pain from neutral face on left to crying face on right, and the second row represents anxiety (fear) from neutral face on left and open-mouthed scared face on right	Content validity was tested on 74 children, aged 4–10 y, randomly selected from inpatient areas	Minimal psychometric testing reported
Douthit[25] (1990)	Five cartoon baby-type faces from smiling face on left to crying face on right	Tested in 26 children 3–12 y of age[176] during a postoperative period; compared with CHEOPS and observer scales in 3- to 6-y-olds and CHEOPS and VAS in 6- to 12-y-olds	Correlation was found to be high among scales, because similar trends in pain scores were observed[176]
Lehmann et al[26] (1990)	A horizontal scale that depicts a simple line-drawn neutral face, drawn inside a square box, on the left; the next item is a sad face, also drawn in a box, which is followed by increasing numbers of sad faces in stacks ranging in number from 2 to 5	Children ($n = 91$), aged 3–8 y, were asked to recall 2 painful experiences and rate the pain and compare the faces scale with another picture scale, a block-based scale, triads, and a question of "which hurt more?"; children ($n = 172$), aged 3–13 y, rated pain in an emergency department with limb trauma; scale was used to assess use of analgesia[177]	Minimal reporting on psychometric properties; the study aimed at children's ability to self-report; recalled pain-experience ratings showed low reliability for children <7 y old[26]; scale showed responsiveness for this population
Pothmann[20] (1990)	The "Smiley Analogue Scale" consists of 5 simple line faces. Ranging from a frowning face on the top left and the curving downwards in a semi-circle to a smiling face on the right	Tested in 96 children, aged 3–18 y, experiencing different painful procedures or conditions; compared with a VAS	Minimal conclusions were made; correlation between scales was reported; low validity was observed in assessment of mild pain; modified GPOH-Smiley Scale was used as an outcome measure for pediatric cancer pain[178,179]
Schachtel and Thoden[28] (1993)	Children's sore throat–relief scale consisted of 5 cartoon faces that ranged from a neutral face on the left with gradual increasing smile and eye size on faces to the right	Used to compare analgesia for acute sore throat with placebo in 116 children aged 2–12 y; compared with pain thermometer scale and observer rating on a 5-category scale	Minimal construct validity reported and responsiveness shown
Barretto et al[24] (2004)	The VAS of faces consists of 5 cartoon faces, from a smiling face on the left to a crying face on the right, and corresponds to scores of 1–5; includes 4 sets that depict both genders for white and black children	Children ($n = 601$), aged 8–9 y, were asked about previous toothache experience	Internal validity was reported
Gad et al[29] (2004)	4 faces with a neutral "no-pain" cartoon face on the left (score = 0) to a frowning "very-much-pain" face on the right (score = 3)	Measured pain with 60 children, aged 6–12 y, who were having IV cannulation using lidocaine cream	No psychometric testing reported

EMLA indicates eutectic mixture of local anesthetics; IV, intravenous; CHEOPS, Children's Hospital of Eastern Ontario Pain Scale; GPOH, German Society for Paediatric Oncology and Haematology.

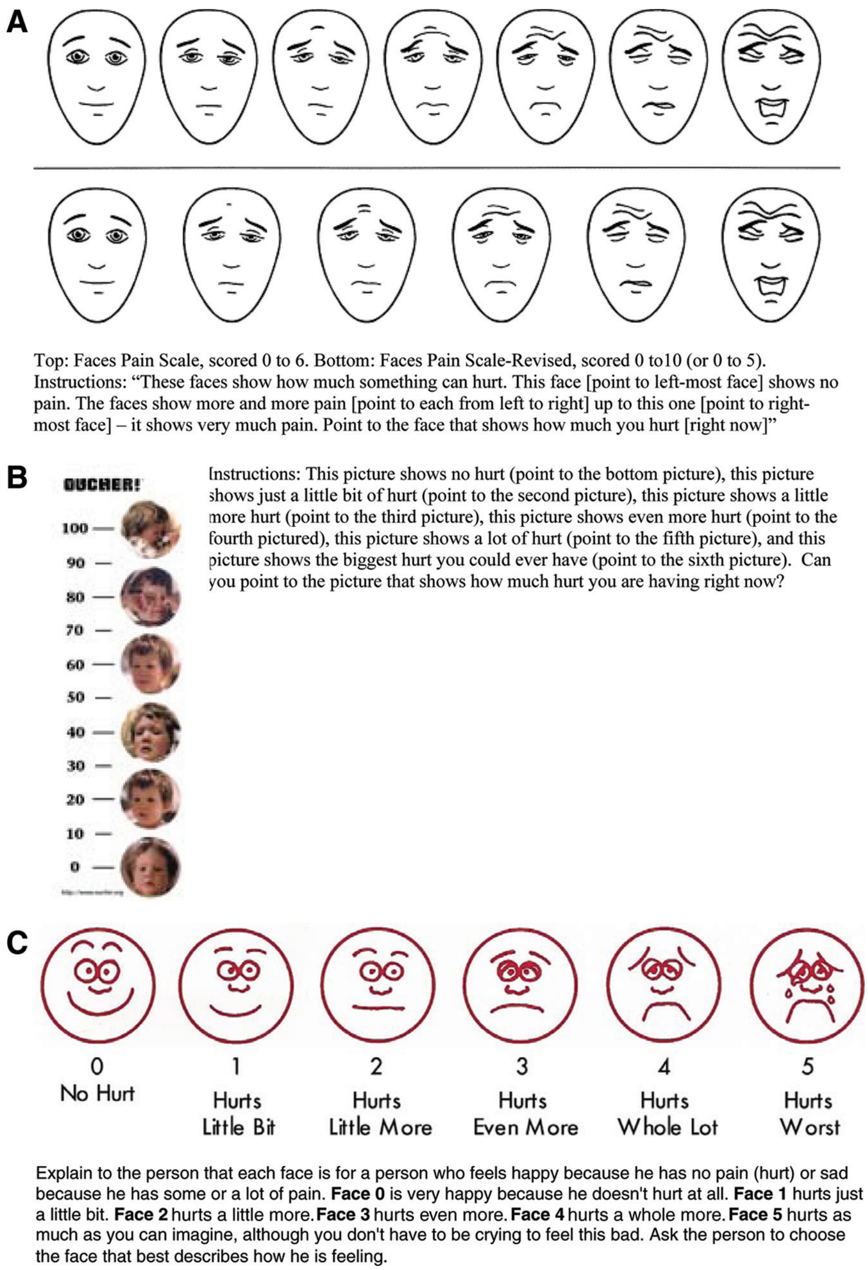

FIGURE 2

A, The FPS and FPS-R (Reprinted with permission from Hicks CL, von Baeyer CL, Spafford PA, van Korlaar I, Goodenough B. The Faces Pain Scale-Revised: toward a common metric in pediatric pain measurement. *Pain*. 2001;93(2):176 [permission granted by the IASP®].) B, The Oucher scale (white version) (developed and copyrighted by Judith E. Beyer, 1983). (Reprinted with permission from Beyer JE, Turner SB, Jones L, Young L, Onikul R, Bohaty B. The alternate forms reliability of the Oucher pain scale. *Pain Manag Nurs*. 2005;6(1):11.) C, The Wong Baker Faces Pain Rating Scale (Reprinted with permission from Whaley D, Wong DL. *Nursing Care of Infants and Children*. 5th ed. St Louis, MO: Mosby; 1995:1085.)

from each other. Parents and nurses underestimated children's self-report assessment of pain across all scales.

Newman et al[45] compared the use of the WBFPRS, the FPS-R, and the VAS in a population of 61 Thai children, 4 to 15 years of age, with HIV infection in an outpatient clinic and 61 age-matched children with no chronic disease. Children were asked to grade their present pain. A high correlation was reported between the 2 faces scales, although this correlation was less strong in 4-year-old children.

Luffy and Grove[81] compared the African-American Oucher scale, the WBFPRS, and the VAS in 100 black children, between 3 and 18 years of age, in a sickle cell anemia clinic. The testing procedure included asking children to describe a previous painful procedure or treatment and to rate this pain on each of the 3 scales presented in a preselected random order. The exact same process was repeated at least 15 minutes later with no intervening painful procedure being performed between test and retest. Several children had difficulty with the VAS, whereas none had difficulty using the WBFPRS, and only minor problems were encountered when using the Oucher, usually because of the use of the associated numerical scale.

Reported Preference of the Faces Pain Scale

Authors of most studies in which preference between a faces scale and another self-report scale were examined concluded that the faces pain scale was preferred by respondents when they were given a choice.[13,35,64,109,111,123] Three separate research groups have concluded that a faces scale administered on a laptop or handheld computer was preferred to a paper version.[55,137,159] Badr et al[130] reported that dolls with drawn-on faces to represent the pain faces were preferred to the printed WBFPRS. It is interesting to note that in 1 study the pieces of hurt (poker chip tool) was more preferred than the WBFPRS among Jordanian girls, whereas boys preferred the faces scale, and the authors suggested that this result may be a product of Jordanian cultural differences.[121] Of the 3 studies that used more than 1 faces pain scale and reported a pref-

TABLE 3 Summary of Recommended Faces Pain Scales Used in Children

Name of Scale	Intended Age Group, y	Advantages	Disadvantages
FPS[30]	3–12	Quick and simple to use Minimal instruction required Demonstrates a lack of upper-end bias	Uses 0–6 metric; cannot be scored 0–10 Less preferred than the WBFPRS when given a choice
FPS-R[31]	4–12	Scored 0–10 Quick and simple to use Minimal instruction required Translated into ≥35 languages Available free of charge	Less preferred than the WBFPRS when given a choice
The Oucher[33]	3–12	Ethnically/culturally specific photographic versions have been developed Includes numerical rating scale that may be used by older children	Reliability and validity measures required for 3- to 4-y-olds Numerical rating may be difficult for younger children Children must be screened to determine ability to count by tens or twos to 100 More expensive to reproduce multiple versions of color photographs
WBFPRS[35]	3–18	Quick and simple to use Minimal instruction required Translated into ≥10 languages Preferred (relative to other pain scales) by children of all ages and by nurses Available free of charge	Limited psychometric testing of translations Confounds affect (smiles, tears) with pain intensity Ratings are higher than on scales with a neutral "no-pain" face

Data source: Stinson JN, Kavanagh T, Yamada J, Gill N, Stevens B. *Pain.* 2006;125(1–2):143–157.

erence, the WBFPRS was consistently cited as the most preferred (Table 5).

A greater number of studies used the WBFPRS ($n = 56 + 29$ excluded) compared with the FPS/FPS-R ($n = 48 + 15$ excluded) and the Oucher ($n = 29 + 11$ excluded). One interpretation of this difference could be that the WBFPRS is generally preferred by investigators in pediatric pain. Another interpretation is that the WBFPRS was published earlier, and in much more widely distributed publications and textbooks (nursing), than the other scales and, hence, is more familiar.

DISCUSSION

Faces scales are frequently used as self-report measures of pain intensity in research and clinical practice, but debate around the choice of scale continues.[160–164]

The most widely used and best-validated faces pain scales are now the FPS-R, the Oucher, and the WBFPRS.

Several studies have shown that faces scales with smiling no-pain anchors may provide greater pain scores in comparison with other scales.[44,56,165] Studies that compared any of the faces scales with other self-report measures have generally reported high correlations (often greater than $r = 0.8$) between scores on different self-report scales.

However, a high correlation between 2 scales provides no information about the accuracy of agreement between the scales. Even in the presence of a high correlation, scores based on 2 scales may never agree with each other. Thus, the minimum criterion for convergent validity adopted for this review, a correlation of at least 0.7 between a faces scale and another self-report measure, represents only a starting point for the examination of construct validity. Agreement should also be assessed by using limits of agreement between pairs of scores.[166] This approach was not used in our review, because it was used in very few studies.

The use of smiling versus neutral faces at the lower anchor face and presence versus absence of tears at the upper anchor may present no problems in scaling for adults, older children, and younger children who are cognitively advanced and who understand that the scale represents a continuum from no pain to most pain. However, younger children make a rating on the scale presumably primarily by matching their experience with the expression on 1 of the faces[11] rather than by selecting a point along an underlying continuum; when this choice is difficult, they resort to other strategies such as response biases.[167] For children who use primarily that matching strategy, and not a strategy based on a mature mental model of a scale, the specific expressions on the faces probably do make a difference.

Despite young age groups being reported as using faces pain scales adequately,[30,35] much less research has been conducted with children of younger ages (3- to 5-year-olds). Frequently, faces scale ratings by 3- to 4-year-olds correlate less strongly with criterion measures compared with children in other age groups.[26,65,72]

TABLE 4 The FPS ($N = 26$) and FPS-R ($N = 22$)

Study	Sample and Respondent	Other Pain Scale(s) Used	Psychometric Classification of FPS (see Table 1)[a]	Preferences/Comments
FPS ($N = 26$)				
FPS: initial validation[30]	553 children aged 6–10 y in 2 groups: 195 first-graders and 358 third-graders; self-report	—	IIIa: for recalled pain episode in 6-y-old children ($r = 0.79$)	—
EMLA and music distraction for IV cannulation pain[37]	180 children aged 4–16 y in 3 treatment groups: 60 (EMLA, placebo, music): 20 children in each age group of 4–6, 7–11, and 12–16 y; self-report; investigator	VAT; global observation scale	I: Between VAT and FPS, $r = 0.94$; IIa: Between 3 treatment groups, $P = .01$; EMLA group scored lower than placebo and music groups ($P = .01$); IIIb: self-report and observer scores, $r = 0.61$	—
Oral morphine vs IV morphine for painful episodes of sickle cell disease[38]	50 children aged 5–17 y in 2 treatment groups: 26 (oral morphine 1.9 mg/kg every 12 h plus IV placebo [saline]) and 24 (IV morphine 0.04 mg·kg·h, plus placebo tablet); self-report	Oucher; CHEOPS	I: Correlations between all scales reported as $r = 0.59–0.90$ ($P = .0001$ for all); individual correlations were not stated; IIa: No difference in the scores between the 2 groups ($P = .6$)[b]	—
Venipuncture needle pain and placebo effect[39]	117 children aged 3–17 y in 3 age groups: 3–7, 8–11, and 12–17 y; self-report; observer rating on FPS from video recording	Child Anxiety and Pain Scale	IIa: Higher scores associated with younger children ($P = .007$)	—
Pain in 4- to 6-y-old children receiving IM injections: self-report scales were compared[40]	50 children aged 4–6 y; self-report; 60 nurses rated pain on video recordings of 10 children in study of FPS and VAT; investigator used behavioral checklist	PCT; VAT; descriptive verbal rating scale	I: FPS with PCT, $r = 0.77$; FPS with VAT, $r = 0.75$; FPS with descriptive scale, $r = 0.80$; IIIb: For FPS, correlation between nurses and children, $r = 0.43$	Highest scores with PCT and lowest with FPS but no significant statistical differences; scores skewed to "no pain" or low pain on the FPS and descriptive scale compared to the PCT or VAT
Vapocoolant spray vs EMLA for immunizations[41]	62 children aged 4–6 y in 2 treatment groups: 21 (vapocoolant spray) and 20 (EMLA) and a control group of 21; self-report; blinded observer; parent; nurse	VAS; OSBD	IIa: Scores of spray-treatment group lower than those of control group ($P < .01$)	Similar difference between spray group and controls for parental and nurse faces scoring ($P < .01$); between EMLA and control groups for parental and nurse scoring: $P < .05$; correlation statistics not reported
Parent and child pain reports[42]	110 dyads of parents and children aged 7–12 y; self-report	—	IIIb: Agreement between self-report and parent report ($r = 0.68–0.76$); κ statistics represented poor-to-fair agreement with parents[b]	Parents tended to underestimate on day of surgery and day 1
Comparison between the FAS and FPS for pain during blood sampling[43]	80 children aged 4–10 y in 2 age groups: 4–6 and 7–10 y; self-report	FAS; MVAS for pain intensity; MVAS for unpleasantness	I: The FPS correlated with the MVAS for intensity ($r = 0.77$), with the MVAS for unpleasantness ($r = 0.52$); and with the FAS ($r = 0.54$)	—
Comparison of faces scales measuring pain of venipuncture[44]	75 dyads of children aged 5–12 y; self-report; parents	WBPRS; Maunuksela et al[22]; Le Baron and Zeltzer[21]; Kuttner and LePage[27]	I: r ranged between 0.89 and 0.91 for each of the 4 pain scales for children's self-report (r for parent reports ranged from 0.81 to 0.88); IIIb: parents overestimated level of the child's pain in comparison to child's self-report (WBFPRS, $P < .001$)[b]	Higher pain ratings obtained by using the 2 scales that had smiling "no-pain" faces[22,35] compared with the other scales with neutral "no-pain" faces with children and parents; preference ratings were highest for the WBFPRS from both parents (40.3%) and children (64.4%)
Evaluation of FPS in young children[45]	135 children aged 3.5–6.5 y (3 phases of study) in 3 groups: 45 in each age group: 3.5–4.5, 4.5–5.5, and 5.5–6.5 y (phase 4 measured test-retest reliability for painful scenarios: 45 children, 15 in each group); self-report	—	IIIa: In phase 4, mean combined correlation r was 0.55 (range: 0.35–0.81)	Questionable discriminability of faces 5 and 6; questionable accuracy with young children

TABLE 4 Continued

Study	Sample and Respondent	Other Pain Scale(s) Used	Psychometric Classification of FPS (see Table 1)[a]	Preferences/Comments
Analgesic effect of ketorolac solution in strabismus surgery[46]	30 children aged 4–12 y in 2 groups: 17 treatment and 13 placebo; self-report	Modified CHEOPS	IIa: No differences between the 2 groups: on arrival ($P = .64$); on discharge ($P = .47$); highest FPS score ($P = .44$)[b]	—
Postoperative tonsillectomy pain: blunt dissection vs electrocautery dissection[47]	36 children aged 5–15 y; 2 treatment groups: 20 and 16; self-report	VAS	IIa: Scores significantly higher for blunt dissection compared to electrocautery dissection; statistics not reported	—
Analysis of child facial coding system for children receiving immunizations[48]	123 children aged 4–5 y; self-report	CFCS by investigators; VAS by parent and technician	IIIb: Self-report FPS scores significantly correlated with parent's VAS ($r = 0.59$) and technician's VAS ($r = 0.60$)	—
EMLA for IV catheter insertion[49]	57 children aged 4–12 y in 2 treatment groups: 28 (EMLA) and 29 (placebo); self-report; nurses	Combined FPS with VAS	IIa: Mean scores lower in EMLA group ($P < .0001$); IIIb: correlation with nurses; child mean score for EMLA was 1.25 and for placebo was 8.39; nurse mean score for EMLA was 1.07 and for placebo was 8.07; correlation statistics were not reported	—
Validation of 2 self-report scales for emergency department[50]	60 children aged 5–16 y in 2 groups: 30 (with pain and without pain) in each group; self-report	CAS	I: Correlation between CAS and FPS ($r = 0.894$); IVb: decrease in pain scores after analgesia for children with pain ($P < .001$)	—
Assessment of clinically significant changes in acute pain[51]	121 children aged 5–16 y; self-report	CAS	I: Similar changes in scoring observed between FPS and CAS; not statistically measured; IVb: reduction in pain scores after intervention; statistics not reported	Researchers determined that pain intervention is significant only if the pain score decreases by 2 faces on the FPS
Postoperative pain ratings[52]	90 children aged 5–15 y in 2 age groups: 45 in each: 5–9 and 10–15 y; self-report	FAS; CAS-intensity (i); CAS-unpleasantness (u)	I: Correlation of FPS with CAS-i ($r = 0.87$–0.89); with CAS-u ($r = 0.79$–0.80); and with FAS ($r = 0.66$–0.70)	—
Pain assessment after injury[53]	276 children aged 5–17 y; self-report; parents	CAS	I: Correlations between self-report on FPS and CAS ranging from $r = 0.78$ to $r = 0.83$); IIIb: parent and child reports (combined FPS and CAS) $r = 0.52$ for current pain and $r = 0.34$ for worst pain; IVa: children with compared to without extremity fractures ($P < .001$)	Twice as many parents overestimated child's pain as underestimated in worse-pain ratings
Pain in pediatric oncology[54]	Children aged 4 mo to 17 y; 409 interviews, 363 dyads of self-report and parents, plus 46 parents only	NRS (children > 12 y); results from FPS recategorized to NRS	IIIb: Concordance between self-report and parent, κ scores from 0.13–0.35 ($P = .001$)	—
Comparing 6 self-report measures of pain intensity[55]	82 children aged 4–16 y in 2 age groups: 37 children aged 4–7 y and 45 children aged 8–16 y	CAS; pieces of hurt tool; finger span; adjectival scale; SAFE	I: FPS with CAS, $r = 0.75$; SAFE, $r = 0.72$; adjectival, $r = 0.65$; pieces of hurt, $r = 0.62$; finger span, $r = 0.57$	Greater variability in younger children; of 65 children: SAFE ranked best by the younger age group; CAS ranked best by the older age group; facial expression scales (FPS and SAFE) were ranked easier to use than others
Faces scales for postoperative pain[56]	78 children aged 5–13 y; self-report; parents; nurses	Kuttner and LePage[27]; WBPRS; Maunuksela et al[22]; LeBaron and Zeltzer[21]; CAS	I: FPS with the WBFPRS, $r = 0.91$; Le Barron, $r = 0.88$; Kuttner, $r = 0.88$; Maunuksela et al, $r = 0.86$; CAS, $r = 0.84$	Parents and nurses underestimated pain across all scales; the WBPRS was preferred by children (55.6%), nurses (53.9%), and parents (77.1%)
Two different tonsillectomy techniques and pain management[57]	92 children aged 5–15 y in 2 treatment groups: 43 and 49; self-report	VPRS by parents and nurses	IIa: Differences in pain scores between 2 groups, $P < .05$	—

TABLE 4 Continued

Study	Sample and Respondent	Other Pain Scale(s) Used	Psychometric Classification of FPS (see Table 1)[a]	Preferences/Comments
Analgesia for femur fractures in emergency department[58]	31 children aged 5–18 y; 2 types of analgesia for 2 groups: 14 and 17; self-report	CHEOPS and FLACC by nurse observers and research assistants	IIa: Median FPS scores lower in nerve-block group compared to morphine group at 30 min (95% confidence interval: 16%–56% between groups)	—
Acute otitis media analgesia[59]	63 children aged 3–17 y in 2 groups: 31 (lidocaine) and 32 (saline)	VAS	IIa: Significant difference in scores between 2 groups at 10 min ($P = .04$) and 30 min ($P = .02$)	—
Comparison of 2 scales in Indian children[60]	181 children aged 6–12 y; self-report; parents; HCP	CAS	I: Between FPS and CAS, $r = 0.88$; IIIb: nurses FPS score with self-report, $r = 0.587$; parents FPS with self-report, $r = 0.358$–0.401	Correlation also between 2 scales for parents and HCP ($r = 0.85$–0.88)
Gender differences in parent and child pain ratings[61]	73 dyads of children aged 4–12 y in 2 groups of children: 37 boys and 36 girls; 2 groups of parents: 32 fathers and 41 mothers	—	IIIb: κ statistics showed poor agreement between child and parent scores[b]	—
FPS-R ($n = 22$)				
FPS-R: metric measurement[31]	Ear-piercing: 76 children aged 5–13 y; self-report; inpatients: 90 children aged 4–12 y (40 with current pain, 50 to recall worse pain); self-report	VAS; VAS; CAS	I: FPS-R and VAS, $r = 0.93$; I: FPS-R and VAS, $r = 0.92$; FPS-R and CAS, $r = 0.84$	—
Ear-piercing, expected and reported pain[62]	60 children aged 5–12 y; 2 groups (parental information and contact-control) of 30; self-report	VAS	I: Correlation between VAS and FPS-R at 3 time points, $r = 0.87$–0.96; IIa: intervention group scored lower than control group, $P = .005$	—
Pain on 2 different MMR vaccines[63]	620 children aged 4–6 y in 2 groups: 311 (Priorix) and 309 (RORVax); self-report; parents	—	IIa: Difference between groups, $P < .001$; IIIb: parents' scores correlated with children's, $r = .84$	—
Validity and reliability of Catalan version of the FPS-R (FPS-R-C)[64]	371 children in 2 samples: sample 1, 124 hospitalized children aged 7–15 y; sample 2, 247 schoolchildren aged 7–12 y (tested with painful-event scenarios)	CAS; FAS	I: Sample 1, FPS-R-C and CAS for all ages, $r = 0.83$–0.90; sample 2, FPS-R-C and CAS for all scenarios, $r = 0.85$–0.96; IIIa: sample 2: $r = 0.42$–0.68; test-retest for the full scale, $r = 0.63$	Sample 1, 66% preferred FPS-R-C to CAS; sample 2, 68% preferred FPS-R-C to CAS; difference is significant ($P < .01$)
Pain scale comparison in Thai children[65]	122 children aged 4–15 y; self-report	WBFPRS; VAS	I: FPS-R with WBFPRS, $r = 0.79$; FPS-R with VAS, $r = 0.67$[b]	High agreement between faces but sequential presentation
Venipuncture pain management[66]	144 children aged 3–12 y in 2 treatment groups: 48 (lidocaine, 0.25% and 0.5%) and 49 (placebo); self-report	VAS for children >8 y	I: VAS and FPS-R, $r = 0.67$; IIa: difference between groups not significant, P ranged from .06 to .115[b]	—
Oral morphine for traumatic pain[67]	74 children aged 6 mo to 16 y (15 <5y; 55 >5 y); 59 self-report	OPS by investigator; VAS	I: VAS with FPS-R, $r = 0.66$[b]; IVb: decrease in pain over time ($P < .01$)	—
Liposomal lidocaine for procedural pain[68]	Triad of 142 children aged 1 mo to 17 y in 2 groups: 37 (lidocaine) and 30 (placebo) for self-report; self-report ($n = 67$); parent; research assistant	—	IIa: Lower scores in lidocaine group ($P = .01$); IIIb: similar results obtained from parents and research assistant; statistical correlations not reported	—
Virtual reality for pain distraction during IV line placement[69]	20 children aged 8–12 y in 2 groups: 10 (virtual reality and control); self-report; parent; nurse	VAS; WBFPRS	I: FPS-R with WBFPRS, $r = 0.96$; IIa: control group ($t = -3.25$) compared to virtual reality, ($t = -1.00$); IVa: FPS-R showed fourfold increase after IV line placement	—
IV vs IM ketamine for orthopedic procedures[70]	208 children aged 14 mo to 15 y; 163 children >5 y using FPS-R; 2 treatment groups: 109 and 99; self-report	OSBD by nurses; Likert-scale by parents	IIa: IM group reported less pain ($P = .03$)	—

TABLE 4 Continued

Study	Sample and Respondent	Other Pain Scale(s) Used	Psychometric Classification of FPS (see Table 1)[a]	Preferences/Comments
Tonsillectomy postoperative pain[71]	25 children aged 5–15 y; 1 tonsil removed by microdebrider and the other by electrosurgery; self-report	—	IIa: microdebrider side less painful than electrosurgery side ($P < .01$)	—
Role of developmental factors in children's use of self-report scale[72]	112 children aged 3–6 y; self-report	—	IIb: Response to vignettes of 4- to 6-y-olds compared to chance scoring ($P < .001$)	Increasing errors made with decreasing age
Oxycodone, ibuprofen, or combination for injury-related pain[73]	66 children aged 6–18 y in 3 treatment groups of 22; self-report	VAS by parents, nurse, and investigator	IIa: No differences in FPS-R scores between 3 groups at 2 time points ($P = .41$ and .35)[b]; IVb: children with displaced/angulation fractures reported higher scores than those with nondisplaced fractures ($P = .001$)	—
Pain management for vaccinations[74]	239 children aged 4–12 y in 2 intervention groups: 132 and 107	VAS; CHEOPS: parents and general practitioners	I: In both groups, correlation between FPS-R and VAS, $r = 0.8$	—
Cross-cultural adaptation of 2 assessment tools[75]	20 children aged 7–17 y; self-report	FLACC by HCP	—	Content validity (20 patients and 22 HCP) for Brazilian children
Safety and efficacy of PC epidural analgesia[76]	100 children aged 6–19 y; self-report	—	IVb: Responsiveness apparent but not statistically reported	—
NRS use[13]	Study A, 175 children aged 8–12 y; study B, 63 children aged 6–16 y; self-report	NRS-11; FAS	Study A, I: NRS-11 and FRS-R, $r = 0.78$; study B, I: NRS-11 and FPS-R, $r = 0.93$	Study A, the majority preferred FPS-R (65.9%): "easier"
Support of NRS-11 for children's self-report[12]	Study A, 69 children aged 7–17 y; self-report	NRS-11	Study A, I: correlation of NRS-11 and FPS-R, $r = 0.87$	—
Topical clindamycin after adenotonsillectomy[77]	79 children aged 4–12 y in 2 groups: 41 (placebo) and 38 (clindamycin); self-report	—	IIa: Comparison of reduction in pain between the 2 groups on day 1 only, $P = .002$; other days (2–5), $P > .114$[b]; IVb: reduction of pain (clindamycin group) in follow-up period, $P = .006$	—
Analgesia after adenotonsillectomy[78]	60 children aged 3–7 y in 2 groups: 30 (ropivacaine) and 30 (placebo); self-report	—	IIa: No difference in FPS-R scores between 2 groups ($P = .958$)[b]; IVb: pain decrease after 24 h ($P = .024$)	—
Analgesia (paracetamol and ibuprofen) and limb fractures[79]	72 children aged 5–14 y in 2 different analgesia groups: 43 (paracetamol) and 29 (ibuprofen); self-report	—	IIa: No difference between 2 groups ($P = .73$)[b]; IVb: pain scores decreased over time ($P < .0001$)	—
Pain assessment during intraosseous anesthesia by using computerized system[80]	50 children aged 7.81–12.99 y; self-report	VAS	IVa: Pain scores higher on FPS-R during injection ($P = .0226$)	—

EMLA indicates eutectic mixture of local anesthetics; IV, intravenous; IM, intramuscular; VAT, visual analog toy; CHEOPS, Children's Hospital of Eastern Ontario Pain Scale; PCT, poker chip tool; FAS, Facial Affective Score; OSBD, Observational Scale of Behavioural Distress; MVAS, mechanical VAS; CFCS, child facial coding system; NRS, numerical rating scale; SAFE, Sydney Animated Facial Expression Scale; VPRS, verbal pain rating scale; FLACC, face, legs, activity, cry, consolability scale; HCP, health care professional; MMR, measles, mumps, rubella; OPS, objective pain scale.

[a] Psychometric classifications: I, convergent construct validity (correlation $r > 0.7$); II, known group validity: a, 2 comparable groups ($P < .05$), and b, discrimination of painful versus nonpainful scenarios ($P < .05$); III, reliability: a, test-retest reliability $r > 0.5$, and b, correlation between self-report and observational $r > 0.4$; IV, responsiveness: a, to pain-increasing events ($P < .05$), and b, to pain-decreasing events ($P < .05$).

[b] Findings did not support validity, reliability, or responsiveness of these instruments.

TABLE 5 Studies That Used the Oucher Pain Scale ($N = 29$)

Study	Sample	Other Pain Scales	Psychometric Classification of the Oucher (see Table 1)[a]	Preference/Comments
Content validity of pain intensity instrument[33]	78 children aged 3–7 y in 3 groups: 26 children in 3 age groups	—	—	Evidence of content validity
Construct validity and pain perception[82]	25 children aged 3–12.4 y; self-report; 7 children (3–6.6 y) used photographic; 18 children (5.2–12.4 y) used numerical	PCT; VAS	IVb: Numerical Oucher scores decreased significantly after analgesia ($P < .01$)	Low sample number ($n = 7$) using photographic Oucher; statistical comparisons not possible
Self-report and behavioral pain measures[83]	25 children aged 3–7 y; self-report	CHEOPS by HCP; ACCS	I: Oucher with ACCS; $r = 0.87–0.98$	—
Pain in adenotonsillectomy[84]	64 children aged 3–15 y in 3 groups: 21 (paracetamol 240 mg), 21 (paracetamol 500 mg), and 22 (500 mg paracetamol + 10 mg codeine); self-report		IIa: 1 h postoperatively, no significant difference among the mean pain scores ($P > .05$)[b]; 3 h postoperatively, significant difference between scores of group I and group II ($P < .05$) but not between group I and group III; 6 h postoperatively, significant difference between the scores of group I and both other groups ($P < .05$)	—
Postoperative pain management with IM ketorolac[85]	87 children aged 4–11 y in 2 groups: 45 (ketorolac) and 42 (saline) (children >8 y used numerical scale; actual number not recorded); self-report	CHEOPS (investigator)	IVb: Decrease in hourly Oucher scores in both groups ($P = .001$ and $P < .001$)	Inability to obtain sufficient data after surgery prevented any statistical calculations of discriminant validity
Sight of blood and decorative adhesive-bandage use and pain ratings[86]	20 children aged 3–6 y in 4 groups: 5 in each; self-report	PCT	I: Between the Oucher and PCT, $r = 0.6882$; IIa: no significant differences between groups[b]; IVb: decrease in scores between time of finger-stick and band-aid application ($P < .0001$)	—
Alternate Oucher testing[87]	79 children aged 4–12 y; 58 used numerical Oucher, and 21 used photographic Oucher (3 y 1 mo to 10 y)	2 versions: white and Hispanic; PCT	I: Correlation between original Oucher and alternate, $r = 0.76$	Only 1 child, who scored >0 on the PCT, used photographic Oucher; analysis not possible
Validity of Abu-Saas tool[88]	Study 1: 26 children aged 5–15 y; study 2: 79 children aged 5–15 y; self-report	VAS; Abu-Saas pediatric pain tool; CMFS; 10-cm scale; Word descriptor	I: VAS and 10-cm scale correlate with Oucher numerical scale, $r = 0.92$ and 0.94; only 4 children used photographic Oucher; therefore, not analyzed	—
OTFC for painful procedures[89]	29 children aged 3–8 y in 2 groups: 14 (OTFC) and 15 (placebo); self-report; parent; nurse	—	IIa: OTFC group scores lower than placebo ($P = .006$)	—
Postoperative pain in Danish children[90]	100 children aged 3–15 y; photographic scale: 72 aged 3–12 y; numerical scale: 28 aged 7.5–15 y; self-report	PCT	I: Photographic Oucher and PCT, $r = 0.79$; numerical Oucher and PCT, $r = 0.71$; IVb: photographic mean pain scores, 1.9 (±1.5) (before analgesia) and 1.3 (±1.3) (after analgesia); numerical mean pain scores 44.3 (±20.5) (before analgesia) and 32.2 (±19.3) (after analgesia)	—
Juvenile chronic arthritis pain[91]	56 children aged 6–20 y; self-report	Pain thermometer	I: Between the Oucher and pain thermometer, $r = 0.92$	—
Construct validity for black and Hispanic versions of the Oucher[92]	104 children aged 3–12 y: 52 Hispanic, 52 black; 4 groups of 26 in each, including both versions with numerical and photographic scales; self-report	ACCS	I: The Oucher and ACCS for all 4 groups, $r = 0.89–0.97$; IVb: before and after analgesia ($P = .01$)	—
Oral tramadol, analgesia after dental extraction[93]	60 children aged 4–7 y in 2 groups: 32 (tramadol) and 28 (placebo); self-report	Objective pain score: parents/nurse	IIa: Tramadol group had less pain than placebo ($P < .05$)	—
Tramadol effects[94]	50 children aged 4–7 y in 2 groups: 40 (tramadol) and 10 (placebo); self-report; mother; nurse	—	IIa: Tramadol group scored less pain than placebo ($P < .05$); IIIb: maternal and nurse scores reported as being "very similar"; statistical analysis not reported	—
Distraction for injections[95]	95 children aged 4–6 y in 3 groups: 33 (bubble), 30 (touch), and 32 (control); self-report	—	IIa: Treatment groups vs control ($P = .013$)	—

TABLE 5 Continued

Study	Sample	Other Pain Scales	Psychometric Classification of the Oucher (see Table 1)[a]	Preference/Comments
Three pain measurement tools in black children[81]	100 children aged 3–18 y; self-report	WBFPRS; VAS	I: No statistical differences between 3 scales (χ^2 = 0.81); IIIa: extents of agreement for test-retest of the scales: 70% for the Oucher, 67% for the WBFPRS, and 45% for the VAS ($P < .05$)	56% of children preferred the WBFPRS ($P < .01$)
Pain management and cardiac surgery[96]	51 child/parent dyads of children aged 3–16 y in 2 groups: either parent education or standard care (numbers not reported); self-report; parents (numerical Oucher)	—	IIIb: Parent and younger child ($n = 7$) scores significantly and positively correlated, r = 0.73–0.95; parent and older children, r = 0.66–0.85	—
Topical anesthesia for dermatologic procedures[97]	60 children aged 7–15 y in 2 groups: 29 (placebo) and 31 (lidocaine); self-report	—	IIa: Pain scores of lidocaine group less than placebo ($P < .001$)	—
Lidocaine and urethral catheterization[98]	20 children aged 4–11 y in 2 groups: 10 in each (lidocaine and control); self-report	—	IIa: Lidocaine group had significantly lower pain ($P = .001$)	—
Imagery and postoperative tonsillectomy/adenoidectomy pain[99]	73 children aged 7–12 y in 2 groups: 36 (treatment) and 37 (control); self-report of numerical Oucher	FAS (affect)	IIa: Pain scores decreased with imagery group, mean difference of 30.00 vs 42.00 of control ($P < .001$)	—
Alternate forms of the Oucher pain scale[100]	137 children aged 3–12 y; 70 children,-photographic scale (3.1–7.5 y); 67 children, numerical scale (5.6–12.9 y); self-report	Reduced size of the Oucher (white); Hispanic; black	I: For all versions with original Oucher, r = 0.875–0.998	—
Validating Derbyshire hospital pain tool[101]	60 children aged 6–12 y; self-report; ward nurse; researcher	DPC	I: DPC with photographic Oucher, $r = 0.79$; DPC with numerical Oucher, $r = 0.83$	—
Asian version of the Oucher[102]	Study A: 206 children aged 3–7 y; study B: 149 children aged 3–7 y; self-report	Study B: VAS and PCT	Study A: content validity evident; study B: I, Asian Oucher with VAS, r = 0.86–0.96; Asian Oucher with PCT, r = 0.67–0.85	—
Validity of MPS[103]	113 children aged 6 and 16 y used numerical Oucher; 39 children aged 3–16 y used pictorial Oucher; self-report	MPS	I: MPS with photographic Oucher, $r = 0.82$; DPC with numerical Oucher, $r = 0.802$	—
Vascular access and S-Caine patch analgesia[104]	61 children aged 3–17 y in 2 groups: 41 (S-Caine patch) and 20 (control); self-report; investigator; independent observer	—	IIa: Lower scores in the patch group compared to control ($P < .001$); IIIb: investigator and observer scores were similar, but interrater statistics were not reported	—
2 nonpharmacologic pain management in IM injection[105]	90 children aged 5–12 y in 3 groups: 30 (local cold therapy), 30 (distraction), and 30 (control); self-report	—	IIa: Significant difference in pain intensity after injection in all 3 groups ($P < .001$)	—
Venipuncture pain and local refrigeration[106]	80 children aged 6–12 y in 2 groups: 40 (ice-bag) and 40 (control); self-report	CHEOPS by observer	IIa: Pain scores higher in control group ($P = .0097$)	—
Pain response to MMR vaccination[107]	60 children aged 4–6 y in 2 groups: 30 (Priorix) and 30 (M-M-R II); self-report	VAS by physician and parent	IIa: M-M-R II scores higher than in Priorix group ($P = .047$)	—
Cartoon stickers and hemoglobin finger-stick[108]	130 children aged 3–5 y in 2 groups: 65 (received stickers) and 65 (no stickers); self-report	—	IIa: No statistical difference between groups ($P > .05$)[b]; younger ages rated higher pain.	—

PCT indicates poker chip tool; CHEOPS, Children's Hospital of Eastern Ontario Pain Scale; HCP, health care professional; ACCS, Analogue Chromatic Continuous Scale; IM, intramuscular; CMFS, Child Medical Fear Scale; OTFC, oral transmucosal fentanyl citrate; DPC, Derbyshire Pain Chart; MPS, Manchester Pain Scale; MMR, measles, mumps, rubella.

[a] Psychometric classifications: I, convergent construct validity (correlation $r > 0.7$); II, known group validity: a, 2 comparable groups ($P < .05$), and b, discrimination of painful versus nonpainful scenarios ($P < .05$); III, reliability: a, test-retest reliability $r > 0.5$, and b, correlation between self-report and observational $r > 0.4$; IV, responsiveness: a, to pain-increasing events ($P < .05$), and b, to pain-decreasing events ($P < .05$).

[b] Findings that do not support validity, reliability, or responsiveness of these instruments.

TABLE 6 Studies That Used the WBFPRS ($N = 56$)

Study	Sample and Respondent(s)	Other Pain Scale(s) Used	Psychometric Classification of the WBFPRS (see Table 1[a])	Preference/Comments
Comparison of scales[35]	150 children aged 3–18 y; self-report	Simple descriptive scale; numerical scale; glasses scale; chips/pieces of hurt scale; color scale	I: No statistically significant differences between scoring on all scales (χ^2 $P > .05$); IIIa: test-retest reliability evaluated by χ^2 analysis ($P < .05$)	The WBFPRS was most preferred scale for all age groups
Pain in children with cancer in an ICU[109]	30 children aged 5–13 y; self-report; parents; nurses	PCT; OPS (nurses only)	I: Correlation of the WBFPRS with the PCT for children ($r = 0.67$) and parents ($r = 0.7$)	The WBFPRS was preferred by majority of children (91%) and parents (93%)
Reliability and validity of scale for measuring procedural pain[111]	118 children aged 3–18 y; self-report	Word descriptor scale; numerical scale; word graphic scale (VAS)	I: WBFPRS/word graphic, $r = 0.71$; WBFPRS/numerical scale, $r = 0.75$; IIIa: postprocedure scores, $r = 0.90$; IVa: preprocedure mean score: 0.49; postprocedure mean score: 1.61 ($P < .001$)	65.1% preferred the WBFPRS (83.3% of 3- to 7-y-olds); preference was not age dependent ($P = .14$)
Topical anesthesia for lacerations[112]	107 children aged 3–16 y in 2 treatment groups: 56 (adrenaline and cocaine) and 51 (lignocaine); self-report; parents; HCP	VAS	IIa: Lower pain scores in adrenaline and cocaine group compared to lignocaine group; differences between scores of 2 groups: $P < .001$	—
Physiological, self-report, and behavioral pain ratings in black and white children[110]	55 children aged 3–7 y in 2 groups; black (25) and white (30); self-report	CHEOPS (2 investigators)	IIa: No significant differences between groups in the mean WBFPRS scores ($P = .345$)[b]	—
Pain assessment after cardiac surgery[113]	82 children aged 3–18 y; self-report; various factors/groups observed to compare	—	IIa: Higher pain scores in children with sternal incisions ($n = 68$) compared to substernal incision ($n = 13$) ($P < .007$); repeat cardiac surgery group ($n = 47$) rated pain higher than first-time surgery group ($n = 35$) ($P < .04$)	—
EMLA and procedure-related pain[114]	336 procedures in 36 children aged 1–16 y; children >5 y self-report using the WBFPS (number of children in this age group not reported); parent; nurse; physician	OSBD: nurse/physician	IIa: Children who had LP without EMLA first time and then subsequent 2 LPs with EMLA: $P < .025$	—
Pain assessment[116]	36 children aged 5–17 y; self-report	—	IVb: After analgesia administration, pain scores reduced in 75.6% of children (no statistical analysis reported)	—
Postoperative analgesia for strabismus surgery[115]	30 children, ages not stated, in 3 groups: 10 in each; retrobulbar block (group 2), subconjunctival local anesthetic (group 3), and control (group 1); self-report	VAS; modified OPS (HCP)	IIa: Groups 1 and 2 had higher pain scores than group 3 ($P < .05$); IVb: scores from 30 to 360 min postoperatively ($P < .05$)	—
Comparison of faces scales for children's pain measurement after venipuncture[44]	75 children aged 5–12 y; self-report; parents; nurses	FPS; Maunuksela et al[22]; LeBaron and Zeltzer[21]; Kuttner and LePage[27]	I: r ranged between 0.82 and 0.91 for each of the 4 pain scales for children's self-report (parents report range of r from 0.83 to 0.88); IIIb: parents overestimated the level of child's pain in comparison to child's self-report (WBFPRS ($P < .001$)[b]	Higher pain ratings were obtained by using the 2 scales that had smiling no-pain faces[22,35] compared to the other scales with neutral no-pain faces with children and parents; preference ratings were highest for the WBFPRS from both parents (40.3%) and children (64.4%)
Topical anesthesia for IV cannulation[117]	100 children aged 5–21 in 2 treatment groups: 50 (iontophoresis of 2% lidocaine with epinephrine) and 50 (EMLA); self-report	VAS: parent and investigator	IIa: Less pain reported with iontophoresis group ($P < .001$)	—

TABLE 6 Continued

Study	Sample and Respondent(s)	Other Pain Scale(s) Used	Psychometric Classification of the WBFPRS (see Table 1[a])	Preference/Comments
Nasal diamorphine for fractures[118]	404 children aged 3–16 y in 2 groups: nasal diamorphine (204) and IM morphine (200); self-report; parent; HCP	—	IIa: Pain scores lower in nasal-spray group at 5 min ($P = .04$), at 10 min ($P = .003$), and at 20 min ($P = .002$); IIIb: parent and HCP scores reported as consistent with self-report scores but not statistically shown	—
Intervention effect on procedural pain[119]	43 children aged 4–12 y; self-report	VAS; PBCL (distress) by investigator	IVb: self-reported pain scores over time compared to baseline ($P < .05$) (combined WBFPRS and VAS)	—
Fibrin sealant and tonsillectomy[120]	20 children aged 5–17 y in 2 groups: 10 in the treatment group (fibrin sealant) and 10 controls; self-report	—	IIa: Treatment group reported less pain ($P < .05$)	—
Cultural validity and reliability of pain tools[121]	95 children aged 3–14 y; self-report	PCT; word description	I: PCT/WBFPRS, $r = 0.73$ (WBFPRS/word description, $r = 0.65$); IIIa: test-retest of WBFPRS, $r = 0.84$	Internal consistency reported for all 3 scales (Cronbach's $\alpha = 0.92$); the PCT (55.8%) and WBFPRS (36.8%) were preferred
Three pain measurement tools in black children[81]	100 children aged 3–18 y; self-report	African-American Oucher; VAS	I: No statistical differences between 3 scales ($\chi^2 = 0.81$); IIIa: extents of agreement for test-retest of the scales: 70% for the Oucher, 67% for the WBFPRS, and 45% for the VAS ($P < .05$)	56% of children preferred the WBFPRS ($P < .01$)
Comparing 3 analgesia techniques for bone marrow aspiration and LP[122]	178 children aged 1–18 y in 3 groups: 50 (EMLA cream), 56 (oral midazolam and EMLA cream), and 72 (propofol/fentanyl general anesthesia); self-report	—	IIa: LP procedure scores of EMLA (2.8 ± 1.5) vs propofol/fentanyl (0.2 ± 0.4) ($P = .001$); midazolam/EMLA (2.6 ± 1.6) vs propofol/fentanyl (0.6 ± 0.8) ($P < .001$); bone marrow procedure scores of EMLA (4.1 ± 0.9) vs propofol/fentanyl (0.1 ± 0.4) ($P = .017$); midazolam/EMLA (4.1 ± 1.1) vs propofol/fentanyl (0.3 ± 0.5) ($P = .011$)	—
Pain assessment in emergency department[123]	78 children aged 4–14 y; self-report; parents; HCP	Linear scale	IIIb: No significant difference in pain scores of children compared with parent ($P > .05$)	Younger children were more comfortable using the WBFPRS
Comparison of the FLACC with the WBFPRS self-report during procedure[124]	30 children aged 3–7 y; (WBFPRS used as gold standard to validate FLACC); self-report	FLACC (nurses)	I: FLACC and WBFPRS; stronger correlation with children >5 y ($r = 0.830$) (3- to 5-y-olds, $r = 0.254$); all children, $r = 0.584$	—
Parents' positioning and distraction during venipuncture[126]	43 children aged 4–11 y in 2 groups: 23 (control) and 20 (experimental); self-report	—	IIa: No significant difference found between 2 groups of self-reported pain scores, although scores tended to be lower in experimental group ($P = .68$)[b]	—
Nitrous oxide for minor surgical procedures[125]	143 children aged 2.5–20 y in 3 groups: 58, 49, and 38; self-report	—	IVa: Abscess excision preprocedure pain (mean: 2.1) and procedure pain (mean: 0.8) ($P \leq .01$)	—
Validating AHTPS[128]	292 children aged 3–16 y; self-report	AHTPS (investigator)	I: Expected poor correlation due to self-report problems at triage, $r = 0.46$[b]	—
Pain relief for meatotomy[127]	52 boys 1–10 y old in 2 groups: 26 (LMX) and 26 (EMLA); parent report when child too young: no numbers recorded	—	IIa: With 30-min application of EMLA (3.2 ± 4.7) vs LMX (1.1 ± 2.9) ($P < .5$)	—

TABLE 6 Continued

Study	Sample and Respondent(s)	Other Pain Scale(s) Used	Psychometric Classification of the WBFPRS (see Table 1[a])	Preference/Comments
Faces scales for postoperative pain[56]	78 children aged 5–13 y; self-report; parents; nurses	FPS; Maunuksela et al[22]; LeBaron and Zeltzer[21]; Kuttner and LePage[27]; CAS	I: r ranged between 0.82 and 0.91 for each of the 5 pain scales for children's self-report (parents report, r ranged from 0.75 to 0.91; nurses r ranged from 0.62 to 0.82)	The WBFPRS as preferred by children (55.6%), nurses (77.1%), and parents (53.9%); parents', and nurses', pain scores generally higher with the 2 scales with the smiling no-pain left anchor[22,35] compared to neutral no-pain left anchor face scales; children had higher ratings using the WBFPRS, whereas the other scale ratings did not differ, including the Maunuksela et al[22] faces pain scale; parents and nurses underestimated pain across all scales
Pain scale comparison in Thai children[65]	122 children aged 4–15 y; self-report	FPS-R; VAS	I: VAS/WBFPRS, $r = 0.70$; WBFPRS/FPS-R, $r = 0.79$	—
Tonsillectomy: coblation vs electrocautery[129]	101 children aged 2–16 y in 2 groups: 52 (coblation) and 49 (electrocautery); self-report; parents		IIa: Coblation (2.5, 1.9, 1.5) vs electrocautery (4.6,4.3, 3.8) scores: $P < .005$; IVb: scores over time for each group: $P < .005$	Parent scores were statistically significantly higher than the children's
Virtual reality for pain distraction during IV placement[69]	20 children aged 8–12 y in 2 groups of 10 (virtual reality and control); self-report; parent; nurse	VAS; FPS-R	I: FPS-R with WBFPRS, $r = 0.96$; IIa: control group ($t = -2.74$) compared to virtual reality ($t = -2.86$)[b]; IVa: WBFPRS showed significant score increases after IV placement	—
Analgesia comparison after tonsillectomy[133]	61 patients, adult and children, numbers of each not specified in 3 groups: 25 (coblation), 19 (electrocautery), and 17 (ultrasonic); self-report	—	IIa: Coblator mean pain score, 2.85, vs electrocautery mean pain score, 3.84 ($P = .0236$); coblator mean pain score, 2.85, vs ultrasonic scalpel mean pain score, 4.20 ($P = .0031$)	—
Comparison of ethyl chloride spray with topical anesthetic in children receiving venipuncture[131]	77 children aged 5–13 y in 2 treatment groups: 33 and 42 receiving 3 venipunctures; self-report	—	IVb: 2-sample t test, mean difference: −0.43 (95% CI: −0.91 to 0.05)	—
Management of procedure-related pain in children[132]	45 children aged 6–16 y in 3 groups: 15 in each treatment group: local anesthetic, local anesthetic plus hypnosis, and local anesthetic plus attention; self-report	PBCL: trained nurse	IIa: Between 2 of 3 treatment groups: EMLA + hypnosis and EMLA + attention, $t_{28} = 4.12$ ($P < .001$); EMLA + hypnosis and EMLA, $t_{28} = 6.17$ ($P < .001$); IVb: with effect of time: $P < .001$	—
Procedural pain in children with cancer, undergoing Port-a-Cath access[130]	45 children aged 4–10 y; self-report; parents; nurses	DOLLS (an adaptation of the WBFPRS using dolls); FLACC (nurses); OSBD-R (parents and nurses)	I: Between DOLLS and WBFPRS: children, $r = 0.9$; parents, $r = 0.73$–0.81; and nurses, $r = 0.78$–0.82; IIIb: WBFPRS children and parents, $r = 0.79$	Children indicated a preference for the DOLLS
Mucosal sealing for tonsillectomy pain[156]	39 children aged 3–15 y; comparing sutured vs nonsutured alternate sides; self-report	—	IIa: Sutured wound-site pain vs nonsutured wound-site pain ($P < .01$) (except first postoperative day); IVb: pain scores for both groups first postoperative day mean scores, 6.69 and 6.51, compared to 10th postoperative day, mean scores 0.95 and 0.28 (P not reported)	—

TABLE 6 Continued

Study	Sample and Respondent(s)	Other Pain Scale(s) Used	Psychometric Classification of the WBFPRS (see Table 1[a])	Preference/Comments
Local anesthesia and adenoidectomy[157]	98 children aged 3–10 y in 2 groups: 49 (local anesthesia) and 49 (control); self-report	VAS (nurses and parents)	IIa: No significant differences observed between 2 groups on self-report ($P = .516$)[b]	—
Pain-severity ratings by teenagers[158]	100 children aged 11–18 y; self-report	VAS; Casual 10 scale	I: Paired t test: Casual 10 vs WBFPRS: $P = .0004$; WBFPRS vs VAS: $P = .0214$	Casual 10 scale scoring tended to higher than for 2 other scale scores
Development of computer method of pain assessment[137]	54 children aged 3–17 y in hospital; self-report	CFS	I: $r = -0.72$ (low scores on CFS indicate greater pain)	76% of participants preferred the CFS
Music as treatment for pain and stress in children during venipuncture[135]	108 children aged 4–13 y in 2 groups: 54 (music therapy) and 54 (control); self-report	OSBD-A (amended): (2 observers	IIa: Music group reported less pain ($P = .048$)	—
Comparing pain between intracapsular and extracapsular tonsillectomy procedures[136]	43 children aged 5–19 y in 2 procedure groups: 16 (intracapsular) and 27 (extracapsular); self-report collected by parents	—	IIa: Intracapsular pain scores (2.75 ± 2.28) lower than extracapsular (5.21 ± 3.23) ($P < .0001$)	Responsiveness observed by reduced pain over time but not statistically reported
Comparison of topical analgesia for venipuncture[138]	55 children aged 6 mo to 16 y in 3 treatment groups: 18 (ethyl chloride spray), 18 (topical anesthetic Ametop), and 19 (no analgesia); self-report	FLACC if unable to self-report	II: Discriminant validity apparent with lower pain scores of ethyl chloride spray and topical anesthetic groups compared with no analgesia: not statistically reported; IVa: patients who had topical anesthesia applied for a shorter time period ($P = .005$)	No data provided on number of children who used the WBFPRS vs observer FLACC
Acute abdominal pain in children in a pediatric emergency department[134]	87 children aged 8–18 y; self-report	CAS; VAS; verbal numerical scale	I: Concluded that the 4 scales were not in agreement to measure pain intensity, and the verbal numerical scale, in particular, had no agreement with the other 3 scales[b]; VAS/WBFPRS: 95% CI lower limit of agreement = −20.1, upper limit = 33.7[b]; CAS/WBFPRS: 95% CI lower limit = −18.5, upper limit = 36.3[b]; WBFPRS/verbal numerical scale: 95% CI lower limit = −38.7, upper limit = 15.7[b]	—
Venipuncture and IV cannulation pain: comparison between powder lidocaine and placebo[141]	579 children aged 3–18 y in 2 groups: 292 (powder lidocaine) and 287 (sham placebo); self-report; parents	VAS for children aged 8–18 y; VAS for parents	IIa: Active system scores, 1.77 ± 0.09, lower than sham placebo, 2.10 ± 0.09 ($P = .011$)	—
Ultrasound treatment before topical anesthetic before venipuncture[142]	59 children aged 3–7 y in 2 groups: 31 (treatment) and 28 (control); self-report	VAS (parents only)	IIa: No clinically or statistically significant differences reported between treatment and control groups ($P = .72$)[b]	—
Analgesic effect of powder lidocaine for children undergoing venipuncture[143]	204 children aged 3–12 y in 2 groups: 102 (analgesia) and 105 (control) divided into 2 age groups (3–7 and 8–12 y); self-report	VAS (additional for 8- to 12-y-olds)	I: Similar scores reported between the VAS and WBFPRS in the 8- to 12-y-old group, statistics not reported; IIa: 3- to 7-y-olds in analgesia group reported lower scores, 1.52 ± 1.83, than control 2.42 ± 2.12 ($P = .024$)	—
Khon Kaen University scale for pain assessment[139]	150 children aged 6–12 y; self-report; 150 parents; 17 nurses	Khon Kaen University scale; numerical rating scale	I: No difference in 2 scales rated by children ($P = .848$); nurses ($P = .258$); parents ($P = .676$)	—

TABLE 6 Continued

Study	Sample and Respondent(s)	Other Pain Scale(s) Used	Psychometric Classification of the WBFPRS (see Table 1[a])	Preference/Comments
Pain of tonsillectomy if platelet-rich plasma used[140]	57 children aged 4–15 y in 2 groups: 27 (platelet-rich plasma) and 30 (control); self-report or parent (individual numbers not reported)	Numerical pain scale	IVb: Responsiveness with lower pain with increasing time from surgery, reported but not statistically measured	Number of days with pain score >4 between 2 groups ($P = .23$)
Intracapsular vs subcapsular coblation tonsillectomy[145]	69 children aged 2–16 y in 2 groups: 34 (intracapsular) and 35 (subcapsular); self-report; parents	—	IIa: Intracapsular group pain scores lower than subcapsular group on days 5 and 6 ($P < .05$)	Parental scores also only significantly different between 2 groups on days 5 and 6 ($P < .05$)
Pain during vaso-occlusive events in patients with sickle cell anemia[146]	279 vaso-occlusive events in 105 children aged 8–19 y in 2 groups: 178 (admitted) and 101 (discharged); self-report	—	IIa: Changes in scores after administration of morphine: admitted children, -1.1 ± 0.14, and discharged children, -2.5 ± 0.16 ($P < .0001$); IVb: scores, 4.4 for admitted and 3.9 for discharged ($P = .002$)	—
Collar and cuff vs back slab for humerus fractures[144]	40 children aged 4–10 y in 2 groups: 20 (collar and cuff) and 20 (back slab); self-report	—	IIa: Back-slab group reported lower scores than collar-and-cuff group ($P < .0001$)	—
Using kaleidoscope to reduce pain during venipuncture[152]	206 children aged 7–11 y in 2 groups: 105 (intervention) and 104 (control); self-report	VAS	I: Mean scores between the WBFPRS and VAS in intervention group: $P < .001$; mean scores between WBFPRS and VAS in control group: $P < .001$); IIa: intervention group reported lower scores than control ($P < .001$) on WBFPRS but not VAS	—
Comparison of pain-assessment in triage nurse, child, and parent[151]	86 children aged 3–15 y (WBFPRS for younger children); self-report; parents; nurses	Linear numerical pain rating scale for older children, no age limit specified	IIIb: No significant differences between parent and child ($P = .11$), but parent scores tended to be lower	Nurses score significantly lower than parents and children ($P < .001$)
Analgesia in strabismus surgery[150]	54 children aged 1–16 y in 2 groups: 27 (sub-Tenon levobupivacaine) and 27 (control); nurse or parent performed assessment	FLACC for infants and preverbal children, no age limit specified or numbers reported	IIa: No significantly statistical differences in pain scores between the 2 groups ($P = .22$) at 30 min or at 2 h ($P = .37$)[b]	Responsiveness apparent but not statistically reported
CFS[148]	79 children aged 3–17 y; self-report	CFS	I: Correlation with CFS, $r = -0.68$ ($P < .001$) (low scores on first scale indicate greater pain)	—
IM injection analgesia comparison[147]	64 children aged 3–17 y in 2 groups: 28 (Shotblocker) and 36 (no intervention); 32 of these children aged 6–17 y in 2 treatment groups: 14 (Shotblocker) and 18 (no intervention); self-report; nurses; caregivers	6-point Likert scale for nurses and caregivers	IIa: Between 2 groups in children aged 6–17 y: $P = .04$	—
Pain perception during nasendoscopy[149]	23 children aged 4–18 y; self-report; parents	PBCL (HCP)	IIIb: Between child and parent $r = 0.464$ ($P = .011$)	—
Effects of music on pain in children with cerebral palsy receiving acupuncture[153]	60 children with cerebral palsy aged 2–12 y; 2 groups: 30 (intervention) and 30 (control); self-report; parents; nurse	CHEOPS	IIa: No significant statistical differences observed between groups ($P = .058$)[b]; IVb: time effect: $P = .000$; interaction effect: $P = .005$	—
Validation of WBFPRS in pediatric emergency[155]	120 children aged 8–17 y; self-report	VAS	I: Between WBFPRS and VAS, $r = 0.9$	—
Pain in atraumatic restorative treatment compared to conventional restorative[154]	40 children aged 4–7 y in 2 treatment groups: 20 (atraumatic restorative treatment) and 20 (conventional restorative treatment)	—	IIa: Atraumatic restorative treatment group reported lower scores than conventional restorative treatment group ($P = .0037$)	—

PCT indicates poker chip tool; OPS, objective pain scale; HCP, health care professional; CHEOPS, Children's Hospital of Eastern Ontario Pain Scale; EMLA, eutectic mixture of local anesthetics/lidocaine 2.5% and prilocaine 2.5%; OSBD-R, Observational Scale of Behavioural Distress–Revised; OPS, Observational Pain Scale; LP, lumbar puncture; IV, intravenous; IM, intramuscular; PBCL, Procedure Behavior Checklist; FLACC, face, legs, activity, cry, consolability scale; AHTPS, Alder Hey Triage Pain score; LMX, lidocaine 4% (formerly ELA-Max); CFS, Computer Faces Scale; CI, confidence interval.

[a] Psychometric classifications: I, convergent construct validity (correlation $r > 0.7$); II, known group validity: a, 2 comparable groups ($P < .05$), and b, discrimination of painful versus nonpainful scenarios ($P < .05$); III, reliability: a, test-retest reliability $r > 0.5$, and b, correlation between self-report and observational $r > 0.4$; IV, responsiveness: a, to pain-increasing events ($P < .05$), and b, to pain-decreasing events ($P < .05$).

[b] Findings that do not support validity, reliability, or responsiveness of these instruments.

TABLE 7 Summary of Psychometric Evidence Obtained From Review of Studies ($N = 127$) That Used Face Pain Scales (Note That 6 Studies Used 2 Faces Scales)

Psychometric Property	Faces Scale	Positive Evidence, *n*	Negative Evidence, *n*	Not Assessed or No Statistical Data Reported, *n*
I. Convergent construct validity				
Correlation, $r > 0.7$, with another self-report pain scale given at the same time	FPS and FPS-R	21	1	26
	Oucher	12	0	17
	WBFPRS	17	2	37
II. Known group validity				
a. Differences in score between 2 comparable but different groups ($P < .05$)	FPS and FPS-R	15	9	24
	Oucher	12	4	13
	WBFPRS	26	14	16
b. Accurate discrimination of painful vs nonpainful pictures or vignettes ($P < .05$)	FPS and FPS-R	1	0	47
	Oucher	0	0	29
	WBFPRS	0	0	56
III. Reliability				
a. Test-retest reliability, $r > 0.5$	FPS and FPS-R	3	3	42
	Oucher	1	0	28
	WBFPRS	3	0	53
b. Concordance with simultaneous observational score, $r > 0.4$	FPS and FPS-R	9	3	35
	Oucher	1	0	28
	WBFPRS	5	1	50
IV. Responsiveness				
a. To pain-increasing events or stimuli such as a painful procedure ($P < .05$)	FPS and FPS-R	3	0	45
	Oucher	0	0	29
	WBFPRS	3	0	53
b. To pain-decreasing events such as administration of analgesia (passing time before operation or after a procedure) ($P < .05$)	FPS and FPS-R	6	0	42
	Oucher	4	1	24
	WBFPRS	9	0	47

The use of parent and staff observational scores, therefore, may be particularly useful when assessing younger children. However, poor agreement between parent, practitioner, and child faces pain scores has been reported.[168] Most studies have shown that parents (and nurses) underestimate children's pain,[56] but overestimation by parents has also been reported.[44] The type of pain experienced by the child may affect how parents score pain (eg, postoperative pain versus venipuncture pain).

The following summarizes the strengths and weaknesses of each of the faces pain scales for use with children. First, extensive data support the reliability and validity of the FPS-R for the assessment of pain intensity in children aged 4 to 12 years; it exceeds conventional requirements for validity of research tools and shows excellent interscale agreement even in 4-year-old children.[31] The scale is scored on the widely accepted conventional 0-to-10 metric and is simple and quick to use. The instructions are available in many languages. Having no smiling face and no tears may be advantageous in avoiding the confounding effect of affect and pain intensity.[165,169,170] A limitation of the FPS-R is that it has shown low preference when children and adults are given a choice among faces scales (although it is preferred to visual analog and numerical scales, as noted above). Thus, if patient and staff acceptance are of great importance for a particular study, the FPS-R may not be ideally suited. However, the FPS-R has been recommended for use in clinical trials for which psychometrically optimal measurement is important to achieve.[6]

The Oucher also has adequate psychometric properties in terms of validity and reliability,[6,33] and it has the advantages of being presented by using photographic faces that match various ethnic or racial groups and a nonsmiling lower anchor face. However, the faces are neither gender nor ethnically neutral.[6] The existence of different versions for white, black, Hispanic, and Asian children raises the question of how many different ethnically specific versions may be needed to address human diversity. Difficulty in using the Oucher has also been reported, particularly by younger children (3–7 years old) because of the confusion that may be presented by the associated numerical rating scale.[33] This scale is more expensive to reproduce than the other faces scales, because it requires printing of color photographs. The Oucher may be particularly useful for older children (>7 years old) and for studies restricted to the ethnic groups for which specialized versions are available.

The WBFPRS also has adequate psychometric properties, and it is easy and quick to use[6,35] and inexpensive to reproduce. The greatest strength of this scale may be its acceptability, given the consistent finding that the WBFPRS was preferred by children (any age), parents, and practitioners when compared with other faces pain scales.[44,56,81] The major concern with the WBFPRS is the confounding of emotion with pain intensity in the representation of the faces. Children who do not cry with intense pain, especially older boys, may be reluctant to pick the face scored 10 of 10 because it shows tears.[170] The use of smiling no-pain and mild-pain faces on this scale lead to it showing a painful expression only in the faces scored 6, 8, and 10, which results in higher scores on the WBFPRS than on other scales administered at the same time (eg, ref [56]). As noted above, this is probably not an issue for most older children, who understand the underlying dimension from no pain to severe pain and use the scale accordingly. If there are concerns regarding potential for confounding of pain intensity with affect, or regarding the possibility of overestimation of pain scores for a particular study or purpose, then this scale may not be optimal. If these are not major issues and patient and staff acceptance are critical, then the WBFPRS may be suitable.

It is important to note that although we examined psychometrics and preferences, we assumed that scales were applied according to published instructions and formatting, including instrument-specified wording and presentation of anchors. It is important to avoid careless scale application.

CONCLUSIONS

There are an adequate number of valid and reliable face pain scales for use in children. However, a gold-standard faces pain scale or, indeed, self-report scale for children has not been identified and is probably not attainable. There are obvious and subtle differences in all faces pain scales. However, the information that children can provide about their pain is much more relevant than these differences.[164]

Ultimately, the absolute value of the pain-intensity score is not as important as the changes in scores in each individual child. In clinical use with individual patients, a change in pain of 2 of 10 (ie, a change of 1 face) represents the least change that can be considered clinically significant when using a faces scale. In clinical trials, the current consensus is that outcomes should be reported as the percentage of patients in each arm of the study who achieve treatment success as defined by a reduction in their individual pain scores of ≥50% or the number of patients having no more than minimal pain after the intervention.[180] This approach can be used to report outcomes on faces scales.

All 3 faces pain scales measure the same phenomenon but may not be interchangeable for the purpose of clinical research. Researchers who use a faces pain scale should be aware of the possibility of providing data on psychometric properties of the scale as a secondary outcome of the study.

For clinical purposes, in institutions where 1 of the faces scales is already in use, we found no grounds to change to a different scale; such a change would be disruptive and costly and possibly have little benefit. On the other hand, when no faces scale has yet been adopted, the results of this review may assist in making the choice. For research use, particularly for multicenter clinical trials, standardization of methods is necessary; the authors of a previous systematic review recommended the FPS-R for this purpose on the basis of its utility and psychometric features.[6]

Self-report measurement of pain intensity in younger age groups (3–5 years) and in older children with mild developmental delay requires further research. It has been suggested that 6 faces are too many for preschool-aged children,[11,181] which could partly explain their well-documented response bias toward using the extremes on the scale.[167]

Research should continue, not on developing new scales for older children (because there are already so many), but on studying the use of existing scales in various clinical situations, in a consistent manner, and including disease-related or chronic pain, which have received minimal comparative self-report pain-scale testing to date.

ACKNOWLEDGMENTS

Dr Sung is supported by a New Investigator Award from the Canadian Institutes of Health Research.

We acknowledge Elizabeth Uleryk (library director, Hospital for Sick Children) for all her invaluable assistance with the search strategies necessary for this review. Also, we thank Rhonda Adams (senior secretary, hematology/oncology department, Hospital for Sick Children) for her excellent assistance in retrieving many of the articles required.

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APPENDIX 1 Studies That Used FPS

Study	Sample and Respondent	Other Pain Scale(s) Used	Comments
Noncontributory Results ($N = 9$)			
Pain memories (Zonneveld et al[182] [1997])	55 children aged 5–16 y; self-report	—	High accuracy of recall pain intensity compared to other studies; suggested that may be a result of inappropriate pain measure previously used
Analgesia (paracetamol with or without fentanyl) and assessments for pain after tonsillectomy and adenoidectomy (Hamers et al[183] [1999])	83 children aged 3–12 y in 4 groups: 18, 24 (with fentanyl), 21 (with systematic assessment), and 20 (with systematic assessment and fentanyl); self-report	Oucher; VAS (parent, nurses, and researcher); CHEOPS (researcher); FLACC (researcher)	Significant number of missing data of self-report scales; I: FPS similar to Oucher scores; correlation statistics not reported; IIa: no significant differences between groups ($P = .49–.84$; IVb: decrease in scores after analgesia over 3-h period (P values not reported)
Posttonsillotomy pain (Ozköse et al[184] [2000])	45 children aged 2–11 y; number of 2- to 6-y-olds not reported	FPS in 2- to 6-y-olds (observer); VAS >7 y	Unclear if self-report or observer; no number of children in the FPS group; no psychometric data reported
Major surgery and pain thresholds (Demyttenaere et al[185] [2001])	25 dyads of parents and children aged 6 to 16 y; self-report; parents; nurses	—	IIIb: Parent and child correlation, $r = 0.016$; parent and nurse correlation, $r = 0.471$
EMLA for pain reduction with IM injection in 4- to 6-y-olds (Cassidy et al[186] [2001])	161 children aged 4–6 y in 2 treatment groups: 83 and 78; self-report	VAS; pain and anxiety by parents and technicians; CHEOPS and CFCS by blinded raters from video recordings	No psychometric data reported regarding FPS
Distraction for preschool immunization (Cassidy et al[187] [2002])	49 children aged 5 y in 2 intervention groups: 27 (watching a blank screen) and 22 (watching television); self-report	CHEOPS and CFCS by blinded raters from video recordings	IIa: No significant differences between the 2 intervention groups ($P = .11$)
HCP perception of infant pain (Breau et al[188] [2004])	95 HCP; no self-report	0–10 rating	No psychometric data reported regarding FPS
Verbal pain expression during immunization (Stanford et al[189] [2005])	58 children aged 4–6 y	CHEOPS	No psychometric data reported regarding FPS
Laceration repair in emergency department (Sinha et al[190] [2006])	240 children aged 6–18 y in 2 groups: 120 (distraction) and 120 (control); self-report	VAS by parents	IIa: No significant differences in FPS scores between 2 groups
Insignificant statistical information ($n = 6$)			
Nitrous oxide analgesia for painful procedures (Babl et al[191] [2008])	124 children aged 1–17 y but FPS-R in 5- to 7-y-olds only; self-report	—	Number of children using the FPS-R was not cited; no psychometric data available
Venipuncture with 3 types of venous access (Spagrud et al[192] [2008])	55 children aged 3–18 y; self-report; parent; nurse	—	IIa: No differences between peripheral access compared with port access scores ($P > .05$)
Preschool children's pain ratings for hypothetical situations (von Baeyer et al[167] [2009])	185 children aged 3–5 y in 3 groups: 62 children aged 3 y, 73 children aged 4 y, and 50 children aged 5 y	—	Results showed difficultly for preschool children in using self-report pain measures
Nitrous oxide for venipuncture pain (Furuya et al[193] [2009])	72 children aged 6–15 y in 4 groups: 18 in each group; parent; nurse; no self-report	—	No contributory psychometric data reported
Monitoring electrical skin conductance as pain assessment (Hullett et al[194] [2009])	54 children aged 4–7 y; self-report	Number of fluctuations in skin conductance per second	No psychometric data reported regarding the FPS-R
Nitrous oxide and analgesic cream for botulinum toxin injections (Brochard et al[195] [2009])	24 sessions of injection; self-report; parent	VAS; CHEOPS by investigator	Only 2 children used the FPS-R; 22 used a VAS

CHEOPS indicates Children's Hospital of Eastern Ontario Pain Scale; FLACC, face, legs, activity, cry, consolability scale; EMLA, eutectic mixture of local anesthetics/lidocaine 2.5% and prilocaine 2.5%; IM, intramuscular; CFCS, child facial coding system; HCP, health care professional.

APPENDIX 2 Studies That Used the Oucher Pain Scale With Noncontributory Results ($N = 10$)

Study	Sample and Respondent	Other Pain Scale(s) Used	Comments
Pain intensity and management with sickle cell disease (Conner-Warren[196] [1996])	30 children aged 4–18 y; self-report	—	No psychometric data reported regarding Oucher pain scale
Postoperative pain guidelines (Huntink-Sloot et al[197] [1997])	50 children aged 0–14 y; 4–14 y: Oucher; self-report	CHEOPS: 0- to 4-y-olds	No psychometric data regarding Oucher pain scale
Analgesia and assessments for pain after tonsillectomy and adenoidectomy (Hamers et al[183] [1999])	83 children aged 3–12 y; 4 groups: 18, 24 (with fentanyl), 21 (with systematic assessment), and 20 (with systematic assessment and fentanyl); self-report	FPS; VAS (parent, nurses and researcher); CHEOPS (researcher); FLACC (researcher)	Significant number of missing data of self-report scales; I: FPS similar to Oucher scores; correlation statistics not reported; IIa: no significant differences between groups ($P =$ .16–.98); IVb: decrease in scores after analgesia over 3-h period (P values not reported)
Vaso-occlusive events in sickle cell disease and analgesia (Beyer[198] [2000])	21 children aged 6–16 y; self-report	APPT	IVb: No significant difference between 2 time points ($P > .05$)
EMLA or ELA-Max for IV insertion (Kleiber et al[199] [2002])	30 children aged 7.4–12.9 y, IV in each hand with different topical anesthesia; self-report	—	IIa: Expected no difference between 2 topical anesthesia types ($P = .31$)
Introduction of guidelines for postoperative tonsillectomy pain (White and Nolan[200] [2005])	71 children aged 3–11 y in 2 groups: 34 (5–11 y) and 30 (3–6 y)	—	No psychometric data reported regarding Oucher pain scale
Predicting topical anesthetic effectiveness (Kleiber et al[201] [2007])	218 children aged 4–10 y; self-report	—	Bias toward even numbers on scoring; no significant psychometric data
Painful episodes with sickle cell disease and complete blood count values (Jacob et al[202] [2005])	27 children aged 5–19 y; self-report of numerical Oucher	—	No psychometric data reported regarding Oucher
IV ketamine for posttonsillectomy pain (Da Conceição et al[203] [2006])	90 children aged 5–7 y in 3 equal groups: 30 (control), 30 (ketamine before surgery), and 30 (ketamine after surgery); no self-report; nurses	—	Nurses scoring: pain scores greater in control group than in other groups ($P < .05$)
Tonsillectomy and sucralfate (Sampaio et al[204] [2007])	58 children aged 3–9 y in 2 groups: 29 (sucralfate) and 29 (control); no self-report; surgeon	—	Surgeons assessment 6 h postoperatively, control group scores; higher than sucralfate ($P = .039$)

IV indicates intravenous; CHEOPS, Children's Hospital of Eastern Ontario Pain Scale; FLACC, face, legs, activity, cry, consolability scale; APPT, Adolescent Pediatric Pain Tool; EMLA, eutectic mixture of local anesthetics/lidocaine 2.5% and prilocaine 2.5%; LMX, lidocaine 4% (formerly ELA-Max).

APPENDIX 3 Studies That Used the WBFPRS With Noncontributory Results ($N = 28$)

Study	Sample and Respondent	Other Pain Scale(s) Used	Comments
Analgesia after cardiovascular surgery (Higgins et al[205] [1999])	71 children aged 3–18 y; 54 with preoperative scores and 22 with preoperative scores; retrospective self-reported pain scores	—	No statistical psychometric data reported regarding the WBFPRS
Reliability and validity of Wisconsin pain scale (Soetenga et al[206] [1999])	Parents of 74 children <3 y old and nonverbal children; nurses: no self-report	Wisconsin (nurses)	Parents scores of the WBFPRS correlated with the Wisconsin scale ($r = 0.62$)
Comparing sequential vs simultaneous immunization injections (Horn and McCarthy[207] [1999])	46 children aged 4–6 y in 2 groups: 24 (simultaneous) and 22 (sequential); self-report	OSBD-R by researchers; VAS (parents only)	IIa: No difference between the 2 groups on self-report; Mann-Whitney *U* test 231, with a z score of −0.21
Comparison of topical anesthesia for Port-A-Cath (Bishai et al[208] [1999])	39 children aged 5–16 y in 2 different topical anesthesia groups: 20 and 19; self-report; parents; nurses	VAS	IIa: No differences between groups in children scoring ($P = .09$)
Tonsillotomy vs tonsillotomy (Hultcrantz et al[209] [1999])	41 children aged 3.5–8 y in 2 groups: 21 (tonsillotomy) and 20 (tonsillectomy); self-report	—	II: Discriminant validity observed, tonsillotomy appeared less painful and less analgesia was administered; results were not statistically reported
Pain relief after tonsillectomy (Moir et al[210] [2000])	51 children aged 3–12 y in 2 analgesia-type groups: 31 and 20; self-report; parents	—	IIa: No significant difference in mean pain scores at any time points between the 2 groups ($P > .05$)
Unsedated upper endoscopy (Bishop et al[211] [2002])	48 children aged 8–18 y in 2 groups: 27 (sedated) and 21 (unsedated); self-report	—	IIa: No statistically significant differences in pain scores between the 2 groups (*P* value not recorded)
Analgesia for postsurgical pain (Finkel et al[212] [2002])	81 children aged 7–16 y; self-report; parents; nurses	—	The WBFPRS was not used as an outcome measure; no psychometric data reported
Comparison of PCA morphine and morphine-epidural (Bozkurt[213] [2002])	44 children aged 5–15 y; 2 analgesia groups: 24 and 20; nurses only: no self-report	—	Pain scores reported by nurses, similar in both groups ($P > .05$)
Comparison of analgesia for strabismus surgery (Wennström and Reinsfelt[214] [2002])	50 children aged 4–16 y in 2 types of analgesia in groups, 25 in each; self-report	—	No psychometric data reported
Warmed vs room-temperature local anesthesia (Ram et al[215] [2002])	44 children aged 6–11 y; self-report	VAS; modified BPS by HCP	Used to measure pain affect
Anaesthesia comparisons for lacerations (Kennedy et al[216] [2004])	65 children aged 3–16 y; self-report	Likert-type scale for parents	No psychometric data reported; after local anaesthesia, 75% graded face number 0 or 1
Comparison of analgesia for ilioinguinal block after hernia repair (Tsuchiya et al[217] [2004])	Parents of 30 children aged 3 y in 3 groups: 10 (0.2% ropivacaine), 10 (1% lidocaine), and 10 (0.25% bupivacaine); no self-report	—	IIa: 0.2% ropivacaine vs 1% lidocaine 2 and 6 h postoperatively ($P < .05$); 0.25% bupivacaine vs 1% lidocaine at 2 and 6 h ($P < .05$)
Postoperative pain after adenoidectomy: pain scores made by parents, staff, and child (Knutsson et al[218] [2006])	98 children aged 3–9 y; self-report	VAS (nurses and parents)	No psychometric data on the WBFPRS reported
Oral vs rectal analgesia after adenotonsillectomy (Owczarzak and Haddad[219] [2006])	75 children aged 1–5 y in 2 groups: 37 and 38; parents: no self-report	—	No statistical differences seen in postoperative pain scores between groups
Caudal epidural for postoperative analgesia (Shaikh et al[220] [2006])	176 boys aged 2–8 y; self-report	—	The WBFPRS was used as a guide to administer analgesia; psychometric properties not considered
Analgesia comparison in dental procedure (Ram and Amir[221] [2006])	62 children aged 5–13 y; 2 visits using different analgesia for each visit; self-report	Modified behavioral pain scale: dental nurse	IIa: No significant differences found between 2 analgesia types ($P > .05$)
Postherniotomy analgesia (Demiraran et al[222] [2006])	Nurses of 75 children aged 1–6 y in 3 groups, 25 per group: 2 $mg \cdot kg^{-1}$ tramadol in 0.2 $mg \cdot kg^{-1}$ saline, 0.2 $mL \cdot kg^{-1}$, 0.25% bupivacaine, and IM 2 $mg \cdot kg^{-1}$ tramadol; no self-report	—	IIa: Pain scores between groups, $P < .05$; IVb: changes in pain scores seen over time (*P* value not reported)

APPENDIX 3 Continued

Study	Sample and Respondent	Other Pain Scale(s) Used	Comments
Pain management after tonsillectomy and adenoidectomy (Pop et al[223] [2007])	92 children aged 3–13 y in 5 analgesia-treatment groups: 12 (IV fentanyl), 25 (IV fentanyl and oral analgesia), 13 (IV morphine), 32 (IV morphine and oral analgesia), and 10 (oral analgesia); self-report	—	IVb: Responsiveness was apparent but not statistically reported; missing data of self-report; results indicate no significant differences between the 5 groups
Distraction for adolescents during allergy testing (Jeffs[224] [2007])	32 participants aged 10 y 10 mo to 17 y in 3 treatment groups: 10, 12, and 10; self-report	Adolescent Pediatric Pain Tool	3 groups showed similar pain ratings for both scales, but no statistical analysis was reported
Expression of pain in Kuwait (Alwugyan et al[225] [2007])	281 children aged 6–12 y; self-report	—	No significant data reported regarding psychometrics
Comparison of pain in 2 techniques of adenoidectomy (Shapiro and Bhattacharyya[226] [2007])	46 children aged 2–16 y in 2 treatment groups: 23 and 23; parents: no self-report	—	Responsiveness apparent but not statistically reported
Parental report of children's postoperative pain (Unsworth et al[227] [2007])	33 children aged 4–12 y; self-report (this group was compared to a group of children who did not self-report)	—	No report of pain scores; main outcome measure was analgesia use dependent on WBFPRS rating
Pain assessment in emergency department (Kaplan et al[228] [2008])	Children aged 3–20 y; 462 (preintervention group) and 372 (postintervention group); self-report	—	No data on psychometric properties
Observational pain report compared with self-report in triage (Shavit et al[229] [2008])	29 children aged 3–7 y; self-report	VAS (8–15 y); AHTPS: staff	AHTPS: significantly lower scores than self-report ($P < .042$)
Anxiety associated with surgery (Wakimizu et al[230] [2009])	158 children aged 3–6 y; 2 groups: 81 and 77; self-report	STAI parents	The WBFPRS was used to rate anxiety only
Comparing analgesia with suspected limb fractures (Furyk et al[18] [2009])	73 children aged 4–13 y in 2 groups: 36 (nebulized fentanyl) and 37 (IV morphine); doctor report of pain only; no self-report	—	IIa: No significantly statistical differences in pain scores between the 2 groups ($P = .081$ at 15 min and $P = .34$ at 30 min); IVb: 95% confidence interval: 2.32 to −0.32 at 15 min and 1.89 to −0.65 at 30 min)
Effect of local anaesthesia after dental surgery (Townsend et al[231] [2009])	27 children aged 3–5.5 y in 2 groups: 10 (local anaesthesia and NSAID) and 10 (NSAID only); self-report	VAS by parents; FLACC by nurses	IIb: No difference between 2 groups ($P < .92$)

EMLA indicates eutectic mixture of local anesthetics/lidocaine 2.5% and prilocaine 2.5%; OSBD-R, Observational Scale of Behavioural Distress–Revised; IM, intramuscular; AHTPS, Alder Hey Triage Pain score; NSAID, nonsteroidal antiinflammatory drug; PCA, patient-controlled analgesia; BPS, Behavioural Pain Scale; STAI, State Trait Anxiety Inventory.

A Systematic Review of Faces Scales for the Self-report of Pain Intensity in Children

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Pediatrics 2010;126;e1168; originally published online October 4, 2010;
DOI: 10.1542/peds.2010-1609