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# Measuring Musculoskeletal Pain in Infants, Children, and Adolescents



Musculoskeletal pain is common in children and adolescents. As many as half of all children and adolescents report experiencing musculoskeletal pain at least once a month, and as many as a third report persistent or recurrent musculoskeletal pain.[70,75] Musculoskeletal pain is known to have a substantial impact on the everyday life of children and adolescents. For example, in those who report musculoskeletal pain, approximately 40% report that it interferes with daily activities and sports participation, 20% report missing school/work, 20% to 30% take medication, and more than half seek health care, all of which are associated with significant health care costs, especially for those who experience persistent pain.[52,58,100,109,110] Critical to the effective management of musculoskeletal pain by clinicians is accurate, reliable, and timely assessment, which is a pivotal component of evidence-based medicine. Specifically, the valid and reliable measurement of pain is helpful in understanding a person's pain experience, identifying appropriate treatment options, and monitoring change in a person's pain condition, minimizing potential adverse physiological and psychological consequences of unrelieved or inadequately managed pain.[3,18,34,93,107,111,146]

Fundamental differences exist between the expressions of the pain experience in infants, children, adolescents, and adults, which highlights the need to assess and interpret pain in a way that is specific to each age group. For example, while the definition of pain is universal, "A distressing experience associated with actual or potential tissue damage with sensory, emotional, cognitive and social components,"[159] the way in which these components interact with environmental, developmental, sociocultural, and contextual factors suggests that the way in which infants, children, adolescents, and adults conceptualize, understand, and communicate pain is distinctly different.[34,35,56,70] For example, the vocabulary by which infants identify pain emerges at around 18 months (eg, "ouch," "ow," "hurt") and continues to develop until they are around 5 years of age, when it

**SYNOPSIS:** Accurate, reliable, and timely assessment of pain is critical for effective management of musculoskeletal pain conditions. The assessment of pain in infants, children, and adolescents with and without cognitive impairment can be particularly challenging to clinicians for a number of reasons, including factors related to the consultation (eg, heterogeneous patient population, time constraints), the clinician (eg, awareness/knowledge of available pain scales), standardized assessment scales (eg, availability, psychometric properties, and application of each scale), the patient (eg, developmental stage, ability to communicate), and the context in which the interaction took place (eg, familiarity with the setting and physiological and psychological state). As a result, pain is frequently not assessed or measured during the consultation and, in many instances, underestimated and undertreated in this population. The purpose of this article is to provide clinicians with an overview of scales that may be used to measure pain in infants, children, and adolescents. Specifically, the paper reviews the various approaches to measure pain intensity; identifies factors that can influence the pain experience, expression, and assessment in infants, children, and adolescents; provides age-appropriate suggestions for measuring pain intensity in patients with and without cognitive impairment; and identifies ways to assess the impact of pain using multidimensional pain scales. *J Orthop Sports Phys Ther 2017;47(10):712-730. doi:10.2519/jospt.2017.7469*

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can reliably be used. Similarly, this is the time at which a child begins to develop an understanding of the causes and consequences of pain and the ability to control its expression.[28,56,127] In the absence of intellectual or cognitive deficit, a child's age may serve as a reasonable and easily measured indicator of level of development, and should be used to guide the way in which pain is measured in children and adolescents.[56,127,151]

The assessment and measurement of pain in infants, children, and adolescents can be a challenge to clinicians.[55,140] Reasons for this include factors related to the consultation (eg, heterogeneous patient population, time constraints), the clinician (eg, awareness/knowledge of available pain scales), standardized assessment scales (eg, availability, psychometric properties, and application of each scale), the patient (eg, developmental stage, ability to communicate), and the context in which the interaction took place (eg, familiarity with the setting and physiological and psychological state). As a result, pain is frequently not formally assessed or measured during the consultation, with more informal questioning used (eg, questions such as "Are you ok?" or "Feeling better?") and the presence of pain validated through observation of behavioral cues, such as crying or grimacing.[103,128,146] Even in populations who are at a higher risk of experiencing musculoskeletal pain (eg, children with cerebral palsy), there are data to suggest that pain is assessed using validated tools in less than 10% of encounters.[99] The inconsistency in assessment, measurement, and documentation of pain means that, in many instances, pain may be underestimated and undertreated in this population.[146] Reports of hospital audit data suggest that a third of children experience moderate to severe pain during their hospital admission, and documentation of pain assessment varies between 12% and 100% of the time across hospital settings and between clinicians. All too frequently, the assessment, measurement, and documentation of pain do not meet hospital or professional guidelines.[99,103,111] Encouragingly, clinical practice has been responsive to knowledge translation and implementation strategies aimed at improving the assessment, measurement, and documentation of pain in children and adolescents.[53,76] Further work is needed to understand the frequency at which the assessment and measurement of pain are conducted in other health care settings, such as in primary care and community facilities.

Pain is recognized as a core outcome domain by a number of national and international initiatives, such as the Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials Consensus Group, the Society for Pediatric Pain Medicine Assessment Task Force, and the National Institutes of Health Toolbox.[32,57,93] These initiatives promote the use of evidence-based measures of pain intensity and impact in clinical practice and research. Recommendations are the results of formal collaborative processes and methodologies that combine empirical evidence, expert opinion, and clinical utility. The purpose of this paper was to provide clinicians with an overview of scales that can be used to measure musculoskeletal pain in infants, children, and adolescents in a way that is quick, accurate, and reliable. However, few pain scales have specifically been evaluated for this purpose, and suggestions are based on scales that have been evaluated to measure procedural (eg, immunization pain) and nonspecific (eg, musculoskeletal pain) pain, with emphasis on clinical utility. Using the social communication model of pain as a framework,[35,55] the present article specifically considers factors that may influence the pain experience and expression, reviews the various approaches that can be used to assess and measure pain, provides age-appropriate suggestions for measuring pain intensity in patients with and without cognitive impairment, and identifies ways to assess the impact of pain using multidimensional pain scales. The article incorporates and extends the work of the previous collaborations outlined above, by identifying and integrating evidence from more recent publications into the measurement of pain in infants, children, and adolescents. Scales designed for use in the intensive care setting (eg, to assess pain in the intubated patient) or solely to assess postoperative pain are not reported in this paper, unless specifically stated. Also, the authors acknowledge that there are aspects of pain beyond pain intensity, such as affective (emotional, unpleasantness) and evaluative (cognitive processes [eg, appraisal of pain]) dimensions, that are not addressed comprehensively in this article.

## The Social Communication Model of Pain

The social communication model of pain (**FIGURE 1**) is a theoretical model that can be used as a framework from which to examine, understand, and approach the assessment and management of pain in individuals of all ages and for those with cognitive impairments.[35,55] This comprehensive model highlights a number of factors (biological, psychological, and social) related to the individual in pain and the treating clinician that influence how pain is experienced, expressed, and interpreted, and the effectiveness of this communication. The model also considers the social context (interpersonal context) in which the communication of pain occurs and, importantly, recognizes how the communication of pain may differ, whether initiated by the person in pain or elicited by an observer's questioning at presentation or after treatment, when a socially desirable response may be provided. This model places assessment and measurement at the heart of understanding a person's pain experience and highlights the importance of how that information is obtained. The remainder of this paper will consider the measurement and assessment of pain in children and adolescents using the social communication model as a guide.

As suggested by the social communication of pain model, a number of factors related to the individual in pain, clinician,

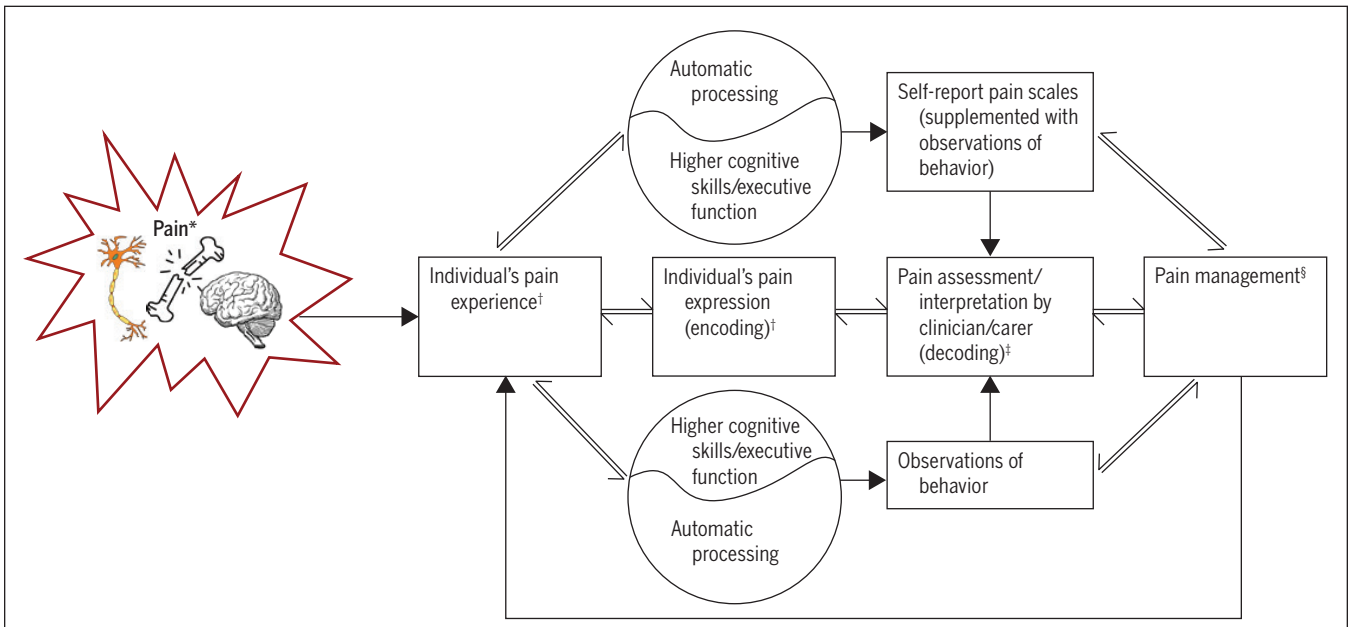


**FIGURE 1.** The social communication model of pain. *Defined as a distressing experience associated with actual or potential tissue damage, with sensory, emotional, cognitive, and social components (Williams and Craig[159]). †Pain experience and expression can be influenced by a number of individual, social, and environmental factors; examples of each of these factors are outlined in **FIGURE 2**. The expression of pain may be verbal, self-reported, or an observation of behavior, and this may be self-initiated by the person in pain or elicited by an observer's question. ‡Pain assessment can be influenced by a number of clinician factors and practical considerations; examples of these are outlined in **FIGURE 2**. §Pain management can include pharmacological, conservative (eg, distraction, relaxation, exercise, education), and environmental interventions. Pain management can be influenced by a clinician/parent or carer appraisal of the situation, their own knowledge/understanding, and beliefs and contextual factors (eg, setting). Adapted from Hadjistavropoulos and Craig (Figure 1, page 555)[55] and Craig (Figure 1, page 24).[35]

and context can influence the experience and communication (expression, interpretation) and management of pain. In **FIGURE 2**, we outline some of the key factors that are relevant to the assessment and measurement of pain in children, for example, the cognitive ability of the child to understand concepts such as pain severity or intensity, the burden that a child may feel when questioned by a clinician, and the potential influences of parents who are present within the consultation.

## Approaches to Measuring Pain Intensity in Children

The 3 main approaches to measuring pain intensity in children are physiological (how the child's body reacts), observations of behavior (how the child reacts), and self-report (what the child says). It is important to note that the choice of approach will depend on the age and abilities of the child, and that the different approaches are not interchangeable and typically only correlate poorly to moderately with each other.[49,157] Ideally, information from each approach may be used simultaneously to provide a detailed understanding of the pain experience, with consideration of both automatic processing and higher cognitive function (**FIGURE 1**).[35,49,55,157]

Physiological indicators (eg, increased heart rate, blood pressure, sweating) are associated with generalized (nonspecific) stress reaction and more strongly associated with distress and anxiety than self-report pain measures.[22] For this reason, physiological indicators should not be used in isolation to estimate presence, quality, or intensity of pain. Further, these indicators habituate over time and are therefore not appropriate for use in acute pain that is continuous or in those with chronic pain.[62]

Observational measures involve observing an individual's nonverbal behavior (eg, crying, facial expression, torso and limb movements) and interactions (eg, social, appetite). The behavioral response to pain is recognized to be more of an automatic and reflexive response to actual or potential tissue damage. Parents and carers can often provide specific and helpful information about typical and idiosyncratic pain-related behaviors that reflect different quality or intensity of pain in their child. This information can then be used to inform the selection of appropriate pain management or prevention strategies.[35,55,153] As cognitive skills and function increase with age, along with the ability to control (eg, suppress, exaggerate, or feign) behavior, observational measures should be used when possible to complement self-report measures of pain (**FIGURE 1**). Observational measures are particularly useful for assessing pain in children aged less than 4 years, who do not have the language skills necessary to communicate pain or lack the comprehension necessary for self-report measures; patients with cognitive or communication impairments (eg, cerebral palsy); and situations in which valid self-report is not possible (eg, ex-

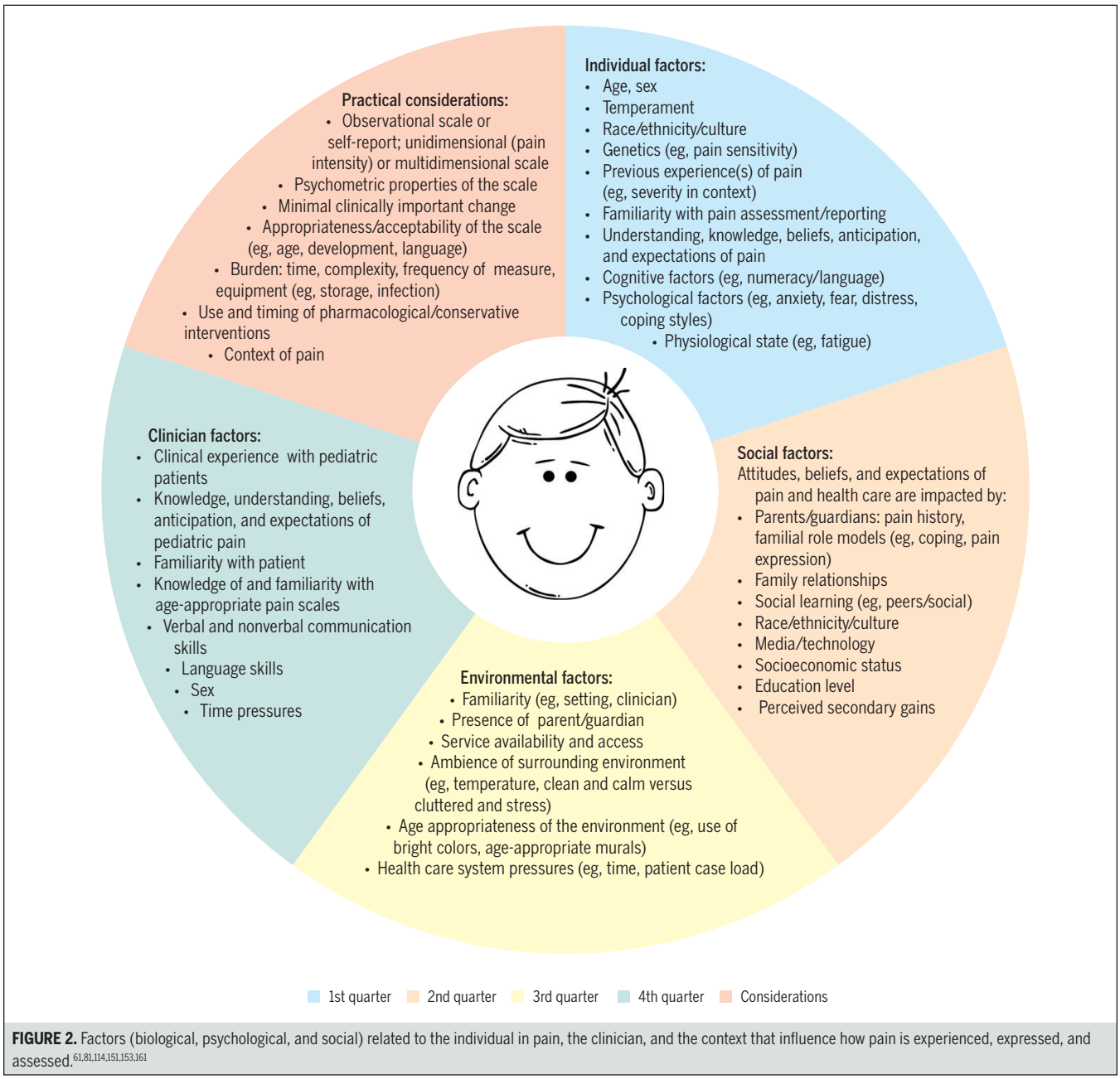


**FIGURE 2.** Factors (biological, psychological, and social) related to the individual in pain, the clinician, and the context that influence how pain is experienced, expressed, and assessed.[61,81,114,151,153,161]



treme distress) or the credibility of the self-report is in doubt.[55]

The most direct and reliable approach to measuring pain in those who are able to communicate their experience is self-report.[129,140] The ability of a child to understand and report the presence and intensity of pain requires cognitive skills, including receptive language and understanding, knowledge and memory of pain, executive function (eg, cognitive flexibility, working memory), and the ability to understand and estimate magnitudes and symbolic processing.[28,66,151,152] These skills begin to emerge as early as 3 years of age and gradually develop to enable the accurate and reliable self-reporting of pain intensity by children aged 5 years (on average) or older. While screening tasks (eg, counting, comprehension, and seriation) are available, these are time consuming and do not predict a child's ability to accurately and reliably self-report pain beyond age alone.[28,155] The association between a child's age and cognitive skills highlights the need to measure pain using different pain scales in children of different ages, such as a more simplified scale (with fewer response options) for younger children.[28,152]

**Proxy Report** While input from parents/guardians has a place in the assessment of pain in children, clinicians should be

mindful of overreliance on this information. Numerous studies have shown discrepancies between reports of pain from parents and children. Studies in the general population of healthy children show that parents typically underreport pain in their children.[30,69,79] In contrast, studies in children with painful health conditions typically report better concordance, although with a tendency for parents to overestimate pain severity, compared to the child's report.[33,149]

## AGE-APPROPRIATE SCALES

Single-item scales of pain intensity are most commonly used to measure pain because they are fast, easy to administer, and closely correlated with the impact of pain on the individual (eg, activity limitations, health care seeking, medication use).[141] Reported in **TABLE 1** are operational definitions of the psychometric properties considered in this paper. **TABLES 2** through **4** outline available pain intensity scales, and **TABLE 5** details multidimensional pain scales, with each table including a general description of the scale, age range, psychometric properties, and practical considerations for use. These tables synthesize evidence from several systematic reviews,[23,32,37,38,43,62,77,83,129,142,153] practice guidelines,[111] and peer-reviewed articles. The evidence outlined in **TABLES 2** through **4** was used to identify an appropriate pain-intensity scale for each age group, with the suggested scales summarized in **TABLE 6**. The scales that have been suggested for use are based on the authors' judgments, along with consideration of the psychometric properties of the scale, type of pain (eg, procedural versus nonspecific pain), population, and context in which the scale has been evaluated.

**TABLE 1** Operational Definitions

| Term | Operational Definition |
|---|---|
| Reliability | The reproducibility of a measure over different occasions, concerned with minimizing sources of random error so that measures are reproducible. In general, acceptable reliability coefficients for research and clinical purposes are 0.7 or greater and 0.9 or greater, respectively[134] |
| Test-retest | The agreement between observations with the same individuals on at least 2 occasions[134] |
| Interrater | The agreement between different raters/observers of an observational measure of pain[134] |
| Validity | Used to assess whether the scale measures what it intends to measure[134] |
| Face | Whether the pain scale includes appropriate items that appear to measure what they are proposing to measure[134] |
| Content | The assessment of whether the items in the pain measure include the appropriate information and content[134] |
| Criterion | Includes concurrent validity and predictive validity. In concurrent validity, a new pain measure is correlated with a gold standard measure, which is administered at the same time. In general, correlations between the new measure and the gold standard should be at least $r \geq 0.3$-0.5. The magnitudes of the coefficients are hypothesis dependent but should not be so high as to make the new measure redundant. In predictive validity, the correlation of the measure to the criterion variable is determined later[134] |
| Construct | Determines the validity of abstract variables that cannot be directly observed, such as pain. These constructs are assessed by their relationships with other variables[134] |
| Convergent | Evaluates how well items on a pain scale correlate with other measures of the same construct or related variables. In general, correlations between the measure and another measure of the same construct should be $r \geq 0.3$-0.5; however, the magnitudes of the coefficients are hypothesis dependent[134] |
| Discriminant | Evaluates how items on a pain scale correlate with other measures that are unrelated. In general, correlations between the measure and another unrelated measure should be $r < 0.3$; however, the magnitudes of the coefficients are hypothesis dependent[134] |
| Responsiveness | Measures whether the measure is able to identify changes in pain over time when change is expected (eg, after analgesia) (COSMIN taxonomy) |
| Interpretability | The meaningfulness of the scores obtained from a pain measure |
| Feasibility | How easily a pain measure can be scored and interpreted |
| Minimal clinically important change | The smallest difference in score in the domain of interest that patients perceive as beneficial and that would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient's management[68] |

### Infant (3 Years or Younger)

Observations of behavior are most commonly used in this age group, which typically manifests as crying, facial expression, verbalization, and torso and leg movements. It is important to note that no scale has been comprehensively evaluated to assess pain in children aged 3 years or younger in primary care settings or in children with chronic or persistent pain.[37,153] The majority of observational scales have been developed to measure postoperative pain in the hospital setting, but a number of these scales have since been used to assess brief pain associated with medical procedures (eg, venipuncture, immunizations). In the absence of more robust evidence, the scales that have been validated to assess procedural pain are reported in **TABLE 2**.[36] Scales that only evaluate postoperative pain or incorporate physiological measures (eg, blood pressure, oxygen levels) have not been included, as this information is not readily available or feasible for use by many clinicians.

**Suggested Scale: The Face, Legs, Activity, Cry and Consolability (FLACC) Scale** The FLACC scale was originally designed and validated for use in infants and children aged 2 months to 7 years to measure postoperative pain.[94] Since its original development, the scale has been used to measure acute and procedural pain in emergency departments, immunization centers, and various clinical settings (eg, radiology, ambulatory, dental) and

**TABLE 2** Observational Scales Used to Measure Pain in Infants and Children 3 Years or Younger

| Pain Scale | Description | Age Range | Evidence Available | Strengths | Limitations |
|---|---|---|---|---|---|
| Face, Legs, Activity, Cry and Consolability scale[5,37,48,93,94,136] | 5-item scale measures facial expression, leg movements, activity, cry, and consolability. Each item is scored from 0 to 2. Total score range, 0-10<br>Originally validated for postoperative pain in children aged 2 mo to 7 y | IAR: 2 mo to 7 y<br>SAR: 2 mo to 16 y | Reliability: intrarater, interrater<br>Validity: convergent, discriminant, criterion<br>Responsiveness<br>Practical considerations: feasibility, user preference | • Validated for acute procedural pain (eg, immunizations and postoperative pain)<br>• Scored on a commonly understood 0-to-10 scale<br>• Translated into Swedish<br>• Recommended by PedIMMPACT[93]<br>• Adapted for children with cognitive impairment (**TABLE 4**) | • Observation time not specified originally. Subsequent studies have used 15 s and 30 s for acute procedural pain<br>• To date, only tested in postoperative and procedural pain; additional studies are needed to evaluate generalizability<br>• Ambiguity around amount and timing of some items (eg, "jaw clench," consolability) |
| Child Facial Coding System[17,32,54] | Frequency and intensity of 13 facial actions; scored from 0 (no action) to 2 (distinct action [eg, squinting, brow lowering, nostril flare, mouth stretching]) | IAR: 2-5 y<br>SAR: 3-7 y | Reliability: interrater<br>Validity: criterion<br>Practical considerations: none | • Validated for children with cerebral palsy; used in children with autism[98]<br>• Developed from the Neonatal Facial Coding System | • Facial actions scored second by second |
| Children's Hospital of Eastern Ontario Pain Scale[36,37,41] | 6-item scale (cry, facial expression, verbalization, touching, torso and leg movements) rated on a 4-point scale. Total score range, 4-13 | IAR: 6 mo to 6 y<br>SAR: 6 mo to 12 y | Reliability: none<br>Validity: convergent<br>Practical considerations: none | • Well evaluated for postoperative pain<br>• Score based on observable behavior only (ie, does not include items such as consolability) | • Length and scoring system make it impractical<br>• Not validated for acute procedural pain, but has been used for this in intervention studies[36] |
| Modified Behavioral Pain Scale[136,137] | 3-item scale measures facial expression, cry, and movements. Facial expression and movement scored on a 0-to-3 scale and cry on a 0-to-4 scale. Total score range, 0-10 | IAR: 4-6 mo | Reliability: intrarater, interrater<br>Validity: convergent, criterion<br>Responsiveness<br>Practical considerations: feasibility, user preference | • Validated to assess acute procedural pain (eg, immunizations)<br>• Scored on a commonly understood 0-to-10 scale | • Evaluated for infants only<br>• Little evaluation done, but used in numerous intervention studies |
| Neonatal Infant Pain Scale[41,84,136] | 6-item scale (facial expression, breathing patterns, cry, arm movement, arousal, leg movement). All items scored from 0 (absent/relaxed) to 1 (change from normal), except cry (0-2) | IAR: 0-2 mo | Reliability: interrater<br>Validity: convergent, content, criterion<br>Responsiveness<br>Practical considerations: feasibility, training | • Validated for acute procedural pain (eg, immunizations)<br>• Multidimensional scale taking into consideration factors such as arousal | • Evaluated for infants only, limited applicability<br>• No reports on clinical utility/feasibility |

*Abbreviations: IAR, intended age range; PedIMMPACT, Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials; SAR, studied age range.*

in research.[37] The FLACC scale is recommended to measure pain in infants (aged 3 years or younger) on the basis that it has been validated to measure acute procedural pain in a variety of settings (eg, outpatient pediatric clinic, emergency department, immunization clinic) and there is no other scale as comprehensively evaluated.

A score of 0, 1, or 2 is given for each of the 5 items. Descriptions of typical behaviors are provided for each item (eg, for the legs, "normal or relaxed position" is a score of 0; "uneasy, restless, tense" is a score of 1; and "kicking, or leg drawn up" is a score of 2). Item scores are summed to provide a total score from 0 to 10. **TABLE 2** contains additional details about the FLACC scale and other observational scales to measure pain intensity in children who are unable to self-report.

### Preschool Child (3-5 Years)

Age is the strongest predictor of a child's ability to understand and use self-report pain scales.[127,155] It is noted, however, that the rate of development is varied. While preschool-aged children (3-5 years of age) are generally less likely to be able to understand self-reported pain scales than older children, some will be able to do so. Experience of pain and prior use of a scale appear to influence a child's ability to use a pain scale reliably, emphasizing the need to measure pain consistently. It is recommended that pain intensity be captured through self-report in children of this age (if deemed appropriate), supplemented by information from parents/guardians of the child and observation of behavior (FLACC scale).

**Suggested Scale: Pieces of Hurt Tool, Supplemented by Parent/Guardian Report and Observation** The Pieces of Hurt Tool was designed and validated for use in children aged 4 to 7 years to measure procedural pain at immunization clinics.[60] The scale has since been used to

**TABLE 3** Self-Report Scales Used to Measure Pain Intensity in Children and Adolescents

| Pain Scale | Description | Age Range | Evidence Available | Strengths | Limitations |
|---|---|---|---|---|---|
| Pieces of Hurt Tool (Hester's poker-chip tool)[47,50,60,133,139] | The child is asked, "Did it hurt?" If the child responds yes, then he or she is given 4 chips ("pieces of hurt"). The child is told, "These are pieces of hurt: 1 chip is a little bit of hurt, and 4 chips are the most hurt you could ever have. Do you have 1, 2, 3, or 4 pieces of hurt?" The number of chips is recorded | IAR: 4-7 y<br>SAR: 3-18 y | Reliability: intrarater, inter-rater<br>Validity: convergent, discriminant<br>Responsiveness<br>Practical considerations: acceptable to carers | • Tangible quantity of pain is easier for younger children to understand<br>• Developmentally appropriate (yes/no, followed by limited response options)<br>• Developed in English. Validated in Jordanian and Thai<br>• Validated in recurrent or persistent pain<br>• Can use any items[139] | • Little testing in younger children<br>• Potential bias toward higher pain scores, especially in younger children<br>• Requires the ability to count and estimate quantities using numbers<br>• Infection risk, storage, and availability of tokens |
| Faces Pain Scale-Revised[11,24,61,95,96,106,115-117,129,142-145] | 6 line-drawn faces aligned horizontally from an expression of "no pain" (left) to "most pain possible" (right). The child points to the face that shows his or her pain. Standardized instructions are used<br>The original Faces Pain Scale had 7 faces scored on a 0-to-6 scale. It was revised to be compatible with other 0-to-10 scales | IAR: 4-12 y<br>SAR: 3-18 y | Reliability: intrarater<br>Validity: convergent, discriminant, content, criterion<br>Responsiveness<br>Practical considerations: feasibility, interpretability, acceptable to carers | • Scored on a commonly understood 0-to-10 scale<br>• Gender-neutral drawings of faces<br>• Developed in English. Translations: more than 35 languages; validated in French, Thai, and Catalan<br>• Minimal clinically important change: 2/10 (1 face) or 25%<br>• Electronic version available[115,116] | • Reduced accuracy with decreasing age<br>• Response bias in those under 5 y of age<br>• Skewed pain intensity ratings toward "no pain"; may underestimate pain intensity |
| Verbal NRS-11[6,23,24,39,95,113,115-117,154] | The child is asked, "On a scale of 0 to 10, where 0 is no pain and 10 is the worst possible pain, tell me what number best represents your pain." The individual responds with a number that reflects his or her pain | IAR: 8-18 y<br>SAR: 6-18 y | Reliability: intrarater<br>Validity: convergent, discriminant, content, criterion<br>Responsiveness<br>Practical considerations: interpretability, acceptable to carers | • Scored on a commonly understood 0-to-10 scale<br>• Adaptable (eg, usual, strongest, lowest pain; pain at rest/with activity)<br>• Developed in English. Translations: Spanish, French<br>• Suitable for those aged 8-20 y and with physical disabilities (eg, cerebral palsy, neuromuscular disease) and chronic pain<br>• Electronic version available[115,116]<br>• Minimal clinically important change: 1/10 | • Requires the ability to count, estimate quantities using numbers, recall pain<br>• Variability in the time period (eg, past week, current pain) and anchors used (eg, worst possible pain, strongest pain)<br>• Further testing required in younger children (6-8 y) |
| Color Analog Scale[20,21,24,91,92,113,115-117,143-145] | VAS with a mechanical device: a plastic slider over a 143-mm-long tetragon, varying from narrow (10 mm) and white (labeled "no pain") to wide (30 mm) and dark red at the end (labeled "most pain"). Range, 0-10 | IAR: 5-17 y<br>SAR: 3-18 y | Reliability: intrarater<br>Validity: convergent, discriminant, content, criterion<br>Responsiveness<br>Practical considerations: feasibility, interpretability, user preference, acceptable to carers | • Minimal clinically important change: 1/10 or 15%<br>• May be easier to administer and score than a VAS[92]<br>• Developed in English. Validated in Spain and India<br>• Electronic version available[115,116] | • Requires users to have the Color Analog Scale device available<br>• Infection risk |
| OUCHER (NRS and photographic scale)[9,10,87,142] | 0-to-10 NRS aligned vertically next to 6 photographs ranging from "no hurt at all" at the bottom (0) to the "biggest hurt you could ever have" at the top (10). (Prior to 2009, scoring was from 0 to 100.) | IAR: 3-7 y<br>SAR: 3-18 y | Reliability: intrarater, inter-rater<br>Validity: convergent, discriminant, content, criterion<br>Responsiveness<br>Practical considerations: interpretability, acceptable to carers | • Various versions (Caucasian, Hispanic, Asian, boy/girl)<br>• Child can choose photographic scale or VAS<br>• Photographic scale (other face scales are line drawings)<br>• Scored on a commonly understood 0-to-10 scale<br>• Evaluated in specific populations (eg, sickle cell) | • Little testing in younger children<br>• Printed OUCHER scale required<br>• Infection risk<br>• Photographs resemble acute pain only<br>• The NRS to the left of the photographs may be confusing for young children (3-7 y)[87] |

*Table continues on page 719*

**TABLE 3** Self-Report Scales Used to Measure Pain Intensity in Children and Adolescents (continued)

| Pain Scale | Description | Age Range | Evidence Available | Strengths | Limitations |
|---|---|---|---|---|---|
| VAS[6,8,24,87,116,117,121,122,160] | 10-cm vertical/horizontal line with anchors (eg, "no pain," "worst possible pain"). The child marks along the line to indicate the intensity of the pain | IAR: 2-17 y<br>SAR: 3-18 y | Reliability: intrarater, inter-rater<br>Validity: convergent, discriminant, content, criterion<br>Responsiveness<br>Practical considerations: interpretability, acceptable to carers | • Evaluated in several populations (eg, sickle cell, juvenile chronic arthritis)<br>• Minimum clinically significant change: 10 mm (95% CI: 7, 12)<br>• Electronic version available[115,116]<br>• Recommended for use by PedIMMPACT[93] | • Variability in line length, demarcations, orientation, and anchors (eg, worst pain, strongest pain)<br>• Photocopying the scale may alter the length of the line<br>• Marking on the VAS scale needs to be measured and recorded (potential source of error)<br>• Less reliable in children under 8 y old<br>• One of the least preferred scales |
| Wong-Baker FACES scale[26,32,47,74,87,129,142,160] | 6 line-drawn faces aligned horizontally, from a smiling "no hurt" face (left) to a crying "hurts worst" face (right). Range, 0-5 (or 0-10 if each face is 2 points) | IAR: 3-18 y<br>SAR: 9 mo to 18 y | Reliability: intrarater, inter-rater<br>Validity: convergent, discriminant, criterion<br>Responsiveness<br>Practical considerations: feasibility, interpretability, user preference, acceptable to carers | • Developed in English. Translations: more than 10 languages, but not all validated<br>• Preferred face scale<br>• Scored on a commonly understood 0-to-10 scale<br>• Suitable for those aged 8 to 20 y and with physical disabilities and specific conditions (eg, sickle cell) | • Younger children tend to use the extremes[27]<br>• May provide higher pain-intensity rating than other face scales[26,142]<br>• Unclear whether it has interval properties |
| Word descriptor scales/ word graphic scale[47,74,138,160] | 5 to 6 words to describe pain, from "no pain" to "worst pain." A word is selected to best describe the pain<br>Each word has a number for scoring. Range is from 0 (no pain) to 5 (worst pain) | IAR: 8-17 y<br>SAR: 3-18 y | Reliability: intrarater<br>Validity: convergent, discriminant, criterion<br>Practical considerations: acceptable to carers | • Developed in English. Validated for use in Jordanian<br>• Incorporated into multidimensional scales (eg, Adolescent Pediatric Pain Tool) | • Requires ability to comprehend pain-intensity terms<br>• One of the least preferred scales[47,74]<br>• May not perform as a continuous scale; pain ratings cluster around words, which reduces sensitivity[138] |

*Abbreviations: CI, confidence interval; IAR, intended age range; NRS, numeric rating scale; PedIMMPACT, Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials; SAR, studied age range; VAS, visual analog scale.*

measure acute (eg, postoperative), procedural, chronic, and recurrent pain in hospitalized children as young as 3 years of age. The Pieces of Hurt Tool is the recommended pain scale for children aged 3 to 5 years.

The child is asked, "Does it hurt?" If the child says "no," then zero is recorded. If the child responds "yes," then the child is presented with 4 tokens (eg, poker chips) and it is explained that each token represents a "piece of hurt" (1 token is a little bit of hurt, 2 is a bit more, and 4 tokens represent the most hurt you could ever have). The child is then asked, "How many pieces of hurt do you have right now?" The number of tokens is then recorded. Additional details are reported in **TABLE 3**.

### Child (6-11 Years)

Face scales are consistently preferred by children over numerical, analog, or word descriptor scales.[142] Several versions are available that use either line drawings or photographs (eg, Faces Pain Scale-Revised [FPS-R], Wong-Baker FACES scale, OUCHER scale). While the scales perform similarly, they are not interchangeable due to their different anchors, highlighting the importance of using the same scale consistently. The main limitation of face scales is that pain intensity, a sensory component of pain, is being measured using faces that express the affective dimension of pain. The type of face anchors used by scales (eg, smiling versus neutral) has been found to influence children's responses.[26,32,142]

**Suggested Scale: FPS-R** The FPS-R was adapted from the original Faces Pain Scale[11] and validated in children 4 to 12 years of age and undergoing a painful procedure (ear piercing), and in an inpatient clinical population.[61] The FPS-R is the recommended pain scale for children aged 6 to 11 years based on considerable evidence in support of its reliability and validity in this age group. The primary strength of the FPS-R compared to other face scales consists of the gender-neutral face anchors that do not convey the affective dimension of pain (eg, smiling, crying).[26]

The FPS-R consists of a set of 6 line-drawn faces with depictions of increasing levels of pain from left to right. Children are asked to specify which face

**TABLE 4** Scales Used to Measure Pain in Children and Adolescents With a Cognitive Impairment*

| Pain Scale | Description | Age Range, y | Evidence Available | Strengths | Limitations |
|---|---|---|---|---|---|
| Revised FLACC scale[29,38,45,88,104-106,150] | 5-item scale measures facial expression, leg movements, activity, cry, and consolability. Each item is scored from 0 to 2 (total range, 0-10). Needs input from parent/guardian to identify "baseline" behaviors<br>Includes open-ended descriptor for individual pain behaviors | IAR: 4-19<br>SAR: 3-18 | Reliability: intrarater, interrater<br>Validity: convergent, discriminant, criterion<br>Responsiveness<br>Practical considerations: feasibility, interpretability, user preference, acceptable to carers | • Simple to use, score, and interpret<br>• Scored on a commonly understood 0-to-10 scale<br>• Individualized by parent/carer<br>• Developed in English. Validated in Danish | • Evaluated in postoperative settings only<br>• Underlying motor impairments (eg, spasticity) may affect assessment<br>• Observation time not established; 5 min used in previous testing<br>• Ambiguity around amount and timing of some items (eg, "jaw clench," consolability) |
| Individualized numeric rating scale[38,106,124,125] | Carers provide word descriptors to be used as anchors for their child's pain behaviors from 0 (no pain) to 10 (worst possible pain) | IAR: 6-18 | Reliability: interrater<br>Validity: convergent<br>Responsiveness<br>Practical considerations: acceptable to carers | • Uniquely created for each individual using information from carer<br>• 1-min observation time | • Minimal psychometric evaluation; not assessed in procedures (eg, injections)<br>• Requires parent-nurse collaboration |
| Non-communicating Children's Pain Checklist-Revised[13-16,38,90] | 30 items (6 subscales: vocal, social, facial, activity, body and limb, physiological). Frequency of each behavior from 0 (not at all) to 3 (very). Range, 0-90<br>Postoperative version: 27 items (total range, 0-81); does not include eat/sleep items | IAR: 3-18 | Reliability: intrarater<br>Validity: criterion<br>Responsiveness<br>Practical considerations: interpretability | • Intended for use by parents but can be used by anyone involved in child's care<br>• Has been used in observational studies | • Psychometric properties not assessed in procedures (eg, injections)<br>• 10-min observation time before scoring<br>• Validation study used 2-h observation period |
| Pediatric Pain Profile[29,38,45,63-65,104,106] | 20 items rated on 4-point Likert scales (0, not at all to 3, a great deal). Used by an observer familiar with the child. Observer completes the scale to establish baseline on a "good day," which is then used as a benchmark for ongoing ratings | IAR: 1-18 | Reliability: intrarater, interrater<br>Validity: convergent, criterion<br>Responsiveness<br>Practical considerations: feasibility, interpretability, training, user preference, acceptable to carers | • Developed for use in residential (during normal morning routine in a home, residential care, residential school) and hospital care (postoperative) settings<br>• Parents rated nurse assessment as more accurate than the revised FLACC scale | • Psychometric properties not assessed in procedures (eg, injections)<br>• 5-min observation period<br>• Clinical utility may be low due to time required to complete the scale and training[38] |

*Abbreviations: FLACC, Face, Legs, Activity, Cry and Consolability; IAR, intended age range; SAR, studied age range.*
**All of these scales are observational scales that have been evaluated to assess postoperative pain. None of the above scales have been evaluated to assess procedural-type pain.*

best illustrates the amount of pain they are experiencing at that time. Each face is assigned an increasing score from left to right, either 0 to 5 or 0 to 10 (increments of 2). Electronic versions of the FPS-R have also been developed and validated (eg, the Sydney Animated Facial Expressions scale[61] and Painometer app).[115,116] Additional details are reported in **TABLE 3**.

### Adolescent (12-18 Years)

**Suggested Scale: Verbal Numeric Rating Scale-11** The numeric rating scale-11 is one of the most commonly used scales to measure pain intensity in both clinical and research settings, despite only recently undergoing appropriate psychometric evaluation in children and adolescents. The scale has been validated to measure acute, procedural pain, as well as chronic pain, in a wide range of settings, including schoolchildren receiving immunizations,[154] outpatient pain clinics,[113] and emergency departments.[6] The numeric rating scale-11 is recommended to measure acute pain in children aged 12 to 18 years due to its simplicity, validity, reliability, and brevity as a pain assessment tool.

The individual is asked, "On a scale of 0 to 10, where 0 is no pain and 10 is the worst possible pain, tell me what number best represents your pain." The individual responds with a number that reflects his or her pain. The numeric rating scale-11 has also been adapted and validated for use to capture pain intensity for both acute and chronic conditions by short message service and online.[4,135] Additional details are reported in **TABLE 3**.

### Children and Adolescents With Cognitive Impairment

Children and adolescents with cognitive impairments (eg, cerebral palsy) experience more significant and frequent pain than children without cognitive impairment, and are less likely to receive adequate pain management, indicating the need for specific and appropriate pain

**TABLE 5** Multidimensional Pain Scales That Measure the Impact of Pain in Infants, Children, and Adolescents

| Pain Scale | Description | Age Range, y | Evidence Available | Strengths | Limitations |
|---|---|---|---|---|---|
| Adolescent Pediatric Pain Tool[46,67,118,119] | Pain intensity measured on 0-to-100-mm VAS, body chart, and 67 word descriptors to express sensory (37 words), evaluative (8 words), affective (11 words), and temporal (11 words) qualities<br>5 pain subscale scores: number of pain sites (from body chart), pain-intensity score, number of temporal descriptors (percent), total pain quality, and temporal descriptors | IAR: 8-18<br>SAR: 8-18 | Reliability: none<br>Validity: none<br>Responsiveness<br>Practical considerations: none | • Self-report<br>• Standardized instructions on the scale<br>• 3-6 min to complete<br>• Used in a variety of pain conditions (eg, postoperative, sickle cell, traumatic injury, cancer, and minor procedures such as allergy testing)<br>• Developed in English. Translation: Spanish | • Evaluated as single components (eg, body chart and word graphic scale have been evaluated in school, medical, and surgical pain settings), but not entire scale<br>• Evaluation required in complex, recurrent, and chronic pain states<br>• Few descriptors represent neuropathic pain<br>• Requires equipment and overlay to score<br>• Children must read or understand English. Some children required assistance |
| Bath Adolescent Pain Questionnaire[42,44,156] | 61 items in 7 domains: social functioning, physical functioning, depression, general anxiety, pain-specific anxiety, family functioning, and development. Each item rated on 5-point scale (0 is never, 4 is always), except the development subscale, which is rated from 0 ("very behind") to 4 ("very ahead"). Range, 0-244 | IAR: 11-18<br>SAR: 10-18 | Reliability: intrarater<br>Validity: convergent, discriminant, criterion<br>Practical considerations: interpretability | • Initially developed and tested in outpatient rheumatology and multidisciplinary pain clinic<br>• Used to assess chronic pain from perspective of adolescent or parent<br>• Validated in secondary care (eg, rheumatology/pain management clinics) | • Questionnaire length<br>• Complicated scoring, with reverse scoring for some items<br>• Total sum score not clinically useful |
| Childhood Health Assessment Questionnaire[19,78,97,112,123] | Includes disability and discomfort in the last week. Disability includes 30 items and 8 subscales: dressing, grooming, arising, eating, walking, reaching, grip, activities. Each item scored from 0 (no difficulty) to 3 (unable to do it, or "not applicable" if beyond development level). Disability score is the unweighted average of the 8 subscale scores. Discomfort: 10-cm VAS | IAR: 1-19 | Reliability: intrarater, interrater<br>Validity: convergent, discriminant, criterion<br>Responsiveness<br>Practical considerations: interpretability | • Evaluated in JIA, cerebral palsy, inflammatory myopathies<br>• Core outcome measure for clinical trials in JIA<br>• Self-report and parent proxy versions<br>• 10 min to complete<br>• Validated in 32 countries | • Relatively insensitive to important short-term changes in children with JIA<br>• Evidence of a floor effect |
| Child Activity Limitations Interview[101,102] | 8 activities selected from list of 21 options found difficult or bothersome due to pain. Importance and difficulty over the last 4 wk are rated on a 5-point scale from 0 (not important/difficult) to 4 (extremely important). Ratings are summed; total score, 0-32<br>21-item version: participants report on limitations for all 21 activities. Ratings summed; total score, 0-84 | IAR: 8-18 | Reliability: interrater<br>Validity: convergent, criterion<br>Responsiveness<br>Practical considerations: acceptable to patients | • Developed in healthy children and validated in chronic or recurrent pain (eg, headache, JIA, sickle cell)<br>• Available as an interview and self-report questionnaire<br>• Child and parent versions<br>• Assesses both active (eg, sports) and routine (eg, going to school) domains<br>• Evaluated in e-diary format | • Tested in specific populations. Requires further evaluation |
| e-Ouch electronic pain diary[86,129-131] | Electronic diary with real-time data: pain intensity, unpleasantness, and interference (with activity, mood, walking, stiffness, enjoyment of life, sleep, schoolwork, tiredness, relationships, and control over pain) using a sliding 0-to-100 VAS. Number of painful joints and pain words also selected. Pain ratings captured 3 times per day (on waking, after school, and before bed) | IAR: 9-18 | Reliability: none<br>Validity: convergent, discriminant<br>Responsiveness<br>Practical considerations: acceptable to patients | • Developed and tested in JIA<br>• Self-reported scale in real time<br>• Scored by the program, and missing data are summarized<br>• Completing all 3 daily pain ratings takes less than 9 min<br>• Low administrative burden due to electronic capture<br>• Adolescents found it "easy to use" and "learn," "quick to complete," and were "very satisfied" | • Requires further evaluation<br>• Analysis of real-time data collection is complex, potentially limiting its clinical implementation<br>• e-Ouch recorded on a personal handheld device as opposed to an app or online<br>• Prespecified reporting times used in testing |

*Table continues on page 722*

**TABLE 5** Multidimensional Pain Scales That Measure the Impact of Pain in Infants, Children, and Adolescents (continued)

| Pain Scale | Description | Age Range, y | Evidence Available | Strengths | Limitations |
|---|---|---|---|---|---|
| Functional Disability Inventory[31,73,158] | 15 items assessing everyday activities in the past 2 wk (eg, walking up stairs). Each item scored from 0 (no trouble) to 4 (impossible). Scores summed; total score, 0-60 | IAR: 8-17 | Reliability: intrarater, interrater<br>Validity: convergent, discriminant, content, criterion<br>Responsiveness<br>Practical considerations: feasibility, interpretability | • Evaluated in a variety of conditions (eg, abdominal pain, acute minor illnesses, back pain)<br>• Recommended by PedIMMPACT[93]<br>• Interview or self-report | • Largely evaluated in clinical populations |
| Pain Experience Questionnaire[59] | 15-item questionnaire with 4 subscales: pain severity, pain-related interference, social support, and affective distress. Each item scored on 7-point Likert scale from "not at all" to "very much" | IAR: 7-18 | Reliability: interrater<br>Validity: convergent, discriminant, content<br>Practical considerations: none | • Developed and validated in mixed population with chronic pain (eg, fibromyalgia, rheumatoid arthritis, headache)<br>• Self-report and parent scale<br>• Validated in German<br>• Based on Multidimensional Pain Inventory | • Requires further evaluation |
| Pain-QuILT[80,81] (previously the Iconic Pain Assessment Tool Version 2) | Web-based tool for tracking pain (quality, intensity, location) using time-stamped records. Pain quality involves choosing from a validated library of pain icons (eg, a matchstick for "burning pain"). Pain intensity: 0-to-10 NRS from "no pain" to "worst pain imaginable." Pain location: dragging and dropping pain icons onto a virtual body map | IAR: 12-18 | Reliability: none<br>Validity: none<br>Practical considerations: user preference, acceptable to patients | • Ability to self-report complex sensations associated with chronic pain (eg, "burning")<br>• Real-time data entry<br>• Users able to record information faster than with other electronic pain assessment tools (median completion time, 1.4 min) | • Requires further evaluation<br>• Developed and tested in an adult population and utility tested in adolescent populations |
| Pediatric Pain Assessment Tool[1,2,86] | 32 word descriptors, 10-cm VAS; present and worst pain, pain coping strategies, and influence of pain on daily activities<br>Modeled on McGill Pain Questionnaire, Pediatric Pain Questionnaire | IAR: 5-17 | Reliability: none<br>Validity: convergent, discriminant, content<br>Responsiveness<br>Practical considerations: acceptable to patients | • Used JIA, cancer, surgery<br>• Child and parent versions<br>• Children 7-16 y had no problems using scale<br>• Developed in Dutch. Validated in Jordanian. Has been administered to Arab-American children | • Younger children may require assistance<br>• Has been evaluated as single components, not the entire scale |
| PROMIS Pediatric Pain Interference Scale[40,72,147] | Pain interference bank contains 13 questions (8 in the short form). All questions use 7-d recall scored on a 5-point Likert scale, with anchors of 0 ("never") to 4 ("almost always"). Raw score totals can be converted to a T score using reference tables | IAR: 8-18 | Reliability: none<br>Validity: convergent, content, criterion<br>Responsiveness<br>Practical considerations: none | • Developed for wide range of conditions (eg, arthritis, rehabilitation, asthma)<br>• Developed using item response theory; users can select appropriate items from a "bank" of questions<br>• Preliminary validation in those with chronic musculoskeletal pain receiving multidisciplinary treatment<br>• Child (8-17 y) and parent proxy (children 5-17 y) versions<br>• Developed in English. Validated in German and Spanish | • Requires further evaluation<br>• Most accurate way to score the scale is through the online assessment center<br>• Scale can be scored manually but requires reference tables to convert to a T score |
| Teen Nordic Musculoskeletal Screening Questionnaire[85] | 27-item questionnaire, dichotomous responses. The presence of musculoskeletal symptoms and their impact on school attendance, sports, and leisure activity participation over the past 6 mo | IAR: 6-18 | Reliability: intrarater<br>Validity: criterion<br>Practical considerations: none | • Musculoskeletal symptom screening tool<br>• Developed and tested in French | • Requires further evaluation |

*Table continues on page 723*

**TABLE 5** Multidimensional Pain Scales That Measure the Impact of Pain in Infants, Children, and Adolescents (continued)

| Pain Scale | Description | Age Range, y | Evidence Available | Strengths | Limitations |
|---|---|---|---|---|---|
| Varni/Thompson Pediatric Pain Questionnaire[7,32,51,77,86,108,148] | Assesses chronic pain intensity and location and sensory, evaluative, and affective qualities. Pain intensity measured on 10-cm VAS, body chart (location and number of pain sites), and with 46 word descriptors to assess sensory, evaluative, and affective qualities of pain<br>Modeled on the McGill Pain Questionnaire | IAR: 4-18<br>SAR: 6-16 | Reliability: intrarater, interrater<br>Validity: convergent<br>Practical considerations: training | • Developed and tested in JIA<br>• Assesses chronic pain from perspective of adolescent, parent, or clinician<br>• In various populations (juvenile rheumatoid arthritis, sickle cell, fibromyalgia)<br>• Adapted for children with cerebral palsy<br>• Developed in English. Validated in Norwegian. Translations: Danish, Portuguese, Swedish, French | • Administered by interview<br>• 10-15 min to complete. Less than 5 min to score<br>• Younger children likely require assistance |
| Young Spine Questionnaire[82] | For each region of the spine (cervical, thoracic, lumbar): pain presence, frequency, and intensity (Faces Pain Scale-Revised). Also includes function at school, recreation, treatment, and family history of pain. No summary score | IAR: 9-11 | Reliability: none<br>Validity: convergent<br>Practical considerations: none | • Iterative development with children aged 9-11 y<br>• Self-report<br>• Developed in Danish. Translated to English | • Requires further evaluation<br>• Validated in narrow age range<br>• Developed and tested in a cross-sectional study; not tested for longitudinal use |

*Abbreviations: IAR, intended age range; JIA, juvenile idiopathic arthritis; NRS, numeric rating scale; PedIMMPACT, Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials; PROMIS, Patient Reported Outcomes Measurement Information System; SAR, studied age range; VAS, visual analog scale.*

assessment measures.[12,89,126] Pain behaviors displayed by children with cognitive impairment are not always comparable to those of children without cognitive impairment, although pain expression has been found to be consistent, observable, and reflective of the presence and severity of pain.[12,111] Thus, pain measurement tools should be adaptable to reflect individual pain-related behaviors, but ideally also contain standardized items that enable their use in any setting.[38] Very few scales are available to assess pain in children with cognitive impairment, and, as seen in **TABLE 4**, these have only been tested in postoperative, residential care, or school settings. No scale has been tested to measure brief procedural, chronic, or recurrent pain in children and adolescents with cognitive impairment. A recommended scale is the revised FLACC scale.

The revised FLACC scale was adapted from the FLACC scale[94] for use in children and adolescents with cognitive impairment.[88] The revised FLACC scale is suggested for children and adolescents with cognitive impairment, based on evidence demonstrating valid and reliable measurement of postoperative pain in a hospital setting, the ability of the scale to be individualized, and evidence of its clinical utility. This suggestion is made in the absence of any other more comprehensively evaluated scale.

The revised FLACC scale is essentially the same as the FLACC scale, but it also enables behaviors to be described that are unique to the respondent for each of the 5 behaviors (face, movement of the body and legs, cry, and consolability). Identifying pain behaviors that are unique to the individual requires input from a family member or carer.

## Assessing the Broader Impact of Pain Using Multidimensional Pain Scales

While this paper has focused predominantly on the measurement of pain intensity, it is acknowledged that pain experience is complex and contains other dimensions, including affective and evaluative dimensions, as well as the impact pain has on everyday life, including an individual's physical, social, and emotional functioning and ability to fulfill his or her "role." The social communication model presented at the start of this paper can still be used to conceptualize the communication of these other dimensions of pain, albeit using broader, multidimensional pain scales. Multidimensional pain scales are particularly useful for assessing recurrent and chronic pain, as they can capture various dimensions of the pain experience (including duration, frequency, location, nature, aggravating and easing factors) and how pain impacts everyday life (eg, interference with daily activity or participation in school and sport). This fills a well-accepted need to differentiate between low-intensity transient pain and more persistent pain that has substantial impact on life.[100] Multidimensional scales differ with respect to the factors assessed (eg, psychosocial factors, situational factors, nature of disability) and period of time. Some of the most commonly used multidimensional pain scales for use in children and adolescents with chronic or recurring pain are outlined in **TABLE 5**. No specific scale

**TABLE 6** Summary of the Scales That Have Been Suggested to Measure Pain Intensity for Each Age Group

| Age Group | Recommended Scale | Type of Scale | Psychometric Properties Evaluated | Strengths | Limitations |
|---|---|---|---|---|---|
| Infant (3 y or younger) | FLACC scale[5,37,48,93,94,136] | Observational | Reliability, validity, responsiveness, user preference, patient preference | • Validated for acute procedural pain (eg, immunizations and postoperative pain)<br>• Scored on a commonly understood 0-to-10 scale<br>• Recommended for use by PedIMMPACT[93] | • Additional studies needed to evaluate generalizability |
| Preschool child (3-5 y) | Pieces of Hurt Tool (Hester's poker-chip tool)[47,50,60,133,139] | Self-report | Reliability, validity, responsiveness, patient preference | • Developmentally appropriate scale (ie, yes/no, followed by limited response options)<br>• Validated for recurrent or persistent pain<br>• Validated in Jordanian and Thai<br>• Can use any items[139]<br>• Recommended for use by PedIMMPACT[93] | • Little testing in younger children<br>• Potential bias toward higher pain scores, especially in younger children<br>• Requires the ability to count and estimate quantities using numbers<br>• Infection risk, storage, and availability of tokens |
| Child (6-11 y) | Faces Pain Scale-Revised[11,24,61,95,96,106,115-117,129,142-145] | Self-report | Reliability, validity, responsiveness, patient preference | • Scored on a commonly understood 0-to-10 scale<br>• Gender-neutral drawings of faces<br>• Translations: >35 languages; validated in French, Thai, and Catalan<br>• Minimal clinically important change: 2/10 (1 face) or 25%<br>• Electronic version available; Sydney Animated Facial Expressions Scale; Painometer app[115,116]<br>• Recommended for use by PedIMMPACT[93] | • Reduced accuracy with decreasing age<br>• Response bias in those under 5 y of age<br>• Skewed pain intensity ratings toward "no pain"; may underestimate pain intensity |
| Adolescent (12-18 y) | Verbal numeric rating scale-11[6,23,24,39,95,113,115-117,154] | Self-report | Reliability, validity, responsiveness, patient preference | • Scored on a commonly understood 0-to-10 scale<br>• Adaptable (eg, usual, strongest, lowest pain; pain at rest/with activity)<br>• Translations: Spanish, French<br>• Suitable for those aged 8-20 y and for physical disabilities (eg, cerebral palsy, neuromuscular disease) and chronic pain<br>• Electronic version available[115,116]<br>• Minimal clinically important change: 1/10 | • Requires the ability to count, estimate quantities using numbers, recall pain<br>• Variability in the time period (eg, past week, current pain) and anchors used (eg, worst possible pain, strongest pain)<br>• Further testing required in younger children (6-8 y) |
| Cognitive impairment (4-19 y) | Revised FLACC scale[29,38,45,88,104-106,150] | Observational | Reliability, validity, responsiveness, user preference, carer preference | • Simple to use, score, and interpret<br>• Scored on a commonly understood 0-to-10 scale<br>• Individualized by parent/carer<br>• Validated in Danish | • Evaluated in postoperative settings only<br>• Underlying motor impairments (eg, spasticity) may affect assessment<br>• Observation time not established; 5 min used in previous testing<br>• Ambiguity of some items (eg, "jaw clench" and consolability [amount and timing]) |

*Abbreviations: FLACC, Face, Legs, Activity, Cry and Consolability; PedIMMPACT, Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials.*

has been suggested, as the choice will depend on the purpose of measurement and the health condition being measured (eg, region- or condition-specific scales). Common to many of the scales is identification of impact on school absenteeism, interference with sports participation, interference with activities of daily living, medication use, and health care utilization. These are acknowledged as important indicators of pain impact in pediatric populations.[100]

Another important dimension of pain assessment is fluctuation over time. In addition to the scales outlined in **TABLE 5**, pain diaries are often used to capture information about pain (eg, intensity, frequency, and location) and its effect on behavior over time. The information collected in a pain diary may provide a more accurate and reliable measure of pain, if completed on a regular basis, by minimizing recall bias. Recent advances in information and communication technology (eg, internet, smartphones) have permitted the development of electronic methods such as e-diaries. Advantages of this electronic

approach over traditional paper-based techniques include minimizing errors in data transfer and transcription, ability to capture time-stamped data, ease of data sharing, increased compliance, and heightened patient satisfaction.[81] Recently, Lalloo et al,[80] Lalloo and Stinson,[81] and Stinson and colleagues[132] have validated a number of web-based and smartphone-based multidimensional electronic pain assessment tools, including e-Ouch, Standardized Universal Pain Evaluations for Rheumatology Providers for Children and Youth, and Pain-QuILT (freely available). These tools can be used in a variety of clinical settings to monitor musculoskeletal pain in children in real time.[80,81]

## GOOD-PRACTICE POINTS

Pain in children has been inadequately assessed, underestimated, and undertreated for many years.[146] This situation can only be rectified through improved communication of pain from the patient to the clinician at every relevant clinical contact, until it becomes a part of routine care.[111] Central to the social communication model of pain framework are the various intrapersonal and interpersonal factors that may influence the expression, assessment, and management of pain. Consideration of these factors and the context in which the communication occurs is vital for effective, accurate, and reliable communication of pain, early detection of pain, and timely management (including reassurance and advice). Most importantly, the improved communication of pain has been found to improve patient outcomes (eg, reduction in mean pain scores, improved satisfaction) and reduce health care costs (eg, reduction in length of stay).[76,120]

An individual's pain experience and expression are determined by a range of biopsychosocial factors that are specific to his or her developmental stage. The clarity of the pain expression can be optimized through the consistent use of valid and reliable pain scales that are age appropriate and meet the cognitive and communication capabilities of the individual, where available. This means using observational scales of behavior for infants, integrating both observational and self-report scales for children, and primarily using self-report scales for those in later childhood or their teenage years. In all cases, patient self-report of pain should be considered and interpreted alongside knowledge of the context, and supplemented with information gained from observation of behavior and input from parents and guardians, when appropriate. A child's ability to use a pain scale accurately and reliably increases with his or her familiarity with the scale, highlighting the need to introduce and educate children on the use of pain scales early in their life course. By providing children with the vocabulary and skills necessary to express their pain, the clarity of the pain expression can be improved, potentially reducing errors in the interpretation by the observer.

Effective pain assessment and management by clinicians can be enhanced through the consistent use of standardized pain scales within and across health care settings and by the accurate and timely documentation of assessment findings.[61] Advantages of this approach include improved continuity of care for the individual and the ability to generate consistent data for longitudinal comparison of pain over time. Evidence from studies on global perceived effect scales shows that patient-reported outcomes taken over time provide a more accurate understanding of changes in a person's health status compared to recall of improvement/deterioration.[71] The minimal clinically important change has been determined for a number of scales (reported in **TABLE 3** where available), which can assist clinicians to determine the effectiveness of an intervention and provide insight into the meaningfulness of the change for the individual. Areas in need of further development include the assessment and measurement of pain resulting from other mechanisms, such as neuropathic and central pain, for which there are currently no scales validated for use in children and adolescents. Undoubtedly preferable to the timely assessment and management of pain are practices that can help minimize or prevent the experience of pain. In many instances, pain can be anticipated (eg, procedural, vaccinations, postoperative pain) and proactively managed by clinicians and parents/guardians, using both pharmacological (eg, topical analgesics) and nonpharmacological interventions (eg, distraction). The "It doesn't have to hurt" online video is one such example of providing clinicians and parents/guardians with effective, evidence-based information that can positively influence a child's experience of painful situations.[25]

## CONCLUSION

To date, little research has been done to evaluate the use of measures designed for assessment of pain in infants, children, and adolescents outside the hospital setting. This constitutes an important evidence gap, given that primary care, community outpatient, and rehabilitation clinics have frequent contact with infants, children, and adolescents with pain. Though further work is needed, this paper provides clinicians with a pragmatic, evidence-based overview of scales that can be used to measure pain intensity in infants, children, and adolescents, with and without cognitive impairment, and to assess the impact of pain. ◉

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