TITLE: Pain Scales in Acute Care Settings: A Review of the Accuracy and Reliability

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CONTEXT AND POLICY ISSUES:

Pain measurement is a complex and challenging area of health measurement. Pain is a personal and subjective experience, influenced by patient characteristics, pain response and the nature of the stimulus (i.e., severity, intensity and duration). Self-report is the most effective method and commonly employed means of assessing pain intensity among both adults and children, and age-specific scales have been developed to achieve this end.1-3 Two examples include the Faces Pain Scale (FPS) and the Numeric Pain Scale (NRS).

The FPS was originally developed by Bieri et al.4 and refined as the FPS-R by Hicks et al.5 The FPS uses illustrated facial expressions to assess pain intensity in children. The child (typically aged four years and older) is asked to select the face that best reflects the intensity of the pain he or she has from a series of faces depicting different levels of pain intensity in a horizontal orientation from “no pain” to “worst pain possible”. The FPS-R is based on six faces instead of seven faces of the original measure so that the common numeric value from 0 to 10 (with faces numbered 0, 2, 4, 6, 8, and 10) can be assigned to the scale. A rating of three or more signifies clinically meaningful pain in children. Faces scales do not require the ability to count or to use numbers in an ordinal fashion. For this reason, they are often used with children as young as three-years-old.6 Many different face scales have been created varying in part by the number and design of the faces. Whether children use faces scales effectively and appropriately is a matter of debate.7

The NRS (developed for self-report of pain intensity in adults) is an 11, 21 or 101 point scale where the end points are the extremes of “no pain” and “worst pain”.2,8 The NRS can be graphically or verbally delivered. The NRS-11 score of 0 correspond with no pain, 1 to 3 with mild pain, 4 to 6 with moderate pain, and 7 to 10 with severe pain. The patient chooses the number that corresponds with the level of pain he or she is experiencing. The minimum clinically important difference in terms of pain intensity has been estimated to range from 1.39 to 2 points.9,10
This report will review the evidence on the accuracy and reliability of the FPS-R and NRS in pediatric and adult acute care settings, respectively.

RESEARCH QUESTIONS:

1. What is the accuracy and reliability of the Faces Pain Scale for use by nurses in pediatric patients in acute care settings?

2. What is the accuracy and reliability of the Numeric Rating Scale for use by nurses in adult patients in acute care settings?

METHODS:

A limited literature search was conducted on key health technology assessment resources, including Medline, CINHAL, The Cochrane Library (Issue 5, 2010), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI (Health Devices Gold), EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between January 1, 2000 and May 13, 2010. No filters were applied to limit the retrieval by study type.

SUMMARY OF FINDINGS:

The search identified one systematic review and five observational studies. Few of the identified studies addressed the accuracy and reliability of the scales when administered by nurses. Therefore, the following discussion includes studies that compared the FPS and NRS to other self-report pain scales in acute care settings.

Systematic reviews

Pediatric (FPS-R)

The systematic review was commissioned by the Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (Ped-IMMPACT) working group and it evaluated the psychometric properties, interpretability and feasibility of self-report pain intensity measures for children and adolescents aged 3 to 18 years.11 The review searched for all published English language studies examining the psychometric properties, interpretability and feasibility of self-reported measures of pain intensity in children and adolescents. Stinson et al. identified 34 studies evaluating self-report measures of pain intensity, of which six studies (evaluating these measures: Pieces of Hurt Tool, FPS/FPS-R, Oucher-Photographic, Oucher- NRS, Wong-Baker FACES Pain Scale, and visual analogue scale [VAS]) were considered to have well-established reliability and validity; however, none of these assessments showed reliability or validity in pre-school children. Furthermore, no single assessment tool was considered optimal for use with all types of pain. The FPS/FPS-R showed adequate stability ($r = 0.63$ to $0.79$) and positive correlations with other pain intensity scales ($r = 0.59$ to $0.90$) and behavioural scales ($r = 0.49$ to $0.90$). It was also reported to have established content and construct validity. Advantages of the FPS/FPS-R included high feasibility and ease of administration, lack of upper-end bias observed with the other scales, it has been translated into over 25 languages, and it is free to use from the internet. Disadvantages were reported as ratings may be skewed toward the no pain end of the scale, there is limited evidence of the interpretability, and there is mixed
evidence regarding the acceptability with children. The authors of the review recommended FPS/FPS-R for use in acute procedure-related, post-operative, and disease-related pain in children aged eight years and older and as a secondary assessment with the VAS among children aged eight to twelve.11

**Observational studies**

**Pediatric (FPS-R)**
Chambers et al. administered the FPS to 78 children between the ages of five and 13 years following minor surgery and the results were compared with those from four other faces scales and the Coloured Analog Scale.12 In addition to self-report from the children, parents and nurses also provided pain ratings using the same measures; scales were administered by the study investigators. Standardized mean pain rating scores were reported to be statistically significantly higher for children (3.55) compared with parents’ pain intensity ratings (3.28) and nurses’ ratings (1.51). Thus, nurses tended to underestimate children’s pain scores across all scales. Correlations among pain scales ranged from 0.82 to 0.91 for children’s ratings, 0.66 to 0.91 for parents’ ratings, and 0.62 to 0.85 for nurses’ ratings. Parents and nurses rated statistically significantly more pain when using scales with a smiling rather than a neutral “no pain” face (for example, FPS versus Wong and Baker). This pattern was not as clear for the children’s ratings, although their highest ratings were provided when using a smiling “no pain” faces scale. In terms of scale preference, all three raters preferred faces scales with a smiling face in the display, largely because these scales seemed “happy, cute, or funny”. Nurses most commonly preferred scales for ease of use. No age or sex differences in pain ratings were observed. Children’s self-reported pain intensity ratings were statistically significantly higher than those provided by parents, which in turn were higher than those provided by nurses. These results suggest children’s, parents’ and nurses’ ratings of postoperative pain intensity are influenced by the presence of a smiling “no pain” face at the beginning of faces scales, with such scales producing significantly higher ratings than scales with neutral “no pain” faces. Ratings on the independent Coloured Analog Scale measure were more comparable to those provided on faces scales with neutral “no pain” faces.

Bulloch and Tenenbein6 evaluated the construct, content and convergent validity of the FPS. All children aged five to 16 years who presented to an urban emergency department with pain (n = 30) were asked to report their current level pain using the FPS and Colour Analog Scale. They were also asked if their pain was mild, moderate, or severe. The measures were repeated following administration of analgesic. The same procedure was administered to children without pain in the emergency department (n = 30). Both scales were found to exhibit construct, content, and convergent validity; administration of analgesics reduced the pain scores from baseline, the nonpainful comparator group did not report any pain on the scales, and the Spearman correlation coefficient between the scales was r = 0.894. However, discriminant validity was not evaluated and whether the scales were measuring pain as opposed to fear was not determined. Also, reliability was not measured and whether these results are repeatable is uncertain.6

The role of developmental factors in predicting children’s use of the FPS-R was studied among 112 children aged three to six years.13 Children were exposed to hypothetical vignettes (Charleston Pediatric Pain Pictures, which are 17 cartoon pictures of a child in painful situations representing no, low, moderate, or high pain) and the accuracy of their responses on the FPS-R
were compared with the pain severity depicted in the vignettes. Children aged five and six years were statistically significantly more accurate in their response on the FPS-R compared with four-year-old children, who were in turn significantly more accurate versus three-year-old children. Of note, over half of six-year-olds demonstrated difficulties using the FPS-R. Child age (compared with numerical reasoning, ability to classify and seriate, language skills, and general cognitive abilities) was the only statistically significant factor correlated with children’s ability to use the scale in response to the vignettes.13

Adult (NRS)
Gallasch and Alexandre14 evaluated the reliability of the NRS compared with three other self-report pain intensity scales (verbal rating scale, face scale, and VAS) among adult physiotherapy patients receiving treatment for musculoskeletal pain. Patients were asked to score their previous 24 h pain on each of the four scales, presented in random order. The study found the NRS had the highest intraclass correlation coefficient (r = 0.99; for the other three: 0.88, 0.96, and 0.97, respectively). Furthermore, the NRS was considered the easiest scale to understand and to complete.

Gagliese et al.15 compared the feasibility and validity of the NRS-11 to the verbal descriptor scale (self-report Present Pain Index from the McGill Pain Questionnaire with a score ranging from 0 = none to 5 = excruciating) and VAS for assessment of postoperative pain in 504 younger and older adults. Age differences in the properties of the NRS-11 were not observed. The NRS-11 was the preferred pain intensity scale reported by patients. It had low error rates, and higher face, convergent, divergent, and criterion validity than the other scales.

Limitations

Pediatric (FPS-R)
Self-report measures in children have limitations since they are dependent on the child’s social, cognitive and communicative competence such as his or her ability to match items, to place items in a correct series, and to listen to the instructions of the person administering the measure while looking at materials.1,16 Children’s responses are also influenced by their context, therefore it is possible that children may respond in a biased fashion (for example, minimize their pain for fear of getting a needle). Self-report measures may be subject to recall bias when they are used to ask children to recall their pain over prolong periods that may range weeks to months.16

Response biases, such as anchor biases (choosing only the lowest and highest pain faces) and sequence biases (ordering faces left–right or right–left sequences), are also possible. One study (n = 185, aged three to five years) reported anchor bias occurred in 16% of children and sequence bias occurred in 35%; no response bias occurred in 48% of children.16 Response biases were identified more often in younger than older children. Thus, response biases are important in children under 5 years. Clinicians should consider self-report pain ratings from preschoolers with caution, seek complementary observational assessment, and investigate discrepancies between self-report and observational estimates of pain.16

Children also possess higher degrees of fear and anxiety when suffering pain, which can interfere with attempts at measurement of pain intensity. Because of this, parents’ assessment
of their child’s pain is often solicited, a practice which has been demonstrated to poorly correlate with the patient’s own perceived pain intensity.17

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING:

Only one of the identified studies evaluated the accuracy and reliability of nurse-evaluated patient pain using investigator-administered FPS compared with other pain scales typically used for children.12 In general, nurses tended to underestimate the pain that patients were experiencing. This may be due to the underlying subjective nature of pain making it difficult for nurses to gage something they are not themselves experiencing. Lack of familiarity or underuse of the scales may also contribute to the lower pain estimates by nurses. Regardless of the reason, underestimation of patients’ pain places them at risk of not having their pain fully treated.

Overall, the reviewed literature indicates self-reports of pain are sensitive in capturing qualities of the pain experience, although they are subject to personal response biases, reflect the person’s appraisal of the consequences of the pain report and require certain cognitive skills.18 For example, children’s self-reports of pain intensity are a valuable source of information, but their interpretation must be considered together with observation of behaviour, reports by parents, clinical data and information on the child’s social environment, especially for pre-school aged children.18 Estimates of pain intensity based on these other sources may not always correlate highly with children’s self-report of pain, and may reflect different perspectives of the pain experience.18

The FPS or FPS-R is an effective, valid and reliable pain measurement tool which correlates well with other pain scales.17 The FPS and the FPS-R have been employed in many different clinical areas and have been found valid in various acute care settings.6 The scale has several advantages over other existing faces scales. First, it has no smiling and/or tearful faces, which is relevant considering that scales that use a series of faces with expressions from smiling faces (no pain) to tearful (worst pain possible) may be confusing to children and confound affective states with pain rating since smiling and tears do not necessarily equate with the absence or presence of pain.17 Second, as a nonspecific cartoon or illustration–based scale, rather than a photograph-based scale, the FPS-R avoids possible sex, racial, and age-based biasing.17 Third, it has the advantage of being suitable for use with the most widely used scoring metric (0 to 10).5 Fourth, besides having a true 0 point, the intervals on the scale are equal. Finally, the instructions have been translated into more than 30 languages.

Although the FPS-R is intended for use in children aged four to 16, children younger than eight years appear to have difficulty distinguishing the middle faces.7,16 Preschool-age children especially seem to have difficulty discerning the various levels of the scale since they are not used to being asked questions by strangers nor are they experienced in giving quantitative ratings or estimates. Many children younger than five years of age have a marked tendency to use only the extremes of the scale. In other words, they treat the scale as dichotomous rather than graded.16 Furthermore, many cognitive, social and cultural factors influence pain ratings (for example, previous painful experiences, temperament, presence of an audience, family and community norms for pain expression), making them idiosyncratic and difficult to interpret.18
An NRS with numbers from 0 to 10 (“no pain” to “worst pain”) is more practical than a VAS, easier to understand for most people, and does not need clear vision, dexterity, paper, and pen.\textsuperscript{3,19} The NRS functions best for the patient’s subjective feeling of the intensity of pain at that moment. They may be used for worst, least, or average pain over the last 24 hours, or during the last week. There are limitations with this, as memory of pain is not accurate and often distorted by changing context factors.\textsuperscript{3}

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