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Validation of the Wong-Baker FACES Pain Rating Scale in Pediatric Emergency Department Patients

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Abstract

Objectives: The Wong-Baker FACES Pain Rating Scale (WBS), used in children to rate pain severity, has been validated outside the emergency department (ED), mostly for chronic pain. The authors validated the WBS in children presenting to the ED with pain by identifying a corresponding mean value of the visual analog scale (VAS) for each face of the WBS and determined the relationship between the WBS and VAS. The hypothesis was that the pain severity ratings on the WBS would be highly correlated (Spearman's rho > 0.80) with those on a VAS.

Methods: This was a prospective, observational study of children ages 8–17 years with pain presenting to a suburban, academic pediatric ED. Children rated their pain severity on a six-item ordinal faces scale (WBS) from none to worst and a 100-mm VAS from least to most. Analysis of variance (ANOVA) was used to compare mean VAS scores across the six ordinal categories. Spearman's correlation (ρ) was used to measure agreement between the continuous and ordinal scales.

Results: A total of 120 patients were assessed: the median age was 13 years (interquartile range [IQR] = 10–15 years), 50% were female, 78% were white, and six patients (5%) used a language other than English at home. The most commonly specified locations of pain were extremity (37%), abdomen (19%), and back/neck (11%). The mean VAS increased uniformly across WBS categories in increments of about 17 mm. ANOVA demonstrated significant differences in mean VAS across face groups. Post hoc testing demonstrated that each mean VAS was significantly different from every other mean VAS. Agreement between the WBS and VAS was excellent (ρ = 0.90; 95% confidence interval [CI] = 0.86 to 0.93). There was no association between age, sex, or pain location with either pain score.

Conclusions: The VAS was found to have an excellent correlation in older children with acute pain in the ED and had a uniformly increasing relationship with WBS. This finding has implications for research on pain management using the WBS as an assessment tool.

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Pain severity assessment, as required by The Joint Commission,[1] is intended to improve the quality of pain management. Measures of a patient's pain must be reliable and accurately reflect the intensity of pain being experienced. The practice of assessing pain as ''the fifth vital sign'' has become widespread, despite a lack of published evidence demonstrating the accuracy and effectiveness of screening strategies. Self-report of pain intensity is the preferred approach to pain assessment. There are several tools available to reliably assess pain in children;[2] however, there is no accepted criterion standard.

The visual analog scale (VAS) is a common method for the quantification of pain severity. It is a continuous outcome measure consisting of a 100-mm scale from 0 to 100 with low and high end points of no pain and worst pain. The VAS is easy to administer and has been validated in adults and older children. The VAS has been shown to be a reliable and valid measure of acute pain in the emergency department (ED).[3]

Facial expression drawings (''faces scales'') are a popular method of pain severity assessment in pediatric populations. Faces scales use a series of facial expressions to illustrate a spectrum of pain intensity. Numerous face-based rating scales are available.[4]

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Faces scales are ordinal outcome measures consisting of a limited number of categorical responses ordered in a specific pattern. Although there is debate about the optimum design of the facial expressions, the literature suggests that they are the preferred method of pain reporting by children.[5] The Wong-Baker FACES Scale (WBS) is one of several faces scales that has been demonstrated in multiple pediatric settings for pain assessment.

There is a fair amount of literature investigating the individual utility of these scales in the chronic setting. However, there is no literature correlating the VAS (a continuous outcome measure) with the WBS (an ordinal outcome measure) in the acute setting. A correlation between pain measurement scales would provide a basis for future studies that include assessment of acute pain severity from children. The objective of our study was to identify a corresponding mean value of the VAS for each face of the WBS and determine the relationship between the WBS and VAS. We hypothesized that the pain ratings on the WBS would be highly correlated with ratings on the VAS.

METHODS

Study Design

This was a prospective, observational study designed to correlate the WBS to VAS. The study was approved by the Human Subjects Research Committee. A letter of consent was utilized to obtain consent from both parent and child to partake in the survey.

Study Setting and Population

The study was conducted in a suburban academic pediatric ED with a census of 18,000 pediatric visits per year. A convenience sample of English-speaking children between the ages of 8 and 17 years presenting to the ED with painful conditions was approached for enrollment. Patients were excluded if they possessed disabilities (auditory, visual, physical, or mental) that would interfere with their ability to comprehend instructions for completing the WBS and/or VAS or marking their response on the WBS and/or VAS.

Study Protocol

Research assistants were available to enroll patients on weekdays between the hours of 9 AM and midnight. The research assistants were in-serviced on the study objectives and administration of the pain severity assessment scales prior to study implementation. The data collection instrument consisted of demographic questions, a 100-mm VAS, and a reproduced copy of the WBS. The VAS and WBS data collection instrument was folded in half to prevent the patient from visualizing and comparing the labeling of the scales. After obtaining baseline demographics, patients were asked to rate their pain on the WBS. Research assistants pointed to each of the six faces and described each face using the brief word instructions provided with the scale.[6] Patients were asked to circle the face that best represented their level of pain severity. Immediately after obtaining WBS scores, patients were asked to rate their pain severity on a horizontally positioned, 100-mm VAS with marked endpoints of ''no pain'' and ''worst possible pain.'' Research assistants were instructed to ask: ''show me on the line, the amount of pain you have; here is no pain; there is the worst possible pain.'' Patients were instructed to draw a mark on the line to indicate the level of pain. The data collection instrument was designed to prevent the patient from visualizing their response on the WBS when marking the VAS.

Data Analysis

Data were entered into SPSS 17.0 (SPSS Inc., Chicago, IL). Descriptive measures of central tendency were utilized to examine distributions of pain scores. The primary aim of this study was to identify the corresponding mean value of the VAS for each face of the WBS and determine the relationship between the WBS and VAS. For each category on the WBS, we calculated the number of observations, the mean with 95% confidence intervals (CIs), and the median with interquartile ranges (IQR).

Spearman's correlation (ρ) was used to measure agreement between the continuous and ordinal scales. Analysis of variance (ANOVA) was used to compare mean VAS scores across the six ordinal categories with post hoc testing to assess individual differences among WBS categories. Each scale was compared by age (above and below the median), sex, and location of injury to determine if there were differences in pain by these characteristics and the relationship between scales was compared across subgroups of these variables.

In previous studies, the reported standard deviation (SD) for the VAS scale scores was approximately 15 mm.[3,7] For the 95% CI around the point estimate for the mean VAS for each of the six faces of the WBS to be nonoverlapping, we calculated the need for 20 subjects to choose each of the six Wong-Baker faces for a total sample size of 120; however, we ended subject accrual at 120 patients without regard to subgroup sample size.

RESULTS

A total of 120 patients were assessed. The median age was 13 years (IQR = 10–15 years). Half of the patients were female, 78% were white, and 95% spoke English as their primary language, with 4% Spanish and 1% other. Three of the six children reporting English as a second language reported their proficiency as good. The most commonly specified locations of pain were extremity (37%), abdomen (19%), and back/neck (11%).

The overall mean (±SD) VAS pain score was 53 (±26) mm. ANOVA demonstrated a statistically significant difference among face groups for the mean VAS ($p < 0.001$), and a post hoc test indicated that the mean VAS in each WBS category was significantly different from the mean VAS in every other category (overall $p < 0.01$). The mean VAS increased uniformly across WBS categories in increments of approximately 17 mm (Table 1). A test for homogeneity of variance across WBS face categories was not significant. Agreement between the WBS and VAS was excellent ($\rho = 0.90$; 95% CI = 0.86 to 0.93).

Table 1
Statistical Analysis of the WBS

	 0 NO HURT	1 HURTS LITTLE BIT	2 HURTS LITTLE MORE	3 HURTS EVEN MORE	4 HURTS WHOLE LOT	5 HURTS WORST
n	5	15	20	36	32	12
Mean VAS, mm (95% CI)	2.6 (0–7.2)	17.6 (11.9–23.3)	37.6 (32.9–42.4)	55 (51.6–58.6)	73 (68.2–77.4)	88 (79.8–96.6)
Median VAS, mm (IQR)	0 (0–6)	16 (8–25)	37 (31–46)	57 (48–62)	74 (66–82)	95 (73–100)

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IQR = interquartile range; WBS = Wong-Baker FACES Pain Rating Scale.

There was no difference in the mean VAS or in the distribution of face categories between males and females, between older and younger patients, or between pain location categories. The relationship between the VAS and the WBS also did not differ between sexes, ages, or pain location groups. As an example, Figure 1 shows the distribution of VAS scores by WBS category and age group.

DISCUSSION

Self-report is the desired method of pain assessment. Obtaining an accurate measurement of pain is vital to gauging baseline discomfort and response to therapy. Multiple scales have been developed for the assessment of pain in children.[8] Pain assessment scales are generally based on domain sampling or psychosocial scaling.[9] Domain sampling yields qualitative, categorical measures of pain, while psychosocial scaling provides quantitative, continuous data.[10]

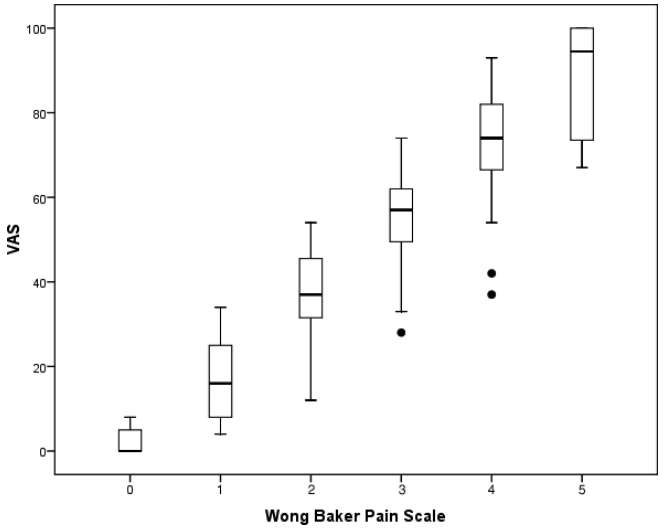

Figure 1. Visual analog scale (VAS) distribution by Wong-Baker Scale (WBS) category and age group.

The most widely used pain assessment scale in acute pain research is the VAS. The VAS is a form of cross-modality matching in which the length of a line is adjusted to match the intensity of pain perception.[11] The VAS has been repeatedly analyzed as a tool for pain assessment. Bijur et al.[3] found the VAS to be a highly reliable instrument for acute pain measurement in adults. The VAS provides a means of assessing baseline discomfort as well as the response to treatment.

There are many factors that can potentially affect a patient's ability to use the VAS, such as age, verbal fluency, visual acuity, motor function, and cognitive ability to translate a sensation of pain into a distance measure.[12] Furthermore, children may not have an adequate understanding of how a ''real'' pain experience compares with an abstract concept of worst possible pain (VAS = 100 mm).[13] There is research demonstrating the difficulty of using VAS for pain measurement in children under 7 years.[12] This finding would seem to be consistent with Piaget's developmental stages of intelligence. Children typically enter the stage of concrete operations by age 7 to 11 years. It is at this stage that children can perform serial ordering operations. These operations relate to the ability to generalize along a linear dimension and are based upon the logic of relations. Shields et al.[14] demonstrated that only one-third of children 5 to 14 years old understood the concept of the VAS for pain management. They noted that patients who were able to understand the concept of the VAS were older than those who did not understand (5–10 years vs. 11–14 years).

Providing an accurate assessment of pain on a VAS or verbal numeric rating scale is similar to arranging a set of sticks in order of size. Accurate data can only be obtained from those patients with the cognitive ability to perform serial ordering. Facial expression scales are thought to be a remedy for this problem. Faces scales use a series of facial expression drawings to demonstrate a spectrum of pain intensity. Faces scales are a

popular approach to eliciting children's self-report of pain. Face scales do not require the child to translate pain experience into a numerical value; however, they do require a child to discriminate among different levels of pain depicted in pictures. Stanford et al.[15] found that age is a significant predictor of a child's ability to accurately apply the Faces Pain Scale–Revised (FPS-R) in hypothetical vignettes. However, face scales are not without their own inherent problems. There is much debate among researchers about the optimum design (facial shape and features), spectrum of pain (furrowing of forehead, elevation of eyebrows, mouth opening, etc.), and anchor points. The FPS-R illustrates a neutral face for ''no pain'' whereas the WBS illustrates a smiley face.

Notwithstanding its shortcomings, the VAS is a powerful tool for research on pain management. The VAS is touted as being more informative and sensitive to changes when compared to ordinal scales. There are numerous studies demonstrating a minimum clinically significant difference in VAS for various situations (general pain, abdominal pain, headache, etc.). Powell et al.[16] determined a minimum clinically significant change in VAS of 10 mm for children with acute pain. The same does not hold true for facial expressions scales such as FPS-R and WBS. To the best of our knowledge, Bulloch and Tenenbein[17] are the only researchers to have demonstrated a minimum clinically significant difference using a facial expression scale. However, they noted that a one- or two-face change occurring at one part of the scale may not be equivalent to a one- or two-face change in a different part of the scale.

Our data provide a correlation between the WBS and the VAS. The mean VAS for each of the face groups was significantly different, with approximately 17 mm separating each of the faces. Therefore, based upon our VAS correlate for each of the WBS face categories, a change in one WBS category would indicate a clinically significant change in pain at any part of the WBS. This finding requires further testing and confirmation.

As noted above, each of the assessment tools has advantages and disadvantages. The VAS is an excellent means of quantifying the effect of pain treatment. There are a few studies correlating the VAS to alternate methods of pain severity assessment in children. Bulloch and Tenenbein[18] demonstrated excellent correlation between the FPS-R and the color analog scale (a form of VAS) and found the FPS-R to be a reliable method of measuring pain in children 5 to 16 years of age. On the contrary, Bailey et al.[19] found no agreement between VAS and WBS in pediatric patients with suspected appendicitis. However, our study differs in the method of statistical analysis. We chose not to use Bland-Altman analysis to determine statistical agreement. An important requirement of the Bland-Altman analysis is that the methods for measuring the same characteristic utilize the same scale of measurement. VAS and WBS are two different scales of measurement (continuous and ordinal, respectively).

Based upon our results, we believe the WBS has the potential to be an excellent measure of treatment effect in school-aged children and adolescents. We anticipate that these findings will hold true in preschool children, who present a different set of challenges to pain assessment and treatment effect.

LIMITATIONS

The generalizability of these findings to younger children and across all cultures is difficult. Our study used older children who were more likely to understand the concept of both VAS and faces scales. Depictions of crying may introduce bias into pain reporting. Children who come from cultures that find crying to be less acceptable or honorable may underreport pain. Although there is no universally accepted lower age limit for the self-reporting of pain, children are limited in their ability to understand sequential ordering. We did not assess the skills of serial ordering prior to study enrollment. Likewise, we did not assess general language development or measure receptive language ability. However, it is unlikely these factors would have altered our results, since the study population was school-aged children and adolescents.

Fear and anxiety may bias pain reporting and interfere with attempts at measuring pain intensity. Although the VAS and WBS are reported to have content validity (the comprehensiveness and adequacy with which the instrument covers the phenomenon of interest), our sample size was not adequate to examine this issue.

Visual analog scale use in children has inherent difficulties. There is literature to suggest that difficulties in using the VAS can be limited through proper explanation and practice sessions.[20,21] Although we included a physical demonstration on marking the VAS, we did not conduct practice sessions beforehand.

CONCLUSIONS

We were able to demonstrate a significant difference in the visual analog scale for each of the Wong-Baker FACES Scale ordinal categories. The VAS was found to have an excellent correlation in older children with acute pain and had a uniformly increasing relationship with WBS. This finding has implications for research on pain management using the WBS as an assessment tool.

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