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Psychometric properties of a self-assessment fear scale in children aged 4 to 12 years. Scary Scale

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ABSTRACT

Background: Caregivers encounter difficulties differentiating fear and pain experienced by children and tend to interpret what children may feel, often resulting in inadequate pain management. While many pain self-assessment scales are available, there is no validated self-assessment fear scale for children.
Methods: The aim of this prospective study was to validate, in children aged 4 to 12 years, the psychometric properties of our scale. In a first part, in a school setting, five exercises were given to 484 children in order to validate the expression of fear, grade the intensity of the faces, the ability to discriminate the faces and the equality of the intervals. The scale's reproducibility was studied by assessing the children's fear in everyday situations at two different time points.
In a second part, in a hospital setting, the aim was to test the scale's feasibility. Sixty children admitted to one emergency care department self-assessed their fear with the Scary Scale.
Findings: The expression of fear was validated by 57.64% ($p < 0.0001$) of the children in comparison with three other emotions (pain, surprise, sadness).The 7–9 year-olds validated the other properties (gradation, discrimination, equality, reproducibility). The 4–6 year-olds failed to validate the gradation exercise, but succeeded with the others.
In the hospital, 95% of children self-assessed their fear using the scale.
Discussion: Our self-assessment fear scale was validated in children aged 7–12 years specifically and was readily feasible in the hospital. We recommend its use in that age group in every care situation triggering fear.
Trial registration: clinicaltrials.gov Identifier: NCT02675504.

Introduction

Nurses analyze care situations based on Virginia Henderson's fourteen basic principles (Henderson, 1997). From these basic principles, the North American Nursing Diagnosis Association-International (NANDA-I) has developed and described nursing diagnoses (Ackley et al., 2019) to assist caregivers in the analysis of clinical situations. Pain and fear are two nursing diagnoses developed from the fundamental principle of "security".

The International Association for the Study of Pain defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage (International Association for the Study of Pain, 2022). By means of the different assessment scales and available therapeutics, nurses can analyze and act in a manner adapted to the diagnosis of pain.

Fear is a distressing emotion caused by an impending danger or pain, whether the threat is real or imagined. Some of the most common fears are fear of death, pain and bodily injury. Some of the most common examples of fear that a nurse can encounter are patients' fears during diagnostic testing. The nurse's role is to identify when patients are experiencing fear by assessing the behavioral and verbal expression of this fear and must find ways to help them in a respectful way to face these feelings (Ackley et al., 2019). However, even though the diagnosis of fear is very well described in terms of evaluation and support, it is little or even not evaluated. A self-assessment fear scale already exists: the

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Children Fear Scale (McMurtry et al., 2011), though it is under-used due to major limitations, such as a high degree of graphic similarity with the Faces Pain Scale-Revised (FPS-R) (Hicks et al., 2001).

Fear and pain are two subjective concepts that involve emotions. Each one influences the other and they can be difficult to distinguish. Their clinical expressions are similar (Binet, 1895; Dantzer, 1993; Garber et al., 1997; Pilon, 1999). They also activate the same structures in the brain. The affective component of pain activates the limbic structures also involved in fear (Marchand, 1998). As such, the sensory and affective processes occur in parallel and simultaneously, adding to this confusion between pain and fear.

In medical practice, the lack of a clear distinction between these two entities creates difficulties in assessing pain in children and sometimes results in inadequate care. Management of pain does not eliminate fear. By attempting to treat what is actually fear with analgesics, our management is ineffective, whereas there are methods for managing fear in children (information given before the treatment, the examination, or the procedure using playful materials, and distraction/hypnoanalgesia during the treatment). A better distinction between fear and pain will help avoid over-consumption of opioids.

The aim of this study was to develop a self-assessment fear scale, called "Scary Scale" and to validate its psychometric properties in children aged from 4 to 12 years. In its first part, the study was conducted in a school setting - a neutral environment – so as to avoid bias in the answers. To test the feasibility of the use of this scale, the second part of the study was carried out under real life conditions, in a hospital setting. We also wanted to see if a concordance existed between children's self-reported fear scores and proxy-reported fear scores by caregivers upon hospital arrival.

Methods

Rationale for the creation of the scale

A self-assessment fear scale, the "Scary Scale", was designed (Fig. 1), with its characteristics drawn from literature review (Beyer et al., 1992; Beyer et al., 2005; Bieri et al., 1990; Foster & Park, 2012; Garra et al., 2010; Kuttner & Lepage, 1989; Streiner & Norman, 2003; Von Baeyer, 2006; Yeh, 2005) and from our own experience.

The graphics for our scale were based on the studies of Ekman, who developed the Facial Action Coding System (FACS) (Ekman & Friesen, 2002).

As there is no gold standard scale in the literature using faces for the self-assessment of fear, we based the method for our study on that of Bieri et al. (Bieri et al., 1990) using the same steps. Unlike Bieri's study, in which children drew the pictures of the Face Pain Scale (FPS), resulting in a scale with seven faces expressing pain, a graphic designer created an original scale with six faces specifically expressing fear.

It consists of six faces of gradually intensifying fear. The scale rates fear with a score ranging from 0 to 10 (rated two by two, gradually) that is consistent with pain rating scales.

Regarding trait validity and tool design, an assistant professor of clinical psychology specialized in applied developmental emphasis on fear and pain in children in medical context was consulted. Additionally, five pediatric nurses, four pediatricians and a nurse researcher were questioned to validate the scale design.

Sample and setting

Sampling was performed in two ways relative to the two parts of our study.

School population: the study took place in seven schools. The inclusion criteria were schoolchildren aged from 4 to 12 years, with parental consent. The non-inclusion criteria were children with psychomotor and intellectual difficulties that impeded understanding of the instructions and use of the scale.

Hospital population: the study took place in an emergency care department. The inclusion criteria were children aged from 4 to 12 years, for whom parental consent was obtained, who were seen during admission in the pediatric emergency care department. The non-inclusion criteria were children admitted in a life-threatening emergency situation, and children with psychomotor and intellectual difficulties that impeded understanding the instructions and use of the scale.

Procedure

In schools: psychometric assessment. The principal investigator provided training for research caregivers in a standardized manner. Two groups of three caregivers spent 20 min in a class for primary school pupils. One gave instructions and two others monitored the conduct of the study. For kindergarten children, each caregiver explained the exercises individually to the children in turn for 20 min each. The study took place on Tuesday or Thursday mornings, which is a time of day and week when attention and concentration capabilities are at their highest (Testu et al., 2008). Each child was given a file that included five exercises (phase 1). Details of the five exercises are available in the supplemental file.

Construct validity was evaluated with exercises one to four.

The objective of exercise 1 was to determine the validity of the expression of fear with the scale to confirm that the faces actually express fear. The scale was presented to the children. It was explained to them that the faces showed someone who felt an emotion growing up. They had to choose the response that expresses this emotion, according to them, among four propositions: fear, sadness, surprise, pain. These emotions were chosen due to their possible confusion. According to Ekman (Ekman & Friesen, 2002; Ekman & Friesen, 2003), fear consists of 6 units of action (Number 1–2–4-5-20-26). Sadness consists of 3 units of action

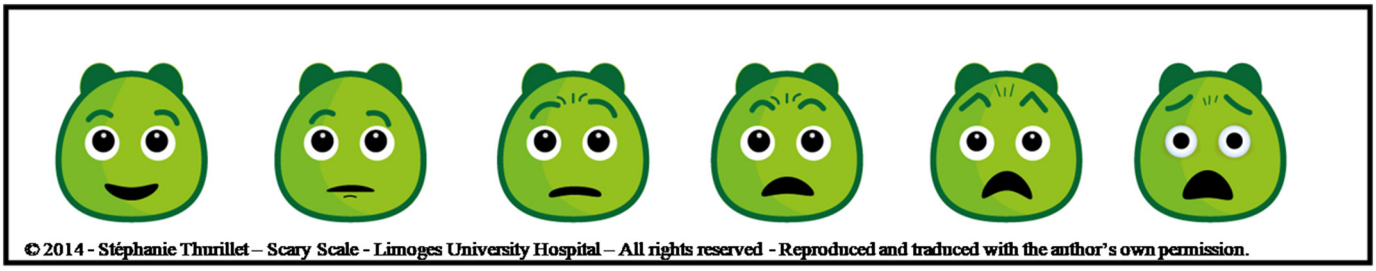

Fig. 1. Scary Scale.
Instructions: These faces show how much fear you can have. This face (show the one on the left) shows someone who has no fear at all. These faces (show them one by one from left to right) show someone who is more and more afraid, up to this one (show the one on the right), that shows someone who is very afraid. Show me the face that shows how afraid you are right now. *As soon as the child shows from the second face, make him/her state the object of his fear. It is up to you to give him/her the necessary information to explain his/her healthcare pathway, care, exams, etc., using playful supports before and/or during.*

(number 1–4-15). It had 2 out of 3 units in common with those of fear. Surprise consists of 4 units of actions (Number 1–2–5-26). All units are common with those of fear. Pain was chosen because of its behavioral component that is common with fear (cry, scream, wince).

The objective of exercise 2 was to rank the intensity gradient in the expression of fear on the six faces.

The children were given six shuffled stickers representing the six faces of our scale and were asked to rank them in descending order of fear.

The objective of exercise 3 was to compare, two-by-two, the intensity of the expression of fear. The six faces of the scale were separated in order to form pairs. This exercise was presented as a table integrating the fifteen possible pairs of combinations (e.g., face 1 with face 6, face 3 with face 5). Given each pair, the children were then asked to circle the face that expressed the most fear. For the kindergarten children, a cover with lifting windows was made so that the children could focus on one pair of faces at a time.

The objective of exercise 4 was to determine whether the position (distance in cm) of each face, starting from face 1,was in the predefined interval (every 5 cm) and to ascertain whether the intensities of the six faces of the fear scale were equal.On the page of this exercise, an enlarged version (25 × 10 cm) of the Visual Analog Scale (VAS) (Huskisson, 1974) was presented as an upside-down triangle. The two stickers that expressed the extremes on the fear scale were attached beforehand, with the sticker expressing the absence of fear (score 0) and the sticker expressing the greatest fear possible (score 10). The children were given the four remaining intermediate stickers in a mixed order. The stickers measured 2.5 × 2.5 cm.

It was explained that the red triangle represented fear. The face at the very bottom showed the absence of fear. The wider the triangle became, the greater the fear was, up to the very top of the triangle (face expressing the greatest amount of fear). The children had to place the faces in the triangle based on the intensity of fear that each face expressed.

Test-retest reliability was evaluated by exercise five.

The objective of exercise 5 was to evaluate the reproducibility of the self-assessment fear scale with the help of everyday situations of fear as illustrated in the photographs. Six pictures of real-life situations triggering fear in children (the most frequently cited in the literature being fear of water, dark, needles, dogs, thunderstorms and spiders) (Copper-Royer, 2013; Petitcollin, 2003) were presented to the children. For each situation, the children used the self-assessment scale to rate by themselves, circling the face most closely corresponding to the fear experienced.

To determine the reproducibility of the scale, this exercise was repeated 15 days later (phase 2).We asked the children to remember their answers given the first time by evaluating once again their fear with the same pictures.

The data from the five exercises were electronically recorded in anonymized form.

In the hospital: feasibility assessment.

Children were included upon their arrival after consent from their parents.

We wanted to determine whether using our scale in a care department would be feasible. We wanted to know whether children were able to rate their fear with the scale. Upon admission, before any care, the Scary Scale was presented to the child to assess their own level of fear. If the child gave a fear score greater than or equal to 2 out of 10, the child had to identify the object of their fear.

In order to answer our last objective, the concordance between children's self-reported fear scores and proxy-reported fear scores by two caregivers upon hospital arrival was also evaluated in order to ascertain whether there was a gap between the fear experienced by children and their caregivers' evaluation. For the proxy assessment, at the same time as the child's self-assessment, each of the two caregivers independently assessed the child's level of fear using the Scary Scale (score from 0 to 10).

During admission, the two caregivers collected the initial information (circumstances of the admission, hemodynamic parameters and pain assessment with Faces Pain Scale-Revised).

All of the data were collected in a paper file using the computer software of the emergency department and were then electronically entered into an anonymized form.

Ethics

This study was authorized by an Ethics Committee on October 9, 2015 under No CCP15–037 / 2015-A00927–42 and with authorization from the school directors.

Data analysis

Calculation of the number of subjects needed for the study

In the school setting, the number of subjects was calculated based on exercise 4 which needed the highest number of subjects.

Concerning the intervals between faces, our hypothesis on the means of the differences between the interval values observed and the theoretical interval values, was based on the study by Bieri et al.(Bieri et al., 1990).Accordingly, we hypothesized four means of differences: a difference of 2.3 cm for the position of face 2, a difference of 6.5 cm for the position of face 3, a difference of 4.6 cm for the position of face 4 and a difference of 6.4 cm for the position of face 5.

The common standard deviation was estimated at 5 cm. According to these hypotheses and based on a single factor ANOVA, a 0.05 alpha risk, and 90% power, 32 subjects per interval needed to be included, i.e. inclusion of 128 subjects per age group. Based on the assumption of 10% non-evaluable subjects, 141 subjects were therefore required per age group, i.e. a total number of 423 subjects.

This number was compatible with an expected proportion of 60% of children with a 10% precision (objective of exercise1), and an estimated kappa coefficient of 0.8 with 10% precision (exercise objective 5). The expected proportions for exercise objectives 2 and 3 required fewer subjects.

In the hospital setting (pediatric emergency department), it was decided to include 60 children for this pilot study, with an equal distribution over the three age groups (20 children/group) of 4–6 years, 7–9 years, and 10–12 years.

Statistical analyses

The qualitative variables were described as percentages with confidence intervals. The quantitative variables were described as mean ± standard deviation, or median and interquartile range. The study results were analyzed by age group (4-6 years; 7–9 years; 10–12 years) as in the study of Hicks (Hicks et al., 2001).

The specific objectives of exercises 1, 2, and 3 were analyzed using proportions and their confidence intervals.

Objective 1 was validated if the proportion of children at school confirming that the 6 faces scale expressed fear was at least 60%. The proportions observed in exercise 1 were compared with a theoretical distribution (25% for each category) using a Chi-squared test.

Objective 2 was validated if the proportion of children at school correctly ranking the faces expressing fear in descending order was at least 60% for kindergarten aged children and 80% for primary school aged children.

Objective 3 was validated if the proportion of children successfully identifying the faces expressing the most fear among the 15 pairs presented was at least 60% for pre-school aged children and 70% for the primary school aged children.

Objective 4: the means of the quantitative intervals of the scale levels were compared with the theoretical means using analysis of variance. In the event of overall significance, pairwise comparisons were performed by *post-hoc* comparisons (Fisher's predicted least-square difference [PLSD]).

Objective 5: the concordance between the evaluated levels of fear using the six-face scale for six situations between Phase 1 (Day 0) and Phase 2 (Day 15) was estimated by a weighted Cohen's kappa coefficient and its 95% confidence interval.

In the hospital setting, the proportion of children who successfully evaluated their fear using the six-face scale was presented with its 95% confidence interval. The concordance between the child's self-assessment of fear and the proxy assessment by caregiver 1 and caregiver 2 was determined by a weighted Cohen's kappa coefficient and its 95% confidence interval. The concordance of the proxy assessment of the child's fear between caregivers 1 and 2 was also determined by a weighted Cohen's kappa coefficient and its 95% confidence interval.

Results were considered to be moderate if they were between [0.40–0.60] and high if they were between [0.60–0.80] (Landis & Koch, 1977).

Results

A consensus was reached concerning the design and construction of the scale.

Results of psychometric assessment in the school setting

A total of 484 children aged from 4 to 12 years (mean age 7.57 years ±2.13) were included over 3 months in seven schools. Themean age per age group was 5.05 years (±0.77) in the 4–6 years group, 8.09 years (±0.76) in the 7–9 years group, and 10.29 years (±0.51) in the 10–12 years group.

All the children performed five exercises at phase 1. At phase 2, fifteen days later, exercise 5 was repeated.

A total of 467 children participated in the study until its end (17 children were sick).

Results of exercise 1:

Of the 483 children (99.79%) who performed this exercise, 57.64% (95%CI [53.22–62.21]; $p < 0.0001$) identified fear on the faces of the scale, 19.83% pain, 11.57% surprise and 10.74% sadness.

For each emotion, there was no significant difference according to the age group (Fig. 2). One child did not want to answer.

Results of exercise 2:

Of the 484 children (100%) who participated in this exercise, 324 (66.94%) successfully ranked the six faces in a descending order of fear intensity. The success rate was higher as age increased. For the 4–6 years: 47.2% of success (95%CI [33.24–50.87]), for the 7–9 years: 76.2% and 10–12 years: 78.7% of success (95%CI [71.27–80.40]). Of the 95 children who had mistaken two faces, 56 had inverted faces 5 and 6.

Results of exercise 3:

The exercise was carried out by 97.3% of children (98.2% ($N = 162$) aged 4–6 years, 98.1% ($N = 202$) aged 7–9 years and 94.7% ($N = 107$) aged 10–12 years).The face expressing the greatest fear was successfully distinguished by over 85% of the 4–6 years and over 92% for the 7–9 and 10–12 years for 14 pairs of faces. The last pair (Face 5 - Face 6) gave a score of 67.3% ($N = 326$) success in the overall population. Success was higher for this pair as age increased (4–6 years: 57.6%, 7–9 years: 71.8% and 10–12 years: 73.4%).

The results are presented in the overall population in Fig. 3.

Results of exercise 4:

All the children participated in this exercise. For each of the four faces, the number of children who placed the faces within the expected interval ranged from 432 (89.2%; face 3) to 447 (92.3%; face 5). The mean distance (in cm) for each face was within the expected interval. Additionally, the mean interval between the mean positions of the faces was 4.7 cm (Table 1).

Results of exercise 5:

This exercise was performed by 91.1% of children (91.5% ($N = 151$) of the 4–6 years group, 91.2% ($N = 188$) of the 7–9 years group and 90.3% ($N = 102$) of the 10–12 years group). Concordance scores are presented in (Table 2) for each fear situation and age group. Concordance scores were moderate to high.

The fear of needles had a high concordance score in each group (overall population 0.65 [0.60–0.70]).

Results of feasibility assessment in a hospital setting

Sixty children (mean age 7.82 years±2.49) were included in the pediatric emergency department. Forty-one (68.3%) children had already consulted in a pediatric emergency care department. Fifty-seven (95%) children managed to self-assess their fear level. There was little concordance between the self-assessment of fear by the children and the assessment by caregiver 1 (wk = 0.36) and that of caregiver 2 (wk = 0.44). The assessment by the two caregivers was highly concordant (wk = 0.69). The mean pain score was 3.28 (±2.56). The mean fear

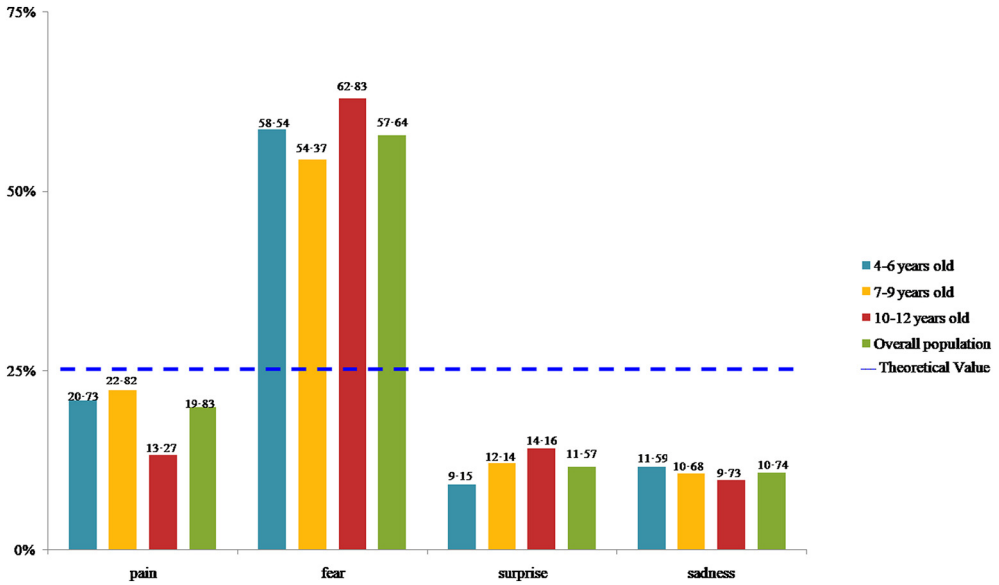

Fig. 2. Comparison of the proportions obtained for each emotion in the overall population and by age group compared to the theoretical intervals (chance).

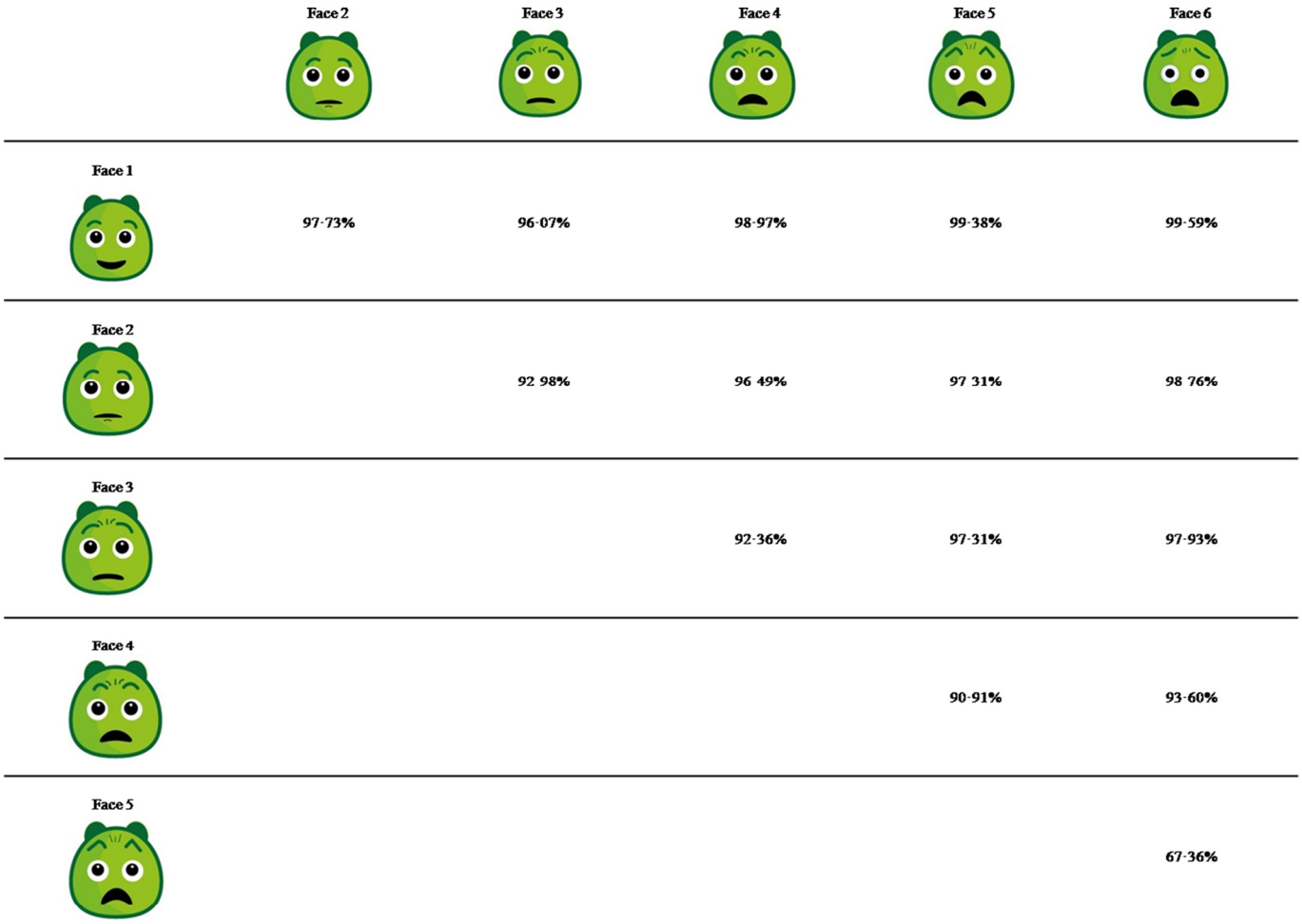

Fig. 3. Percentage of success in discriminating faces expressing the greatest fear among 15 combinations in the overall population.

score was 1.75 (±2.62). These scores are weakly correlated (wk = 0.33) but in a statistically significant manner ($p < 0.0112$).

Discussion

The aim of our study was to develop and validate a self-assessment fear scale. Our results made it possible to validate the psychometric properties of the "Scary Scale" in a school setting and its feasibility ina hospital setting in children aged from 7 to 12 years. While the management of pain is now well codified, in particular with the use of pain assessment scales, scales for fear assessment are not widely used. Indeed, in 2011, McMurtry et al. tested a fear self-assessment scale, Children's Fear Scale (CFS), which was limited to a single context of procedural pain(McMurtry et al., 2011). The CFS is based on the Faces Anxiety Scale (FAS) (McKinley et al., 2003; McKinley & Madronio, 2008) to measure anxiety or fear. The Children's Fear Scale is not exclusively a fear scale. In McMurtry's study, the FAS was reduced to 5 faces to match with another scale (Children Anxiety and Pain Scale CAPS (Kuttner & Lepage, 1989)). The score of the CFS ranged from 0 to 4. It was not as widely distributed (221 citations in Google Scholar since 2011) as the issue warranted because of three main limitations: high graphic similarity with the Faces Pain Scale-Revised (FPS-R) (Hicks et al., 2001) that can induce caregiver confusion in its use, difficulties rating with a scale built with 5 faces instead of 6, resulting in different ratings (0–4 with CFS versus 0–10 with pain scales as FPS-r, VAS) and confusion of anxiety and fear that are two different concepts. Anxiety and fear are two closely related concepts and can be confused. Unlike fear, anxiety is a vague and unsettling feeling whose source is often nonspecific or unknown to the individual (Ackley et al., 2019). When asked, children are capable of stating the object of their fear (Salmela et al., 2009).

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To avoid the same pitfall, we sharply differentiated the graphic design of our scale from those of pain scales. We have confirmed the choice of a scale with faces since, for the assessment of pain, children seem to have a preference for scales with faces (Brahimi et al., 2022). This is because the measurements with these scales are concrete and suitable for young children who do not need to know how to count to use them (McGrath et al., 2009). Using a self-assessment scale would serve to identify, objectivate fear and make it real. It is known that children can answer yes or no to familiar objects (Fritzley & Lee, 2003), but, what about an emotion? For information, fear is a distressing emotion caused by an impending danger or pain, whether the threat is real or imagined (Ackley et al., 2019). We thus hypothesized that this method would be better than asking the children, "do you feel fear? Yes or no?"

Table 1
Success (number, percentage and average distance) in positioning the faces within the expected interval [every 5 cm ±2].

	Number	Percentage (%)	Mean distance (cm)
Face 2	440	90·9	6·3 +/− 2·6
Face 3	432	89·2	10·8 +/− 2·6
Face 4	439	90·7	15·9 +/− 2·5
Face 5	447	92·3	20·4 +/− 2·04

Table 2
Concordance between the two fear assessments (1st assessment and 15 days later) in 6 everyday situations assessed by the Weighed Kappa coefficient and its 95% confidence interval (wk [95% CI]) in the overall population and then in each age group.

	Overall population	4–6 years old	7–9 years old	10–12 years old
1. Fear of water (sea / pool)	0·53 [0·43–0·59]	0·46 [0·34–0·58]	0·62* [0·54–0·70]	0·62* [0·54–0·70]
2. Fear of dark – darkness	0·52 [0·46–0·58]	0·40 [0·28–0·51]	0·54 [0·45–0·63]	0·66* [0·56–0·75]
3. Fear of needle	0·64* [0·59–0·69]	0·62* [0·53–0·72]	0·65* [0·57–0·73]	0·60* [0·50–0·70]
4. Fear of dogs	0·58 [0·50–0·66]	0·45 [0·29–0·61]	0·58 [0·46–0·70]	0·77* [0·67–0·87]
5. Fear of the storm	0·56 [0·50–0·62]	0·46 [0·35–0·58]	0·62* [0·54–0·70]	0·58 [0·46–0·69]
6. Fear of spiders	0·63* [0·57–0·68]	0·50 [0·39–0·61]	0·68* [0·61–0·75]	0·72* [0·64–0·80]

* [0.60–0.80] = high agreement. [0.40–0.60] = moderate agreement.

because some children would lack the abstraction capability to numerically evaluate fear (Siegler et al., 2010).

We designed a fear scale, based on the work by Ekman (Ekman & Friesen, 2002; Ekman & Friesen, 2003) with six faces in order to be consistent with the pain assessment scales. A common metric system enabled the use of conventional and universal language for evaluating the scores (Hicks et al., 2001). To achieve its wide use, the Scary Scale is neutral in terms of gender, ethnic origin and emotional elements such as tears and smiling. The absence of tears and smiles gives better assessments (Tomlinson et al., 2010) and avoids certain biases such as under-assessment (HAS, 2022).

We avoided the use of pink or blue colors, which, in the collective subconscious, symbolize girls and boys, respectively. In European culture and more widely in Western culture, the color green has two dimensions: a negative one suggesting fear and a positive one suggesting calm, nature and reassurance (Pastoureau, 2014). The green color of our faces suggested fear without triggering it.

Validating the psychometric properties of a scale is a tremendous process.To achieve this aim, we used the same criteria for validating the psychometric properties as those used to validate the Face Pain Scale in the Bieri et al. study (Bieri et al., 1990) (FPS-R is the Gold Standard for assessing children's pain score).

We modeled our study on five properties. Each exercise provided a supplemental element of validation.

- The purpose of exercise 1 was to confirm that the graphics of our scale really express fear. In this exercise, like Bieri et al. who has validated with 57.9%, we had set an objective that 60% of the children would identify fear among three other emotions with which it can be confused: pain, sadness and surprise. Our results were very close to the objective (57.64%). The responses of the children were not due to chance ($p < 0.0001$) but were consistent with their choice.
- The purpose of exercise 2 was to assess the intensity gradient in the expression of fear on the six faces. In this exercise, similar to Bieri et al., we had set an objective that 60% of the 4–6 year-olds and 80% of the 7–9 and 10–12 year-olds would rank the faces in descending order. Our results were very close to our objective for the 7–9 and the 10–12 year-olds. The 4–6 year-olds did not reach the set objective, particularly with regard to distinguishing intermediate nuances (Besenski & Forsyth, 2007; Decruynaere et al., 2009; Emmott et al., 2017) due to their intellectual maturity level (Besenski & Forsyth, 2007; Chan & Von Baeyer, 2016; Siegler et al., 2010). The failure to achieve this objective led us to exclude the 4–6 year-olds from the rest of the discussion.
- The purpose of exercise 3 was to assess that faces were different from each other, specifically when they follow one after the other (e.g.: Face 1 - Face 2; Face 2 - Face 3, etc.). In this exercise, we had set an objective that 70% of the 7–9 and 10–12 year-olds would discriminate the face expressing the greatest fear for each pair. The objective was achieved.
- The purpose of exercise 4 was to determine whether the intensity between the faces increased equally. In this exercise, we had set an objective that the children would have positioned the faces in the right place (>89%) and equally (4.7 cm). We consider that the objective of 5 cm is validated. Our scale is well-calibrated.
- The purpose of exercise 5 was to assess the reproducibility of our scale, i.e. the ability of a person to self-assess in the same way at two different times. In this exercise, we had set an objective that the reproducibility of assessment of real life situations triggering fear would be moderate to high for 7–9 and 10–12 year-olds. This objective was achieved.

Our scale is hence validated through the 7–12 year-olds' validation of the five psychometric properties.

With regard to the evaluation of the clinical application and contextualization of the scale in the hospital, among the children who were recruited in the pediatric emergency department ($N = 60$), 95% ($N = 57$) were able to identify their fear level (expected threshold of 80%). 5% ($N = 3$) were unable to self-assess the level of fear or of pain. This difficulty was attributed to the immaturity of these children and not to problems understanding the instructions, as shown previously with the psychometric validation. Even though the 4–6 year-olds did not succeed in all the exercises, some results remain very interesting. The fear self-assessment scale may still be used depending on the degree of intellectual maturity. A simplified version of the Scary Scale would need to be developed for this specific age group.

We also wanted to study objectively the difference between children's self-assessment and caregivers' assessment of children's fear (subjectivity).The proxy assessments of the child's level of fear, carried out by two independent caregivers, were concordant with each other. There was little concordance, however, between each caregiver and the child's self-assessment. Using our scale, the proxy assessment of fear by the caregivers thus does not reflect the child's feelings. It would therefore be preferable for the child to perform a self-assessment of fear by themselves. We could infer that our scale is clearly a fear self-assessment scale and not a proxy assessment scale. It would be interesting, as for the pain scale, to develop a proxy assessment fear scale.

To be well-accepted and used in routine care, a scale must be approved by both children and caregivers. Our scale is play-based and easy to use by children. The feedback of pediatric caregivers after using this scale showed a high level of compliance.

Limitations and perspectives

The 4 to 6-year-olds failed to reach the set objectives, though some of the results remain very interesting. The fear self-assessment scale may still be used depending on the degree of intellectual maturity, or, alternatively, we can also consider a new study for validating a simplified version of the Scary Scale aimed at providing an age-appropriate fear self-assessment tool for these children.

As our objective was to validate the Scary Scale, in this study, we wanted to specifically address the topic of fear as there are still few studies on fear in children. We only sought to study the link between fear and pain at admission to the pediatric emergency department. We did

not consider anxiety in this pilot study ($n = 60$ children). Pain is well-evaluated with validated scales, while anxiety and fear are not systematically identified and treated in routine. Further research could study more specifically the link between pain - fear and anxiety in children undergoing care situations. To assess the universal potential of the scale, studies with larger numbers of participants and in different areas are needed.

In the hospital, children may be confronted with many situations of care (venipuncture, suture, dressings, radiological exams, surgical procedures, etc.) that can cause several mixed emotions. Pain, anxiety and fear are the most frequently experienced by the children.

If caregivers fail to assess children's fear, they remain trapped in their fear. This is a matter of true concern, because underestimating fear can lead to complicated situations where caregivers use restraints (Brenner, 2007; Svendsen et al., 2017) and misuse pain killers. These situations are very traumatic to the children, their families and also the caregivers. It is essential to establish a relationship of trust in the child – parents – caregivers triad by taking a few minutes before any care to meet the child, explain the procedure and assess the child's degree of fear with the Scary Scale. The caregiver can then use appropriate play materials to provide additional information. The care will be made less dramatic and the child will become actor of the situation. If the child is cooperative, the use of restraint will no be required.

For all these reasons, we propose the use of the Scary Scale in combination with pain assessment as soon as the caregivers identify behavioral components such as crying, screaming, avoidance, etc. This combined assessment, will help to better differentiate between the diagnosis of fear and pain and allow nurses to adapt their medication and distraction strategies.

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CRediT authorship contribution statement

S. Thurillet: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Visualization, Funding acquisition. **C. Bahans:** Writing – original draft, Writing – review & editing. **C. Wood:** Writing – original draft, Writing – review & editing. **S. Bougnard:** Conceptualization, Investigation. **A. Labrunie:** Software, Formal analysis. **V. Messager:** Investigation. **J. Toniolo:** Writing – review & editing. **P. Beloni:** Conceptualization, Methodology, Investigation, Writing – original draft, Funding acquisition. **L. Fourcade:** Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

All authors have no conflict to declare.

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Appendix A. Supplementary data

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References

Ackley, B., Ladwig, G., Makic, M. B., Martinez-Kratz, M., & Zanotti, M. (2019). *Nursing diagnosis handbook. An evidence-based guide to planning care* (12th éd.). Mosby.

Besenski, L. J., & Forsyth, S. J. (2007). *Screening young children for their ability to use self-report pain scalesVol. 9(1). (pp. 7), 7.*

Beyer, J. E., Turner, S. B., Jones, L., Young, L., Onikul, R., & Bohaty, B. (2005). The alternate forms reliability of the Oucher pain scale. *Pain Management Nursing: Official Journal of the American Society of Pain Management Nurses*, *6*(1), 10–17. https://doi.org/10.1016/j.pmn.2004.11.001.

Beyer, Judith E, et al. (1992). The creation, validation, and continuing development of the oucher: A measure of pain intensity in children. *Journal of Pediatric Nursing: Nursing Care of Children and Families*, *7*, 335–346. https://doi.org/10.5555/uri:pii:0882596392900426.

Bieri, D, et al. (1990). The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: development, initial validation, and preliminary investigation for ratio scale properties. *Pain*, *41*, 139–150. https://doi.org/10.1016/0304-3959(90)90018-9.

Binet, A. (1895). *Fear in childrenVol. 2. (pp. 223–254), 223–254.*

Brahimi, L., Wood, C., Benkerrou, M., Vieyra, M., Bourillon, A., & Vilmer, E. (2022). Prospective study of the use of two pain assessment tools the visual analogue scale (VAS) and the face scale (FPS) in school-aged children with sickle cell disease-Pediadol. Retrieved fromhttps://pediadol.org/etude-prospective-de-lutilisation-de-deux-outils-devaluation-de-la-douleur-lechelle-visuelle-analogue-eva-et-lechelle-des-visages-fps-chez-lenfant-drepanocytaire-dage-scolaire/ Accessed August 30, 2017.

Brenner, Maria (2007). Child restraint in the acute setting of pediatric nursing: an extraordinarily stressful event. *Issues Compr Pediatr Nurs*, *30*, 29–37. https://doi.org/10.1080/01460860701366658.

Chan, J. Y. -C., & Von Baeyer, C. L. (2016). Cognitive developmental influences on the ability of preschool-aged children to self-report their pain intensity. *Pain*, *157*(5), 997–1001. https://doi.org/10.1097/j.pain.0000000000000476.

Copper-Royer, B. (2013). *Fear of the wolf, fear of everything.* Albin Michel.

Dantzer, R. (1993). The psychobiology of fear. *Communications*, *57*(1), 25–34. https://doi.org/10.3406/comm.1993.1864.

Decruynaere, C., Thonnard, J. -L., & Plaghki, L. (2009). How many response levels do children distinguish on faces scales for pain assessment? *European Journal of Pain (London, England)*, *13*(6), 641–648. https://doi.org/10.1016/j.ejpain.2008.07.004.

Ekman, P., & Friesen, W. V. (2002). *Investigator's guide to the facial action coding system (FACS).*

Ekman, P., & Friesen, W. V. (2003). *Unmasking the face: A guide to recognizing emotions from facial expressions (Malor books).*

Emmott, A. S., West, N., Zhou, G., Dunsmuir, D., Montgomery, C. J., Lauder, G. R., & Von Baeyer, C. L. (2017). Validity of simplified versus standard self-report measures of pain intensity in preschool-aged children undergoing venipuncture. *The Journal of Pain: Official Journal of the American Pain Society*, *18*(5), 564–573. https://doi.org/10.1016/j.jpain.2016.12.015.

Foster, R. L., & Park, J. (2012). An integrative review of literature examining psychometric properties of instruments measuring anxiety or fear in hospitalized children. *Pain Management Nursing: Official Journal of the American Society of Pain Management Nurses*, *13*(2), 94–106. https://doi.org/10.1016/j.pmn.2011.06.006.

Fritzley, V. H., & Lee, K. (2003). Do young children always say yes to yes-no questions? A metadevelopmental study of the affirmation bias. *Child Development*, *74*(5), 1297–1313. https://doi.org/10.1111/1467-8624.00608.

Garber, S., Garber, M., & Spizman, R. (1997). *Your child's fears. How to help him/her overcome them.* Odile Jacob.

Garra, G., Singer, A. J., Taira, B. R., Chohan, J., Cardoz, H., Chisena, E., & Thode, H. C. (2010). Validation of the Wong-baker FACES pain rating scale in pediatric emergency department patients. *Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine*, *17*(1), 50–54. https://doi.org/10.1111/j.1553-2712.2009.00620.x.

HAS (2022). Hight authority of health (French:Haute Autorité de Santé) - Evaluation and strategies for the management of acute pain in ambulatory care in children aged 1 month to 15 years. Retrieved fromhttps://www.has-sante.fr/portail/jcms/c_272030/fr/evaluation-et-strategies-de-prise-en-charge-de-la-douleur-aigue-en-ambulatoire-chez-l-enfant-de-1-mois-a-15-ans Accessed April 3, 2019.

Henderson, V. (1997). *Basic principles of nursing care.* American Nurses Association.

Hicks, Carrie L, von Baeyer, Carl L, Spafford, Pamela A, van Korlaar, Inez, & Goodenough, Belinda (2001). The Faces Pain Scale-Revised: toward a common metric in pediatric pain measurement. *pain*, *93*, 173–183. https://doi.org/10.1016/S0304-3959(01)00314-1.

Huskisson, E. C. (1974). Measurement of pain. *Lancet (London, England)*, *2*(7889), 1127–1131. https://doi.org/10.1016/s0140-6736(74)90884-8.

International Association for the Study of Pain (2022). *IASP terminology - Pain definition.*

Kuttner, L., & Lepage, T. (1989). *Face scales for the assessment of pediatric pain: A critical reviewVol. 21(2). (pp. 198–209), 198–209.*

Landis, J., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*, 159–174. https://doi.org/10.2307/2529310.

Marchand, S. (1998). *The phenomenon of pain. Understanding for better care.* Masson.

McGrath, P. J., Latimer, M., Finley, G. A., & Chambers, C. T. (2009). Measurement of pain in children. *Pain Research & Management: The Journal of the Canadian Pain Society*, *14*(1), 11. https://doi.org/10.1093/ptj/84.6.560.

McKinley, S., Coote, K., & Stein-Parbury, J. (2003). Development and testing of a faces scale for the assessment of anxiety in critically ill patients. *Journal of Advanced Nursing*, *41*(1), 73–79.

McKinley, S., & Madronio, C. (2008). Validity of the faces anxiety scale for the assessment of state anxiety in intensive care patients not receiving mechanical ventilation. *Journal of Psychosomatic Research*, *64*(5), 503–507. https://doi.org/10.1016/j.jpsychores.2008.02.002.

McMurtry, C. M., Noel, M., Chambers, C. T., & McGrath, P. J. (2011). Children's fear during procedural pain: Preliminary investigation of the Children's fear scale. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, *30*(6), 780–788. https://doi.org/10.1037/a0024817.

Pastoureau, M. (2014). *Green: The history of a color.* Princeton University Press.

Petitcollin, C. (2003). *Emotions, user's guide.* Jouvence.

Pilon, C. (1999). *Relieve the child's pain.* Hôpital Sainte Justine.

Salmela, M., Salanterä, S., & Aronen, E. (2009). Child-reported hospital fears in 4 to 6-year-old children. *Pediatric Nursing, 35(5), 269-276*, 303.

Siegler, R. S., DeLoache, J. S., & Eisenberg, N. (2010). *How children develop* (3rd ed.). Worth Publishers.

Streiner, D. L., & Norman, G. R. (2003). *Health measurement scales. A practical guide to their development and use* (3rd éd.). Oxford University Press.

Svendsen, E. J., Pedersen, R., Moen, A., & Bjørk, I. T. (2017). Exploring perspectives on restraint during medical procedures in paediatric care: A qualitative interview study with nurses and physicians. *International Journal of Qualitative Studies on Health and Well-Being*, *12*(1), 1363623. https://doi.org/10.1080/17482631.2017.1363623.

Testu, F., Bréchon, G., Clarisse, R., Fontaine, R., & Le Floc'h, N. (2008). *Life rhythms and school rhythms.* Elsevier Masson.

Tomlinson, D., Von Baeyer, C. L., Stinson, J. N., & Sung, L. (2010). A systematic review of faces scales for the self-report of pain intensity in children. *Pediatrics*, *126*(5), e1168–e1198. https://doi.org/10.1542/peds.2010-1609.

Von Baeyer, C. L. (2006). Children's self-reports of pain intensity: Scale selection, limitations and interpretation. *Pain Research & Management: The Journal of the Canadian Pain Society*, *11*(3), 157–162. https://doi.org/10.1155/2006/197616.

Yeh, C. -H. (2005). Development and validation of the Asian version of the oucher: A pain intensity scale for children. *The Journal of Pain: Official Journal of the American Pain Society*, *6*(8), 526–534. https://doi.org/10.1016/j.jpain.2005.03.002.