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Caregiver accuracy in detecting deception in facial expressions of pain in children

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### Caregiver accuracy in detecting deception in facial expressions of pain in children

Facial expressions provide the most sensitive and specific source of nonverbal information in pain assessment [33]. In pediatric pain assessment, interpreting facial expressions is an essential tool to aid in discerning the presence of pain. Despite a low estimated incidence of deception in pain assessment, there are circumstances under which patients may attempt to conceal their pain, particularly if they associate negative consequences with reporting pain [3,21].

Previous research has employed facial coding to illustrate specific differences between genuine and manipulated expressions of pain; however, it is not clear whether judges are adept at noticing these cues [4,13]. Hadjistavropoulos and colleagues [11] found that untrained judges were able to classify adult's expressions as displaying either pain, no pain, masked, or exaggerated pain at a level greater than chance, and that participants' confidence in their decisions were generally consistent with their accuracy. However, participants still made many mistakes, particularly in distinguishing between genuine and masked expressions [11].

There is evidence that children also can manipulate their facial expressions of pain. Larochette and colleagues [18] examined healthy children's abilities to successfully suppress and fake facial expressions of pain. Children were not able to convincingly fake pain expressions, and their parents were generally accurate in detecting when their child was genuinely experiencing or faking pain. However, children were able to successfully suppress their expressions of pain, such that their parents had considerable difficulty distinguishing the suppressed condition from a neutral (baseline) expression [18]. This is concordant with previous research showing that cues that would allow discerning of masked expressions of pain are subtler than those in faked expressions [13]. Interestingly, children also reported that they often hid their pain in real life, while they reported rarely faking pain [18].

The fact that parents have difficulty identifying when their children are hiding pain has important implications for pain assessment, though no research to date has compared the ability of different caregiver groups

to detect deception in children's facial expression of pain. Previous research has shown that parents are generally more accurate in assessing children's pain than health professionals [28,29].

The primary purpose of the present study was to compare accuracy of caregivers (i.e., pediatricians, pediatric nurses, and parents) in detecting genuine, faked, and suppressed facial expressions of pain in children using a judgment study paradigm [26]. Judgment studies examine how the interpretation of nonverbal behaviour can differ based on the personal characteristics of the judges and the presentation of the behaviour itself, and allows for strong power to examine group differences with small sample sizes [26]. Consistent with previous research, it was expected that parents would exhibit the best accuracy in detecting deception in children's expressions of pain, followed by nurses and pediatricians [28,29]. Secondary objectives were to examine caregivers' confidence in their judgments, the agreement of the caregivers' ratings of the child's experienced pain with the child's self-report of pain, and the facial cues caregivers used in making their judgments. It was expected that caregiver accuracy would be consistent with ratings of confidence in decisions [11,16]. The agreement between parents' ratings of the children's pain and the children's own self-reports of pain was expected to be higher than nurses' and pediatricians' agreement [29].

## **Methods**

### **Participants**

Caregivers were recruited to participate if they were a pediatrician, pediatric nurse, or parent. As the nature of the study involved watching video clips and answering written questions, eligible participants had no vision impairments that were not corrected for by use of glasses or contact lenses, and all were comfortable answering written questions in English. Pediatricians and nurses were eligible to participate regardless of parental status, so long as they did not have a child who had previously completed a cold pressor study. Pediatricians and pediatric nurses were recruited through a variety of methods, including postings on a pediatric hospital employee intranet site, targeted emails to department heads for distribution to staff, study advertisements on hospital units, and

presentations at hospital staff meetings. Parents were eligible to participate if they currently had at least one child aged 8-12 years, were not employed as a health care professional, had not received medical training, and had never observed their own child completing the cold pressor task. Parents were recruited through community advertisements, a database of past participants from our laboratory who had consented to be contacted about future research opportunities, and through participants in other studies ongoing in our laboratory.

Forty-five individuals participated in the present study (15 pediatricians, 15 pediatric nurses, 15 parents). Demographic information for each of the three caregiver groups is presented in Table 1. The nurses and pediatricians all worked in a pediatric tertiary care hospital and represented a wide range of specialties and units. Pediatricians represented cardiology, gastroenterology, hematology, oncology, neurology, respirology, rheumatology, and perinatal care. Nurses represented the cerebral palsy clinic, emergency department, medical-surgical neurosciences unit, oncology, nephrology, orthopedics, pediatric pain management team, and the pediatric medical unit.

### **Procedure**

All participants were shown the same 48 videos clips, each displaying a child's facial expression from one of the four experimental conditions (genuine, faked, suppressed, neutral) (see detailed description of video stimuli below). Videos were presented on a Toshiba PortégéR600 laptop computer with a 12.1" screen. For ease of participant recruitment, participation took place either in the research laboratory ( $n=36$ ) or at various locations throughout the hospital ( $n=9$ ; offices, conference rooms, etc.). To ensure that the study protocol remained the same for each participant regardless of location, locations were inspected by a researcher to ensure privacy and lack of distractions, and to protect the privacy of the children in the videos. Participants were given an explanation of the study and the task involved, asked to provide informed consent, and completed a demographics questionnaire.

Before viewing the videos, a researcher explained the four conditions participants would be viewing and how pain was induced for the genuine and suppressed conditions (i.e., having the child submerge their hand in cold water), and they were given the opportunity to ask questions for clarification. Participants also were given a reference sheet that included a description of each condition, which they could refer to while completing the task.

Participants were then shown the 48 video clips one at a time. Video clips were of ten seconds duration and followed by a blank screen lasting 5 seconds, to allow participants time to pause the video and complete the questions. After each clip, participants were asked to: 1) identify which condition they thought they had viewed; 2) rate how confident they were in their decision; and 3) rate how much pain they believed the child was actually feeling. Participants had as much time as they needed to complete each of the questions, but could only view each video clip once. The judgment procedure took approximately 20-30 minutes. After having viewed all 48 clips, participants completed an open-ended questionnaire which asked them to list all facial cues they had employed in making their decision for each of the four conditions.

A \$10 donation was made on behalf of each participant to the hospital's charitable foundation, and parents received \$5 to assist with parking and transportation costs. As pediatricians and nurses were not traveling from outside the health centre and were participating on breaks or before/after their work shifts, they were offered a hot drink and snack as compensation. Ethical approval for this study was obtained from the Research Ethics Board of the IWK Health Centre.

### **Video Stimuli**

The video stimuli used in the current study were recorded during a study conducted by Larochette and colleagues [18], in which children provided genuine, faked, suppressed, and neutral expressions. Video clips were selected from those children in the Larochette et al. study whose parents had consented to use of their child's video in subsequent research projects. In total, 48 video clips were selected, including 12 different children (50% girls) each displaying the four facial expression conditions. This number of video clips was determined to provide

sufficient exposure to each of the four conditions, without producing fatigue effects. To ensure a representative sample of pain reactivity, children were randomly selected through stratified sampling based on whether the child was coded using the Facial Action Coding Scheme as displaying mild ( $n=4$ , 50% girls), moderate ( $n=4$ , 50% girls), or severe ( $n=4$ , 50% girls) facial reactivity to pain in relation to the entire sample of children while completing the cold pressor task (i.e., the genuine pain condition).

Larochette et al. [18] provided a complete description of children's participation in the four conditions. Briefly, video clips of the genuine condition displayed children's initial facial expressions as they completed the cold pressor task, which is a safe and ethically acceptable method of inducing pain comparable to an acute somatic clinical pain in an experimental setting [1,32]. Children always completed the genuine condition first, then the suppressed and faked conditions followed in a counterbalanced order. Video clips of the suppressed condition displayed children as they completed the cold pressor task under the same conditions as the genuine condition, but they were asked to hide their expression of pain on their face. Video clips of the faked condition displayed children as they placed their hand in warm water, but they were instructed to show an expression of pain on their face. Video clips of the neutral condition displayed the children while they were not experiencing any pain and were not being instructed to manipulate their expressions in any way, which was intended to capture the child's baseline, neutral facial expression.

The video clips presented to participants were silent and were cropped to display the first ten seconds of the child's facial expression in each of the conditions. As considerable nonverbal information can be pulled from facial cues in less than a second, and it has been shown that facial movements are most salient at the onset of painful experiences, the initial 10 seconds of each trial were deemed to provide sufficient information to participants to make their decisions [5,26].

The 48 video clips were presented to participants in one of five possible sequences, which were randomly assigned to the participant using a random number generator, to eliminate the possibility of order effects. Each

sequence contained the same 48 video clips, comprised of the 12 children in each of the four experimental conditions. Participants were not informed that they would be viewing all four conditions from each child. To reduce the likelihood of participants making a comparison between videos of the same child, rather than making their judgment solely on the video clip just viewed, the sequences of videos were quasi-randomized with the condition that the same child was never seen twice in a row.

### **Measures**

**Accuracy.** After watching each video clip, participants indicated which condition they thought they were viewing during the video clip by circling on a scoring sheet one of the four possible responses (genuine, faked, suppressed, neutral). A total accuracy score was determined for each condition by calculating the percentage of video clips in which the experimental condition was correctly identified by the participant. Thus, correctly identifying the condition of every video clip viewed would yield a total accuracy score of 100%, and a score above 25% would be considered better than chance.

**Confidence.** Participants indicated how confident they were that they had correctly identified the condition in the video clip they had just viewed. Confidence was rated on a Likert scale of zero (not confident at all) to 10 (extremely confident).

**Pain ratings.** Participants indicated how much pain they believed the child was actually feeling using the Faces Pain Scale – Revised (FPSR; [12]). Participants were reminded that they were to use the FPS-R to rate how much pain they believed the child was actually feeling, and not to match the facial expression in the video clip to the images on the FPS-R. As the children in the original study by Larochette et al. [18] also provided pain ratings using the FPS-R following the genuine, faked, and suppressed conditions, this data was used to examine how frequently there was agreement between caregiver and child pain ratings (i.e., whether a caregiver’s rating of a child’s pain matched the child’s self-report), how frequently caregivers underestimated the child’s pain (i.e., the



caregiver rated the child's pain as being lower than the child's self-report), and how frequently caregivers overestimated the child's pain (i.e., the caregiver rated the child's pain as being higher than the child's self-report).

**Facial Cues.** After participants had finished watching all 48 video clips, participants were given an open-ended questionnaire asking them to list which facial cues they had used in making their decisions for each of the four conditions. For example, participants were asked "When you thought that a child was genuinely experiencing pain, were there any specific facial cues you used to make your decision?", with subsequent questions inquiring about facial cue use in the faked, suppressed, and neutral conditions.

Responses to the facial cue questionnaire were coded by the first author (KEB) using a coding scheme that was developed based on work by Hill and Craig [14], which examined participant's spontaneous reporting of facial cues in adults in the same four conditions and grouped cues according to muscle group or conceptual similarity. The final coding scheme included the following codes: eyes (sub-codes for blinking, closed, widening, wincing, other); gaze toward the camera; gaze away from the camera; gaze towards the source of pain; gaze away from the source of pain; eyebrow movements; mouth (sub-codes for smiling, smirking, biting lip, thin lips, tightening, opening, other); laughing; breathing patterns; shaking; vocalizations; shock; relaxed; tension; repressed expression; pain expression; exaggerated; incongruent facial actions; involuntary movements; sudden movements; change in expression; temporal sequence of cues; listing a cue that is absent. Twenty percent of participants' responses were double-coded by a second rater, and excellent inter-rater reliability was found with 97% agreement.

## Results

### Demographics

Key demographic variables and group difference statistics are reported in Table 1. Group differences in major demographic variables were examined using a series of one-way analysis of variance (ANOVA) and t-tests for continuous variables, and chi-square analyses (or Fisher's exact test when the assumption of expected

frequencies was violated) for categorical variables. As shown in Table 1, pediatricians were more likely to be men and older than either parents or nurses, though pediatricians and nurses did not differ on years of experience as a pediatric health professional. Pediatricians and parents were more likely to have children than nurses. More nurses reported receiving formal education in pediatric pain during their training than pediatricians, though the two groups did not differ on whether they had received continuing education about pediatric pain during their careers (e.g., workshops, conferences, educational seminars). Nurses rated their current knowledge of pediatric pain assessment higher than pediatricians, though this difference was not statistically significant.

### **Order Effects**

As participants were randomly assigned to view one of five possible sequences of video clips, a one-way ANOVA was conducted to determine whether accuracy or confidence differed based on which sequences was viewed. Results revealed no significant differences between sequences viewed on overall participant accuracy,  $F(4,40)=.591, p=.671$ , or confidence  $F(4,40)=1.849, p=.138$ , indicating that no order effects were present.

### **Judgment Accuracy**

The mean frequency of each possible response for each condition is presented in Table 2; inspection permits an understanding of accuracy and errors in judgment. There was no difference between caregiver groups in how frequently they used each condition label (see Table 2 for one-way ANOVA). However, there was a significant difference between conditions, in that caregivers responded that video clips were significantly more often from the suppressed condition than any of the other three conditions,  $F(2.49,109.40)=15.57, p=.000, \eta_p^2=.261$  (Greenhouse-Geisser correction reported for violation of assumption of sphericity). This indicates that caregivers categorized video clips as being from the suppressed condition more frequently than the other three conditions, and that this bias was consistent across caregiver groups.

A 3 (group: pediatrician vs. pediatric nurse vs. parent) by 4 (condition: genuine vs. faked vs. suppressed vs. neutral) mixed ANOVA was conducted with mean accuracy scores as the dependent variable (shown in Table 3),

with the Bonferonni test used to probe significant main effects. As the assumption of sphericity was violated (Maulchy's test  $p=.038$ ), a Greenhouse-Geisser correction and adjusted degrees of freedom are reported. A main effect of group was present,  $F(2,42)=3.36, p=.044, \eta_p^2=.138$ , in which nurses' overall accuracy was significantly greater than parent's overall accuracy,  $p=.041$ . Pediatricians' overall accuracy did not differ significantly from either nurses or parents. There was also a main effect of condition,  $F(2.48,103.94)=8.74, p=.000, \eta_p^2=.172$ , in which participant's accuracy were significantly greater when participants were viewing the faked and suppressed conditions than the genuine condition ( $p=.000$  and  $.000$ , respectively). No interaction was present between group and condition,  $F(4.95,103.94)=1.40, p=.230, \eta_p^2=.063$ .

### **Confidence in Judgments**

An additional 3 (group) by 4 (condition) mixed analysis of variance (ANOVA) was run with mean self-reported confidence in decisions as the dependent variable (shown in Table 3), with the Bonferonni test used to probe significant main effects. There were no differences between the participant groups,  $F(2,42)=.158, p=.854, \eta_p^2=.007$ . There was a main effect of condition,  $F(3,126)=14.25, p=.000, \eta_p^2=.253$ , in which participants were more confident when viewing the genuine and faked conditions than the suppressed ( $p=.018$  and  $.000$ , respectively) and neutral conditions ( $p=.008$  and  $.000$ , respectively). No interaction was present between group and condition,  $F(6,126)=.494, p=.812, \eta_p^2=.023$ .

### **Pain Rating Accuracy**

Proportions of caregiver underestimation, agreement with, and overestimation of the children's pain ratings from the original study are presented for each of the three caregiver groups in Table 4. As there were no significant differences found between caregiver groups on their proportion of agreement, under- or over-estimation of pain ratings (see Table 4 for one-way ANOVA), results are summarized as follows for the entire sample (it should be noted that the present study may not have been adequately powered to detect between-group differences). When viewing children who were genuinely experiencing pain, caregivers' ratings of child's pain

matched the child's self-report in 21.1% of cases. Caregivers underestimated the child's pain in 44.8% of cases and overestimated the child's pain in 34.1% of cases. In the faked condition, caregivers' ratings of the child's pain matched the child's self-report in 49.6% of cases, and caregivers' overestimated the child's pain in 50.4% of cases. It should be noted that in the faked condition, the child's self-report of pain was always 0 on the FPS-R; therefore the caregiver's rating could not be lower than the child's own ratings. When viewing the suppressed condition, caregivers' ratings of the child's pain matched the child's self-report in 23.9% of cases, they underestimated the child's pain in 53.7% of cases, and overestimated the child's pain in 22.4% of cases.

### **Use of Cues**

Cues that were reported frequently by caregivers (>15% occurrence in any condition) are presented in Table 5<sup>1</sup>. Mouth related cues (e.g., "smiling", "biting lip", "thin lips") were frequently reported as a cue used in each of the four conditions. Eye related cues (e.g., "blinking", "widening", "squinting") were frequently reported for the genuine, faked, and suppressed conditions. Direction of child's gaze, either towards the camera or away from the camera was occasionally noted as a cue caregivers used in all four conditions.

When listing cues used for the genuine condition, caregivers occasionally indicated eyebrow movement or position as a cue, made reference to a general pain expression (e.g., "grimace"), and noted cues related to breathing (e.g., "change in breathing", "respiration increased"). Caregivers also frequently referred to the temporal sequence of events in the genuine condition (e.g., "expressions coming on suddenly", "got worse with more time") and in the faked condition (e.g., "faster change from relaxed face to showing lots of pain"). General descriptions of exaggerated movements were frequently present in the faked condition (e.g., "extreme facial gestures", "excessive movement", "overdramatic").

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<sup>1</sup> Cues that were coded but that were not reported at a frequency of >15% in any condition were as follows: gaze towards the source of pain, gaze away from the source of pain; laughing; shaking; vocalizations; shock; tension; incongruent facial actions; involuntary movements; sudden movements; change in expression.

Caregivers occasionally described the child as showing a “repressed expression” or that they were “trying to hide an expression of pain” as a cue for the suppressed condition. Caregivers often referred to cues that were absent in the neutral condition, rather than commenting on cues that were present (e.g., “no change in expression”, “lack of eye movement”, “no muscle tension”), and general descriptors of the child appearing “relaxed” were also frequently reported as a cue in the neutral condition.

### **Discussion**

The purpose of the present study was to compare the accuracy of caregivers groups in detecting deception in children’s facial expressions of pain using a series of videos depicting children showing genuine, faked, or suppressed expressions of pain, or showing a neutral face. Contrary to the initial hypothesis that parents would demonstrate the best accuracy, nurses’ accuracy of judgments was significantly better than parents, with pediatricians not differing significantly from either group. These results diverge from previous findings in which parents were more accurate in judging infant’s pain than pediatricians, with nurses not differing significantly from either [22]. Previous research has found that nurses’ assessments of children’s pain reflects the child’s exhibited behavioural distress, and that nurses often rely on nonverbal cues to make decisions about pain [2,15,19]. This may have led to nurses having had more experience interpreting facial cues, lending an explanation to their superiority in accuracy reported in the present study. An additional explanation is the nature of the role nurses play in children’s health care, in which physicians often prescribe pain medication *pro re nata*, with responsibility left to the nurse to check patient’s pain levels and administer medication accordingly [2,15]. Unquestionably, nurses are exposed to a broader range of children experiencing pain than parents and nurses and nurses have the benefit of extensive feedback concerning efforts to palliate children’s pain, whether using pharmacological or other comfort means [23].

The finding that caregivers overall had better identification accuracy when viewing the faked condition than the genuine condition is consistent with previous findings that children’s faked expression of pain tends to be

over-exaggerated and include facial actions not associated with a genuine pain expression [18]. As many caregivers noted “exaggerated” or “dramatic” as a cue used to identify the faked condition, caregivers appear to have been adept at noticing these disproportionate reactions. The finding that caregivers had better identification accuracy when viewing the suppressed condition than the genuine condition could be attributed to the fact that caregivers were alerted to the possibility of deception, and therefore may have been more attuned to specific indicators of deception in the children’s facial expressions. Previous research has identified facial cue “leakage” in deceptive facial expressions, in which involuntary facial cues are expressed despite attempts at voluntary control [7,14,25]. Additionally, caregivers were significantly more likely to guess that a child was in the suppressed condition than any other condition, indicating a bias towards assigning the suppressed label which may have inflated caregivers’ accuracy scores in this condition.

Overall, caregivers’ accuracy was quite low, which suggests that in a clinical environment where the base rate of deception is low and clinicians are not primed to detect deception, their ability to identify manipulated facial expressions may be even lower than what was observed in this experimental context. This is cause for concern, as the ability to recognize children who are suppressing their expressions of pain is critical to prevent the undermanagement of pain in children who attempt to hide their expressions for a variety of reasons (e.g., fear of medical intervention). Concern for underdetection of suppression or faking pain needs to be countered by recognition of the potential harm done to therapeutic relationships by accusations of deception. Caregivers’ confidence in their judgments was also quite low overall, and caregivers were more confident when viewing the genuine condition than suppressed and neutral, even though their accuracy in this condition was significantly lower.

Despite to the finding that nurses were more accurate than parents at categorizing expressions of children’s pain, there were no observed differences between caregiver groups in their agreement between caregiver and child reports of pain. Overall, caregivers made a variety of errors in rating children’s pain, but one of particular

importance was that when caregivers viewed genuine and suppressed clips, they underestimated the child's pain in approximately half of the instances. This indicates that in video clips where children were actually experiencing real pain, caregivers had a tendency to rate the child's pain lower than the child's self-report, which has important implications regarding the accuracy of assessments of children's pain intensity in clinical practice.

Caregivers reported using a variety of cues in distinguishing between the four facial expression conditions, suggesting that they may not have a consistent framework of cues used to assess pain authenticity. Although there are specific facial movements associated with genuine and manipulated expressions of pain, many studies note that there are considerable individual differences in expression that should be considered due to factors such as pain tolerance, developmental stage, catastrophizing, and prior experience with pain [4,30,31]. As such, identifying specific cues within each condition may be particularly challenging for caregivers, due to the inherent variability of the stimuli presented. Caregivers reported using general impressions (e.g., "dramatic", "relaxed", "tense"), interactions of the child with the environment, and temporal cues (e.g., expressions appearing suddenly) in addition to facial cues in making their judgments. Thus, caregivers are conscious of using more cues to deception than have been identified in the studies of pain deception using fine-grained facial coding techniques.

Facial expressions are often the primary source of information for health professionals in making judgments about children's pain. However, in clinical settings health professionals generally also have a variety of contextual cues to assist them in making decisions, including body movements, patient self-report, physiological indicators, or information about the child's medical history [27]. Kappesser and colleagues [17] found that the presence of the patient's own pain report increased health professionals' accuracy of pain judgments. Previous research has shown that it is often the discrepancy between facial expressions and verbal utterances that signals deception [34]. It is possible that with the contextual cues that were lacking in the experimental design of the present study, caregivers may have been more accurate in their detection of deception. A compelling avenue of future research would be to examine the relative importance of various cues and contextual factors in health

professionals' decisions in pediatric pain assessment. Psychological variables, such as empathy and catastrophizing have also been shown to influence interpretation of children's pain, but have not yet been examined in pediatricians and nurses, thus warranting further research into the influence of these factors in pain assessment [9,10,20].

There were several strengths to the present study. The use of videos offered more nonverbal information to judges than static photographs, and the randomized presentation assisted in achieving a closer approximation to the clinical environment in which pain assessments would normally be occurring [6,16,18,26]. An additional strength was that health professional participants had a wide range of clinical experience to draw on. Many previous judgment studies have employed naïve judges or medical students [8,11,24]. The use of a judgment study paradigm allowed for an examination of how the interpretation of nonverbal behaviour can differ based on judge characteristics, and allowed for strong power to examine group differences with small sample sizes in a repeated-measures design [26].

Despite these strengths, there were several limitations to be considered. The present study examined parents who were not judging their own child, which may have contributed to their lower scores of accuracy. While health professionals have medical training and experience assessing pain in unfamiliar children, parents in the present study are hypothesized to make their judgments on the basis of their experience with their own children. Further research should examine whether experience with their own children is involved in parents' judgments of pain in other children. An additional limitation was that caregivers were asked to list the facial cues they used after having watched all 48 video clips. As such, it was possible that only the most recent or salient cues were reported. Asking caregivers to record their use of cues in real-time may offer more fine-grained analysis of the specific cues caregivers employ.

The present study builds on a foundation of literature in pain assessment and deception in facial expressions of pain, adding insight into these processes specifically in children. Results demonstrated that



pediatricians, nurses, and parents experience some difficulty at detecting deception in children's facial expressions of pain, with nurses having better accuracy than parents, and pediatricians not differing significantly from either group. Though caregiver confidence in judgments was rather low, it did not appear to be consistently related to accuracy, and caregivers frequently underestimated children's pain in instances where the children were actually experiencing pain. Caregivers reported using a variety of specific cues and general impressions in making their decisions, and training pediatricians and nurses on specific facial cues associated with genuine and manipulated expressions of pain may help improve their accuracy [14]. The low accuracy rate of identifying genuine expressions of pain suggests that health professionals may benefit from further training on pain assessment, regardless of whether or not they encounter deception in their clinical work. It will be important to take into account in future research the relative influence of other contextual factors involved in caregivers' assessments of children's pain, and to further explore the judgment processes of pediatricians and nurses in situations with greater consequences (e.g., decisions regarding administration of pain medication).

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## References

- [1] Birnie KA, Noel M, Chambers CT, von Baeyer CL, Fernandez CV. The cold pressor task: Is it an ethically acceptable pain research method in children? *J Pediatr Psychol* 2011;36:1071-1081.
- [2] Broome ME, Slack JF. Influences on Nurse's Management of Pain in Children. *MCN Am J Matern Child Nurs* 1990;15:158-162.
- [3] Craig KD, Hill ML, McMurtry B. Detecting deception and malingering. In: Block AR, Kremer EF, Fernandez E. *Handbook of Pain Syndromes*. New Jersey: Lawrence Erlbaum Associates, Inc., 1999. pp. 41-58.
- [4] Craig KD, Hyde SA, Patrick CJ. Genuine, suppressed and faked facial behavior during exacerbation of chronic low back pain. *Pain* 1991;46:161-171.
- [5] Craig KD, Patrick CJ. Facial expression during induced pain. *J Pers Soc Psychol* 1985;48:1080-1091.
- [6] Ekman P, Friesen WV, Ellsworth P. *Emotion in the human face: Guidelines for research and an integration of findings*. New York: Pergamon Press, 1972.
- [7] Ekman P, Friesen WV. Nonverbal leakage and clues to deception. *Psychiatry* 1969;32:88-106.
- [8] Galin KE, Thorn BE. Unmasking Pain: Detection of Deception in Facial Expressions. *J Soc Clin Psychol* 1993;12:182-197.
- [9] Goubert L, Vervoort T, Cano A, Crombez G. Catastrophizing about their children's pain is related to higher parent-child congruency in pain ratings: An experimental investigation. *Eur J Pain* 2009;13:196-201.
- [10] Goubert L, Vervoort T, Sullivan MJL, Verhoeven K, Crombez G. Parental emotional responses to their child's pain: The role of dispositional empathy and catastrophizing about their child's pain. *J Pain* 2008;9:272-279.

[11] Hadjistavropoulos HD, Craig KD, Hadjistavropoulos T, Poole GD. Subjective judgments of deception in pain expression: Accuracy and errors. *Pain* 1996;65:251-258.

[12] Hicks CL, Baeyer CLv, Spafford PA, van Korlaar I, Goodenough B. The Faces Pain Scale – Revised: toward a common metric in pediatric pain measurement. *Pain* 2001;93:173-183.

[13] Hill ML, Craig KD. Detecting deception in pain expressions: The structure of genuine and deceptive facial displays. *Pain* 2002;98:135-144.

[14] Hill ML, Craig KD. Detecting Deception in Facial Expressions of Pain: Accuracy and Training. *Clin J Pain* 2004;20:415-422.

[15] Jacob E, Puntillo KA. A Survey of Nursing Practice in the Assessment and Management of Pain in Children. *Pediatr Nurs* 1999;25:278.

[16] Kappesser J, Williams ACdC. Pain and negative emotions in the face: judgements by health care professionals. *Pain* 2002;99:197-206.

[17] Kappesser J, Williams ACdC, Prkachin KM. Testing two accounts of pain underestimation. *Pain* 2006;124:109-116.

[18] Larochette A, Chambers CT, Craig KD. Genuine, suppressed and faked facial expressions of pain in children. *Pain* 2006;126:64-71.

[19] Manne SL, Jacobsen PB, Redd WH. Assessment of acute pediatric pain: Do child self-report, parent ratings, and nurse ratings measure the same phenomenon? *Pain* 1992;48:45-52.

- [20] Martel MO, Thibault P, Roy C, Catchlove R, Sullivan MJL. Contextual determinants of pain judgments. *Pain* 2008;139:562-568.
- [21] Morley S, Doyle K, Beese A. Talking to Others about Pain: Suffering in Silence. In: Devor M, Rowbotham MC, Wiesenfeld-Hallin Z. *Proceedings of the 9th World Congress on Pain*, vol. 16. Seattle: IASP Press, 2000. pp. 1123-1129.
- [22] Pillai Riddell RR, Craig KD. Judgments of infant pain: The impact of caregiver identity and infant age. *J Pediatr Psychol* 2007;32:501-511.
- [23] Pillai Riddell RR, Horton RE, Hillgrove J, Craig KD. Understanding caregiver judgments of infant pain: Contrasts of parents, nurses and pediatricians. *Pain Res Manag* 2008;13:489-496.
- [24] Poole GD, Craig KD. Judgments of genuine, suppressed, and faked facial expressions of pain. *J Pers Soc Psychol* 1992;63:797-805.
- [25] Rinn WE. The neuropsychology of facial expression: A review of the neurological and psychological mechanisms for producing facial expressions. *Psychol Bull* 1984;95:52-77.
- [26] Rosenthal R. *Judgment studies: Design, analysis, and meta-analysis*. New York, NY: Cambridge University Press, 1987.
- [27] Schiavenato M, Craig KD. Pain assessment as a social transaction beyond the 'gold standard.'. *Clin J Pain* 2010;26:667-676.
- [28] Schneider EM, LoBiondo-Wood G. Perceptions of procedural pain: Parents, nurses, and children. *Child Health Care* 1992;21:157-162.

[29] Singer AJ, Gulla J, Thode HC. Parents and practitioners are poor judges of young children's pain severity. *Acad Emerg Med* 2002;9:609-12.

[30] Vervoort T, Goubert L, Eccleston C, Verhoeven K, De Clercq A, Buysse A, Crombez G. The effects of parental presence upon the facial expression of pain: The moderating role of child pain catastrophizing. *Pain* 2008;138:277-285.

[31] Vervoort T, Caes L, Trost Z, Sullivan M, Vangronsveld K, Goubert L. Social modulation of facial pain display in high-catastrophizing children: An observational study in schoolchildren and their parents. *Pain* 2011;152:1591-1599.

[32] von Baeyer CL, Piira T, Chambers CT, Trapanotto M, Zeltzer LK. Guidelines for the Cold Pressor Task as an Experimental Pain Stimulus for Use With Children. *J Pain* 2005;6:218-227.

[33] Williams ACdC. Facial expression of pain: An evolutionary account. *Behav Brain Sci* 2002;25:439-488.

[34] Zuckerman M, Driver R, Koestner R. Discrepancy as a cue to actual and perceived deception. *J Nonverbal Behav* 1982;7:95-100.