Children’s Expectations and Memories of Acute Distress: Short- and Long-Term Efficacy of Pain Management Interventions

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Objective: To examine the effect of psychologic and pharmacologic interventions on children’s expectations and 6-month recollections of painful procedures.

Methods: A repeated measures design allowed examination of 22 fourth graders’ expectations, experiences, and memories of distress across three conditions (typical care, distraction, topical anesthetic) for a three-injection vaccination series. All participants were African American and from urban, low-income families.

Results: Across conditions, children’s expectations of distress were significantly higher than their experience of distress. Distress ratings did not differ among conditions prior to or immediately following the injections; however, children later recalled that the treatment conditions were superior to control for distress relief. Analyses of recall accuracy suggest that the interventions buffered the children from forming negative recollections that occurred with typical care.

Conclusions: Children have negative expectations prior to a procedure despite knowing that a distress management intervention will be employed. However, interventions may thwart the development of negative memories of distress.

Key words: procedural pain; psychological interventions; pharmacological; children; expectations; memory; anxiety.

Treatment outcome studies for invasive pediatric events support the efficacy of the eutectic mixture of local anesthetics (EMLA cream, AstraZeneca LP, Westborough, MA; e.g., Halperin, McGrath, Smith, & Houston, 2000) and a host of psychological interventions, including relaxation, desensitization, modeling, and distraction (for a review, see Powers, 1999). Whereas the majority of pain management researchers have evaluated treatment impact on children’s immediate procedural distress; only a handful have assessed more distal factors such as parent anxiety (e.g., Manne, Redd, Jacobsen, Gorfinkle, & Schorr, 1990), nurse anxiety (e.g., Kazak et al., 1996), cost (e.g., Cohen, Blount, Cohen, Schaein, & Zaff, 1999), and child and nurse satisfaction (e.g., Cohen, Blount, & Panopoulos, 1997). No study has examined both psychological and pharmacological pain management interventions’ impact on children’s expectations of distress prior to the procedure and memories of distress several months following the procedure.

Children’s expectations of distress prior to an invasive medical event are related to their anticipa-
tory anxiety (Lander, Hodgins, & Fowler-Kerry, 1992), which in turn predicts procedural distress (e.g., Dahlquist, 1999). Moreover, it has been posited that negative expectations lead to elevated anxiety and pain experiences during invasive medical procedures (McGrath, 1990). Distorted expectations (i.e., under- or overestimations) have also been found to relate to sensitization and habituation responses to painful events (Arntz & Lousber, 1990). Despite the strong influence of expectations on medical pain and anxiety experience, few pediatric studies have evaluated this variable, and no study has specifically targeted expectations for intervention. A parsimonious way of decreasing negative procedural expectations is to inform patients about the distress management intervention that will be employed. However, it is not clear whether this type of information serves to comfort children.

Similar to the paucity of studies examining children's expectations, only a few studies have addressed children's memories for painful procedures (Ornstein, Manning, & Pelphrey, 1999). Studies of children's memories of medical events have important clinical implications. First, memories are related to children's expectations prior to medical stressors (e.g., Ornstein et al., 1999). Second, recollections of procedural distress can influence future distress reactions during medical events (Zeltzer & Feldman, 1999). In fact, research has shown that the manipulation of children's memories by encouraging the recall of positive aspects of procedures improves coping and decreases distress during upcoming events (Chen, Zeltzer, Craske, & Katz, 1999). Third, memories of prior medical events will influence future health care attitudes and behaviors. A study by Pate, Blount, Cohen, and Smith (1996) demonstrated that negative medical experiences as a child, recalled in adulthood, were predictive of elevated medical fear and avoidance of medical care as an adult. Fourth, diagnoses and treatment decisions for a range of mental and medical difficulties are based on patients' recall of prior distress symptoms (Ornstein et al., 1999). Also, the validity of self-report measures such as visual analogue scales (VASs) depends on memories of prior events (Erskine, Morley, & Pearce, 1990).

Whereas studies have shown the efficacy of altering children's memories of procedures (e.g., Chen et al., 1999), and it has been posited that distraction may inhibit the encoding, storing, and recall of pain (Ornstein et al., 1999), it remains unclear whether pain interventions influence memories of distress.

The purpose of this study was to compare two empirically supported pain management interventions (distraction and topical anesthetic) and typical care in terms of their impact on children's expectations and memories of injections. We selected 9- and 10-year-olds because children of this age were expected to understand and experience positive expectations when informed of the interventions before the immunization procedure (Melamed, 1998), and previous studies suggest that children older than 7 years have more accurate memories for painful procedures than do younger children (Lehmann, Bendebba, & DeAngelis, 1990). Injections were chosen because research suggests that memory is better for acute pain than chronic pain (Erskine et al., 1990). We hypothesized that children would report expectations of low distress when they were informed that they would receive pain management interventions and that the treatments conditions, when compared to typical care, would result in memories of lower levels of anxiety and pain.

Method

Participants and Setting

An elementary school board and two university institutional review boards approved the study because the investigators were affiliated with one university and the clinic was affiliated with another university and an elementary school. Children due to receive hepatitis B vaccination (a series of three intramuscular injections given over a 6-month period) were recruited by mail through a health clinic located in the basement of an elementary school in a low-income, inner-city neighborhood in the Southeastern United States. The sample \( n = 32 \) consisted of 12 boys and 20 girls ranging in age from 8.83 to 11.08 years \( (M = 9.88 \text{ years}, SD = .51 \text{ years}) \). All participants were African American and were from low-income families. None of the children had chronic illnesses or were receiving routine medical procedures. All children received the second injection 1 month after the first, and the third injection 3 months after the second. At the 6-month follow-up, 22 children (10 boys and 12 girls) participated in the memory aspect of the study. The
10 children who were no longer available at the 6-month follow-up had left the school and could not be contacted. School personnel reported that this school has a high rate of attrition from the school system.

Family income per week of participants was approximately $306.44 (SD = 165.04), with 70% of families living in permanent homes and 30% living in temporary or shelter housing. The average primary caretaker was 34.48 years (SD = 5.02) and had completed 11.77 years of education (SD = 2.41). On average, four family members (SD = 1.30) lived in the homes.

The nurse who performed all injections had been working at the clinic for 4 years and knew the majority of children in the study. The study was conducted at a school-based health clinic located in the basement of an elementary school. The grant-funded clinic employs a physician, a dentist, three nurses, a social worker, and a health care educator. All children in the public school are provided comprehensive health care at minimum cost. Thus, every child in the school has a medical chart kept in the clinic.

Procedure

General Procedure. Families with fourth graders in the school were mailed two separate consent forms; one consent form was to receive a voluntary hepatitis B vaccination series, and the other was a parent consent and child assent form to participate in the study. A cover letter explicitly informed families that children could receive the inoculation without participating in the study. Of the 75 families invited to receive the voluntary vaccination and participate in the study, 32 families returned the completed consent forms, received the three injections, and participated in the study. No families elected to receive the immunizations without joining the study. Based on school demographic data, the study sample did not significantly differ from the school population.

After completing the demographic questionnaire, parents received $10 for their participation. In a Latin square design, each child was exposed to all three experimental conditions in one of six possible sequences for their series of three injections (e.g., typical care, distraction, EMLA).

On the scheduled days of the injections, a staff member called children from class to the clinic. In this setting, parents do not typically come to the clinic during their children’s medical procedures, and no parents were present during these immunization procedures. At the nurse’s request, groups of three to five children were called to come to the clinic. Upon entering the clinic, children were individually asked to rate their levels of anticipated distress and pain. Following the immunization, the children completed ratings of their pain and anxiety. Six months following the last injection, a researcher called children one at a time from the classrooms to the clinic to complete the recall questionnaire.

Typical Care. In the typical care condition, the nurse was instructed to interact with the children according to her own routine. Although this would likely include some distraction in addition to other behaviors, no medication or movie was provided to the children.

Nurse Coaching and Movie Distraction. Prior to completing the expectation measures, the researcher informed the children that the movies would serve as a distraction to help reduce the procedural pain. When the children entered the treatment room, the nurse encouraged them to select and begin watching a movie. According to protocol of the study by Cohen et al. (1997), the nurse was trained as to how to interact with the children during the procedure. The nurse was directed to use comments (e.g., “Which one is the good guy?” and “Tell me what is happening in the movie”), commands (e.g., “Watch the movie!”), and gestures to encourage children’s attention to the movie before, during, and after the injection. The nurse was also trained to provide distraction at junctures, such as prior to the injection; when the child was attending to the nurse’s activities; when the child appeared distressed; and anytime when the nurse felt inclined to provide nondistraction behavior (e.g., reassurance). Based on nominations by the fourth graders before the study, the movie choices were Casper, Space Jam, Toy Story, Power Rangers, 101 Dalmatians, and Free Willy 3. A television and videotape player were located near the child’s chair in the treatment room with a sign containing the prompts, “look here!” and “watch the movie!”

EMLA. Due to the delayed activation of EMLA, children received the cream an hour prior to the injection. Per instructions, 2 grams of EMLA cream was applied to the upper arm and covered with an occlusive dressing. The nurse explained to the chil-
dren that the EMLA would numb the skin and decrease the injection pain. Children then went back to class and returned to the clinic an hour later. Before completing the expectation questionnaires, the children were again informed that the cream would numb the skin and reduce injection pain. As in the typical care condition, the nurse was trained to behave according to her routine and the children were not allowed to view a movie.

Measures

Demographic Form. Children’s medical charts included child and parent date of birth, race, gender, medical history, number of family members in the home, and status of present housing (e.g., permanent, institution, other). In addition, parents completed a questionnaire about their own and their spouse’s education and family income.

Expected Anxiety and Pain. Before the procedure and after being informed of the intervention to be employed, children completed VASs assessing their expectations of procedural anxiety and pain. The VASs were 100-mm lines with anchors such as “not upset” and “very upset.” The children were instructed in age-appropriate language to make a vertical mark on the line in response to the following questions posed by the researcher: “How upset will you be during the shot?” and “How much will the shot hurt?” VASs are frequently used in pediatric studies because they are easily understood, they are one of the more valid and reliable self-report measures, and there is less bunching of scores than with categorical measures (McGrath, 1990).

Experienced Anxiety and Pain. Upon exiting the medical room, children answered the following VAS questions: “How upset were you during the shot?” and “How much did the shot hurt?”

Recall of Anxiety and Pain. Six months following the last injection (12 months following the first injection), children answered questions about their memories of the anxiety and pain that they experienced during each of the shots associated with the three treatment conditions. Due to the possibility that the children may have forgotten the injections and treatments, children were queried about details of the episodes. For example, children were asked what movie that they watched and the color of the EMLA cream. All children appeared to remember the injections and treatments with ease. Children responded to the following six VAS questions:

“When you used the white cream, how upset were you during the shot?” “When you used the white cream, how much did the shot hurt?” “When you watched the movie, how upset were you during the shot?” “When you watched the movie, how much did the shot hurt?” “When you did not use the white cream or watch the movie, how upset were you during the shot?” “When you did not use the white cream or watch the movie, how much did the shot hurt?”

Results

Overview and Preliminary Analyses

All analyses were conducted with an alpha level of .05. Initial repeated measures ANOVA analyses were conducted to determine whether gender, age, or the sequence of condition related significantly to expected, experienced, or recalled anxiety or pain. Further analyses were conducted to investigate whether there were significant differences in gender, age, expected distress, and experienced distress between the 10 children who were not available at follow-up and the other children in the original sample. None of these analyses resulted in significant findings; however, to simplify results, only the 22 children who participated in all aspects of the study were included in subsequent analyses. Analyses were conducted to determine whether the sample size of 22 provided sufficient power (.80) to detect differences between treatments. Assuming a medium effect size and an alpha level of .05, a sample of 22 participants would yield power of .73 to detect treatment differences. However, given a small to medium effect size and an alpha level of .05, a sample of 22 would provide a power estimate of only .57. Thus, it is possible that insignificant findings are due to insufficient power in the study.

Nurse coaching behavior was examined to evaluate adherence to the distraction treatment protocol. Specifically, the behavior codes (prompting the child to attend to the movie, comments about the movie, other distraction, other nonprocedural talk, and other commands to use coping strategies) were scored as occurring or not occurring on a 5-second interval system and divided by the total number of intervals for the immunization procedure. Results demonstrated that the nurse exhibited significantly more coaching behaviors during distraction (M =
26% of the procedure time, SD = 14%) than EMLA (M = 6%, SD = 8%, t[29] = 6.69, p = .000), or typical care (M = 14%, SD = 12%, t[30] = 3.53, p = .001), indicating that the nurse complied with training for the distraction condition.

Two-tailed paired sample t tests were conducted to compare conditions on measures of children’s expectations, experiences, and recollections of anxiety and pain. Using an established format (Lander et al., 1992), we calculated accuracy of children’s expectations and recollections by subtracting expected and recalled anxiety and pain from experienced anxiety and pain. Consistent with Lander et al., difference scores of 9 or fewer points on the 100-point scale were considered accurate and difference scores of 10 or greater were classified as under- or overestimations of anxiety or pain, depending on whether they fell below or above the experienced distress score, respectively. Thus, if children’s expectation or memory ratings are within 10% of their postshot experience rating, they are considered “accurate.” This method of determining accuracy is problematic in that it does not account for variability across individuals’ ratings. We conducted paired sample two-tailed t tests to determine whether the conditions influenced the accuracy of children’s expectations or recollections. Table I presents means and standard deviations for the expected, experienced, and recalled pain and anxiety by condition. Figures 1 and 2 illustrate the relationships between expected, experienced, and recalled anxiety and pain by condition.

Table I. Means and Standard Deviations of Dependent Variables by Condition

<table>
<thead>
<tr>
<th>Measure</th>
<th>Typical Care M (SD)</th>
<th>EMLA M (SD)</th>
<th>Distraction M (SD)</th>
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</thead>
<tbody>
<tr>
<td>Expected anxiety</td>
<td>39.73 (40.61)</td>
<td>47.05 (41.15)</td>
<td>45.32 (41.13)</td>
</tr>
<tr>
<td>Expected pain</td>
<td>55.09 (39.72)</td>
<td>52.86 (40.95)</td>
<td>46.36 (38.29)</td>
</tr>
<tr>
<td>Experienced anxiety</td>
<td>25.82 (37.11)</td>
<td>20.86 (34.98)</td>
<td>25.00 (37.81)</td>
</tr>
<tr>
<td>Experienced pain</td>
<td>26.45 (39.02)</td>
<td>28.00 (33.13)</td>
<td>34.32 (40.56)</td>
</tr>
<tr>
<td>Recalled anxiety</td>
<td>55.55a (42.61)</td>
<td>18.52b, d (22.36)</td>
<td>38.91c (37.35)</td>
</tr>
<tr>
<td>Recalled pain</td>
<td>48.95a (40.63)</td>
<td>23.48b (28.17)</td>
<td>28.32c (31.98)</td>
</tr>
<tr>
<td>Accuracy of expected anxiety</td>
<td>−13.90a (51.80)</td>
<td>−26.18c (37.57)</td>
<td>−20.32c (46.37)</td>
</tr>
<tr>
<td>Accuracy of expected pain</td>
<td>−28.64a (52.48)</td>
<td>−24.86c (43.04)</td>
<td>−12.05c (47.75)</td>
</tr>
<tr>
<td>Accuracy of recalled anxiety</td>
<td>−29.73a, c (42.53)</td>
<td>3.33b, c (36.71)</td>
<td>−13.91c (41.61)</td>
</tr>
<tr>
<td>Accuracy of recalled pain</td>
<td>−22.50a, c (46.34)</td>
<td>5.05b, c (37.08)</td>
<td>6.00b, c (39.28)</td>
</tr>
</tbody>
</table>

Expected, experienced, and recalled anxiety and pain were completed on 100-point visual analogue scales, with higher scores indicating higher levels of anxiety or pain.

a,b,c Means in the same row that do not share superscripts are significantly different (p < .05).

d Overestimate.

e Accurate estimate.
Treatment Effects on Expected Anxiety and Pain

There were no significant between-condition differences on children’s expectations of anxiety or pain. In other words, children did not have significantly more confidence in the ability of distraction or EMLA to reduce their anxiety or pain than typical care.

Treatment Effects on Experienced Anxiety and Pain

Based on child self-report, treatments did not produce less anxiety or pain than typical care. (For a more detailed analysis of the treatment impacts on these children’s observed coping and distress and also nurse coaching behavior, please refer to Cohen et al., 1999.)

Treatment Effects on Recalled Anxiety and Pain

Six months following the final injection, children recalled experiencing more anxiety during typical care than during EMLA ($t[20] = 4.52, p = .000$) or distraction ($t[21] = 2.22, p = .038$). Children also recalled feeling more pain with typical care than EMLA ($t[20] = 3.24, p = .004$) or distraction ($t[21] = 2.59, p = .017$). When we compared the treatment conditions, children recalled more anxiety during distraction than EMLA ($t[20] = 3.14, p = .025$). No significant difference existed on children’s pain recall between EMLA and distraction.

Accuracy of Expected and Recalled Anxiety and Pain by Condition

On average, children overestimated how much anxiety they would experience in typical care (13.90 points above experienced anxiety rating), EMLA (26.18), and distraction (20.32). In terms of pain expectations, children overestimated the pain that they would experience in typical care (28.64), EMLA (24.86), and distraction (12.05). There were no significant differences among these overestimations.

In terms of recall of anxiety, children overestimated their experiences of anxiety for typical care and distraction by 29.73 and 13.91 points, respectively. Children were able to accurately recall their anxiety during the EMLA condition within 3.33 points of their prior experience ratings. Further, children were significantly more accurate at recalling anxiety with the EMLA condition than with typical care ($t[20] = 3.02, p = .007$). As for pain recall, children overestimated how much pain they experienced with typical care by 22.50 points. Children accurately recalled the pain experienced with EMLA and distraction within 5.05 and 6.00 points, respectively. Children receiving the typical care condition were significantly more likely to overestimate their recall of pain than either children receiving EMLA ($t[20] = 2.69, p = .014$) or distraction ($t[20] = 2.46, p = .022$).

Discussion

The purpose of this study was to evaluate the impact of psychological and pharmacological interventions on children’s expectations and memories of anxiety and pain during immunizations. Given the unique sample, results should be interpreted in terms of how they inform health care for low-income ethnic-minority children. Results suggested that children have distorted pessimistic expectations of procedural distress and that they do not experience comfort when informed that an intervention will be employed to target distress. It is possible that the lack of prior experience with these interventions influenced this result and that the children might have more optimistic expectations after positive treatment experiences. Regardless, health care staff should recognize that information provision aimed at comforting a child might not serve this purpose. To decrease negative expectations, Kent (1985) recommends filing patients’ ratings of expected and experienced distress in their medical charts so that later, when returning for another painful procedure, they may review their prior distress ratings. He suggests that this may facilitate more accurate expectations, lower anticipatory anxiety, and also expedite a habituation process.

The finding that neither distraction nor topical anesthesia produced beneficial effects in terms of children’s immediate reports of distress stands in contrast to a host of studies supporting the efficacy of these treatments (e.g., Fanurik, Koh, & Schmitz, 2000). This may have been due to insufficient power to detect differences. Regardless, it should be recognized that child self-report is only one compo-
and well-being of low-income ethnic-minority children receiving immunizations.

The results of this study highlight several future avenues of inquiry. Investigations of expectations and memories of children of varying ages might help clarify the age at which children are able to accurately predict and recall procedural anxiety and pain. Similarly, examining psychosocial correlates of accuracy, such as temperament and coping style, might help identify those children with the most negatively distorted predictions and memories. Studies such as these should help in the development of appropriate interventions to reduce negatively inflated expectations and memories. In addition, investigations of how and why children have negative expectations and memories might help illuminate methods of changing these perceptions. Further, by directly targeting expectations and memories as part of a pharmaceutically or psychologically based distress-management intervention, we could engender more positive health care attitudes, experiences, and behaviors in children. Future longitudinal investigations may also determine whether the prevention of negative memory distortions in turn buffers children from developing negative expectations and also decreases procedural distress.

In summary, results suggest that children did not experience relief upon being informed that they would receive a proven intervention during their injection, and children did not report that either of these interventions was more helpful than typical care. However, 6 months following their final injection, children recalled that the interventions provided superior anxiety and pain relief as compared to typical care. Thus, there is some evidence to suggest that psychological and pharmacological treatments may provide long-term benefits by thwarting the development of negatively distorted procedural distress recollections.

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References


