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Parental Report of Self and Child Worry During Acute Pain: A Critical Factor in Determining Parental Pain Judgment

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Abstract

Objectives: To determine which variables predict parental post-vaccination pain ratings. It was hypothesized that after child behaviour, parental sensitivity and parental reports of worry would be the strongest predictors.

Methods: Data for 215 parent-child dyads were analyzed from a longitudinal cohort at the preschool (4-to-5 years of age) vaccination. Preschoolers' pain behaviours 15 seconds, 1 minute-15 seconds, and 2 minutes-15 seconds after the painful immunization were observed and rated. Parental sensitivity as well as parental own worry and their assessment of their child's worry were assessed before and after the needle. Three regression models were used to determine the impact of these variables on parental pain assessment.

Results: Preschoolers' pain behaviours moderately accounted for variance in parental pain judgment (R^2 = .23 to .28). Parental sensitivity was not a significant unique predictor of parental pain rating at the preschool age. Parental assessment of their own worry and worry of their preschoolers after the needle were critical contributors to parental pain judgment. Post-hoc analyses suggest that parents who report low child worry, are more congruent with their child during regulatory phases post-needle. However, both parents with high and low self-worry had more congruent pain ratings with child pain behaviour scores during the reactivity phase.

Discussion: The study suggests that the majority of variance in parent pain ratings was not predominantly based on preschoolers' pain behaviours. Parental worry levels and their assessment of their child's worry were also significant predictors. Clinical implications are discussed.

Key words: acute pain; parent pain judgment; parent and child worry; preschooler pain behaviour

Young children are in a vulnerable position when it comes to their pain management. Pain is a subjective experience, which rightfully establishes the primacy of self-report. However, early in development, young children (0 to 4 years of age) are less capable of self-report compared to older children (1, 2, 3). In addition, although children (ages 5 and older) have been shown to provide reliable estimates of pain using self-report, there can be multiple sources of bias and error in self-reports of pain (4). Therefore, self-report ratings of young children should be interpreted with the consideration of other assessment sources, such as parent reports and direct observations of specific pain behaviors in the young child (most often facial expressions, cry, and body movements). In primary pediatric health care, parental interpretations of their child's pain behaviours or pain ratings are often used to help assess the child's presenting problem. However, little research has focused on determining the key contributors to caregiver pain ratings. Specifically, to our knowledge no work has focused on understanding the key contributors to caregiver ratings of preschooler (4-to-5 years of age) pain experiences.

According to the DIAPR model (5), while infant pain behaviours inform caregiver judgment of infants' pain, these behaviours do not account for the majority of variance in these judgments. A recent study that examined top-down variables (observer or caregiver characteristics, i.e. emotional availability, age, and education) versus bottom-up variables (e.g. infant behaviour, infant sex, etc.) found that emotional availability, a measure that encompasses parent sensitivity – parenting behaviours that are warm, contingent and appropriate in response to their infant's pain signaling – only had an indirect impact on parental pain assessment (6). Importantly, this study also revealed that across the first year of life, infants' pain behavior only accounts for approximately 18 to 36% of variance in parental pain judgment. These results converge with an earlier study on infant pain judgments that suggested maternal psychological

distress impacts parental recall of infant pain more than the child's actual pain behaviours (7). These findings suggest that parents largely base their assessment of infant pain on factors other than the infant facial activity, crying, and body movement, which are gold standard pain measures in clinical pain assessment. Interestingly, these findings emerged despite the quasi-experimental work that found parents rate infants' behaviours as most important for formulating their pain judgements (8). A more recent study by Caes and colleagues (9) examined the influence of caregiver anticipatory distress on caregivers' estimates of their children's pain (ages 0 to 15). The results indicated that higher levels of caregiver distress in anticipation of their child's procedure were related to higher estimations of their child's pain.

Building on this infant research, the current study sets out to examine the relationship between preschooler pain behaviour and parent pain assessment during the preschool vaccination. Moreover, it sets out to extend the current literature base by examining the role of parent worry and perceptions of their child's worry both before and after the vaccination procedure.

A number of studies have shown that parental anxiety predicts child procedural anxiety and pain experience from infancy to adolescence (10,11). Particularly, higher parental anxiety is related to less caregiver sensitivity as well as greater anxiety in infants and young children (6-12 years of age), suggesting parents are less available to help their child regulate if they are not regulating their own emotions (11, 12, 13). A recent study revealed that preschoolers' procedural anxiety mediates the relationship between parents' anticipatory anxiety and children's procedural pain (14). These researchers speculated that parents with high state anxiety are more likely to communicate their emotional state to their children or behave in ways that increase their child's anxiety and exacerbate pain for the child. Another study examining children (ages 0 to 15) found

that parents with high catastrophic thinking (commonly associated with anxiety) experienced greater distress associated with their child's painful procedure, which in turn was related to higher child distress (15). Numerous studies support the hypothesis that infants and children are highly sensitive and influenced by parents' state anxiety and distress (12, 13, 16). However, the relationship between parental worry and parent pain assessments of preschool children in a vaccination context has not been examined.

This is an important focus as previous research has highlighted distinctions between developmental stages in early childhood in an acute pain context, as the experience of pain-related distress and regulation across infant and preschool ages changes over time (17). Most preschool children are on the verge of valid and reliable self-report of pain and other internal states (2). However, some remain wholly dependent on their caregivers to assess their pain and take appropriate action to manage it. It behooves scientists to examine psychosocial mechanisms driving parent pain assessment during this unique developmental stage.

Study Overview

The purposes of the current study are to 1) determine the strength of association between preschoolers' pain behaviour and parental pain assessments and 2) examine the relative predictive strength of parental sensitivity and parent report of their own worry and their child's worry in determining parental pain judgements beyond preschoolers' pain behaviours. Data from two hundred and fifteen parent-child dyads were analyzed in the current project. Based on previous work (6, 7), we hypothesized that a large amount of variance in parent pain ratings would be explained by preschool child's behaviour, as well as parent worry, perceptions of their child's worry and parental sensitivity would also predict parental pain judgments.

Method

Participants

Two hundred and fifteen parent-infant dyads from the Opportunity to Understand Childhood Hurt Cohort were analyzed. Dyads were observed at the child's preschool immunization (ages 4 to 5 years) at two pediatric clinics in the Toronto area. These dyads have all been observed since the child's infant vaccinations (18). The majority of parents in the current study were mothers (84.7%), married (58.6%) and had a university degree (30.7%) or higher (22.8%). Each dyad was initially included in the OUCH cohort if the infant had no suspected developmental delays or impairments, had no chronic illnesses, had never been admitted to a neonatal intensive care unit, and was born no more than three weeks preterm. The current analyses (and all subanalyses contained) do not duplicate any published work on the OUCH Cohort. An ongoing list of publications is listed at www.yorku.ca/ouchlab (navigate to "OUCH Cohort Publications").

Procedure

Ethical approval was obtained from the affiliate university and the associated tertiary-level hospital. Parents who previously participated in at least one of the first four assessments (at the child's 2-, 4-, 6-, and 12-month routine vaccinations) of the OUCH study were provided a flyer by the medical receptionist prior to the child's preschool vaccination and asked if they would like to continue participating in the study. If parents agreed to participate, informed consent was obtained, and parents completed a demographic information form. In the examination room, two video cameras were set up to capture a close up of the child's facial expressions and a wide shot to obtain a view of both the parent and child. The video footage was used to code the child's pain behaviors and the parent's sensitivity. Both before and after the vaccination, parents were asked to rate their child's pain, their worry level, and their child's

worry level. Parent ratings after the needle were generally obtained within 3 minutes.

Materials

Measures of parent and child worry

Parent ratings of self-worry and their child's worry (NRS; 19). Parent perceptions of their own worry level and the worry level of their child were measured using a numeric rating scale (NRS). Parents were asked to rate worry levels immediately following the immunization procedure (e.g., "On a scale from 0 to 10, how worried about the needle do you think your child [you] are right now?) on a scale from 0 "No worry at all" to 10 "The worst worry possible". Convergent validity of a parent's NRS with young children report has been supported by recent research (20).

Measures of child pain

Parent ratings of child pain (NRS; 19). Using a similar method to parent ratings of worry, parent perception of their child's pain post-immunization was also measured using a numeric rating scale (NRS). Parents were asked to rate the pain experience of their child immediately following the immunization procedure ("On a scale from 0 to 10, how much pain do you think your child experienced?") where 0 was "No pain at all" to 10 "The worst pain possible".

Face, leg, activity, cry, and consolability scale (FLACC; 21). The FLACC scale, a widely recognized pain measurement scale, was used as an objective measure of child pain behaviour during the immunization. The FLACC scale is a five-item behavioral scale that measures facial expression, leg movement, activity, crying, and consolability in young children over a 15-second epoch. Each of the items is scored using a scale from 0 to 2 (the total score ranges from 0 to 10). The FLACC scale has been shown to be a valid and reliable measure of pain that can be used in a variety of settings, including assessing pain following minor non-invasive procedures, ear-nose-

throat operations, pain from surgery or trauma, and postoperative pain in cognitively impaired children (22). Three epochs were used for the present analyses, one immediate reactivity epoch (15-seconds after the last needle) and two regulation epochs (15-second epochs 1 and 2 minutes post-last vaccination needle). Different phases of pain responses (i.e. pain reactivity and regulation) were examined, as they have shown different interrelationships with factors that influence infant pain responding (23, 24).

Measure of parent sensitivity

The Maternal Behavior Q-Set Short Version (MBQS; 25). The MBQS is a measure designed to assess parent sensitivity during the immunization. The MBQS is a 25-item version of the 90-item Maternal Behavior Q-set (26) used to assess the quality of parenting behavior during parent-child interactions. The 25 items assess various features related to the construct of caregiver sensitivity, including responding to child distress, monitoring the child's expression of emotions and behaviour, attentiveness to the child's cues, appropriate caregiver affect and support in distressing situations. Trained coders use a seven-point scale, ranging from -2 ("not at all") to +2 ("very much like"), to rate how similar the target mother is to a prototypical sensitive parent. To ensure high reliability, coders were trained by the scale's developer during two days of intensive training. Coders subsequently underwent a process of reliability training whereby they became reliable with the developer's research team. Two coders coded MBQS (n = 216 videos) over a four-year period, with 67% being double-coded to ensure high levels of ongoing reliability. Inter-rater reliability was strong, with an overall intraclass correlation of .82.

Analysis Plan

To determine which factors best predicted parental pain assessment, two regression models were estimated. Parent's assessment of their child's pain was the main outcome variable

(measured by the NRS reported above). Based on results from a previous study investigating the impact of infants' pain behaviours on caregivers' pain judgment (6), the predictors in the first regression model were child pain behaviours after the last needle of the appointment. Behaviours were measured at 3 time points post-needle: right after the needle (immediate reactivity), 1 minute after the needle (regulation 1), and 2 minutes after the needle (regulation 2). Child's sex was included as a covariate based on the aforementioned study. To determine the relative predictive value of reactivity versus regulation pain behaviours, a hierarchical regression analysis was performed, and predictors were entered in two blocks: Block 1 consisted of preschoolers' immediate pain reactivity scores and Block 2 consisted of preschoolers' pain regulation scores (1 and 2 minutes post-needle).

Another hierarchical regression model estimated the unique effects of caregiver variables, namely parental sensitivity and parental assessment of their own worry and their child's worry, which may predict parental pain judgment above and beyond child behaviour. The purpose of this model was to examine the impact of caregiver characteristics hypothesized to impact parental pain ratings, after accounting for child behaviours. Caregiver predictor variables included parental assessment of their own worry and their child's worry levels pre- and post-needle (both measured using a NRS), and parental sensitivity (measured with the MBQS). Post-hoc analyses were conducted and are justified and described below.

Results

All study variables were checked for normality and outliers. Multicollinearity between the predictors was also assessed and no problems were detected. Almost all model residuals were normally distributed and there were no outliers; possible violations of normality were noted but given the large sample size, the ordinary least-squares regressions were justified.

Main Analyses

Model 1. Preschool pain behaviours, controlling for Child's sex. Results from this model are presented in Table 1. Twenty-eight percent of the variance in parental preschool pain rating was predicted by child's pain behaviours. Furthermore, when comparing the relative predictive value of reactivity versus regulation behaviours (Table 2), 23% of parental pain rating was uniquely explained by the immediate pain behaviours, with the pain behaviours expressed after 1 and 2 minutes only explaining an additional 6% of variance in parent pain ratings. Child's sex and child pain behaviours at 1-minute post-needle were not significant predictors of parental pain rating.

Model 2 Preschool pain behaviours, parental sensitivity and parental report of self and child worry. Results from this model are presented in Table 3. Child's sex, child's pain behaviours at 1 minute after the needle, parental sensitivity, and pre-needle assessment of parent's own worry, and their child's worry did not emerge as significant predictors of parent pain ratings. However, parental assessment of their own worry and their child's worry after the needle were significant predictors of parent's rating of their child's pain over and above child sex, parental sensitivity, child reactivity and regulation pain behaviours, and parent and child pre-needle worry. Specifically, higher worry levels reported after the immunization were associated with higher parental pain ratings.

Post-Hoc Analyses

Further analyses were needed to determine whether parental worry after the needle, in a non-clinical sample, was conducive to being attuned to child's needs and would lead to more objective and accurate perceptions of child pain (i.e. congruency between parental pain ratings and child pain behaviour). Higher parental reports of self and child worry post-needle were

linked to higher child pain ratings, but it is unclear whether this reflects a greater acknowledgement of the child's actual pain behavior (i.e. stronger relationship between parental pain rating and child pain behavior) or a result of a cognitive worry bias that could cause parents to perceive their child's pain as worse or more stressful with little attention to the child's actual pain behaviours (i.e. weaker relationship between parental pain rating and child pain behavior).

Thus, we conducted a post-hoc analysis examining the moderating effects of parental worry levels and parental assessment of their child's worry levels on the relationship between parent pain rating and child's pain behaviours after the painful immunization. Results of these analyses are presented in Table 4. When the interaction between a worry variable and child pain behaviour variable was significant, we probed the interaction by estimating the simple slope relation (27) between the child pain behaviour and parental pain rating at the highest worry value (by centering worry at 10) and a low worry value (by centering worry at 1). The results were the following:

1) The interaction between parent report of child worry after the immunization and pain behaviours was not significant during the reactivity stage (B^* = -.28, p = .071, adjusted R^2 = .35) but was significant during the regulation stage (i.e.1 and 2 minutes after the immunization (B^* = -.39, p = .001, adjusted R^2 = .35; B^* = -.39, $p < .001$, adjusted R^2 = .36, respectively). Interactions were probed and the relationships between parent pain ratings and child pain behaviours at each post-immunization time point are presented in Table 4. Probing revealed that only in the group of low parent report of child worry (at 1 and 2 minutes after the needle) was there a significant relationship between parental judgment of child pain and child's post-needle pain behaviours. Conversely, higher parent rated child worry 1 and 2 minutes after the needle was associated with a weaker

association between parental pain judgment and child's pain behaviours.

2) The interaction between parent-reported self-worry after the immunization and pain behaviours was significant during the reactivity stage ($B^* = .67$, $p = .016$, adjusted $R^2 = .37$; see Table 4). Results of probing the interaction revealed that parental report of their own worry level after the needle significantly moderated the relationship between child's pain behaviours 15 seconds after the needle (reactivity) and parental pain ratings, such that both high and low levels of reported self-worry after the needle were associated with a stronger relationship between child's pain reactivity and parental pain assessment. Interactions were not significant during the regulation stage, 1 and 2 minutes after the immunization, ($B^* = .004$, $p = .879$, adjusted $R^2 = .3$ and $B^* = .01$, $p = .826$, adjusted $R^2 = .33$, respectively).

Discussion

The primary focus of this study was to investigate factors that contribute to parental pain ratings of their child after a painful immunization procedure. This study builds on previous work conducted with infants (6), which showed that although parents report infant pain behaviours as integral to their pain judgments, infant pain behaviours did not explain the majority of the variance in parental pain judgments. This study is not only unique in its investigation of caregivers' pain ratings of preschool children, but it also examines the impact of other caregiver characteristics that might influence pain ratings above and beyond those related to child behaviours.

The first research question investigated the impact of preschoolers' pain behaviours on parental pain ratings. Generally consistent with the findings from 12 months of age that found infant pain behaviours explained up to 36% of variance in parental pain rating, 28% of the

variance in parental pain ratings in preschoolers was based on preschoolers' pain behaviours. This result replicated earlier findings showing that infants' pain behaviours did not determine the majority of variance in parental pain ratings, even though immediate reactivity pain behaviours and regulation pain behaviours were significant predictors of parental pain ratings. However, in contrast to the 12-month analyses, reactivity was a stronger predictor than regulation (despite regulation at 2 minutes post-needle emerging as a significant predictor as well) and child sex was not significant. While the majority of variance in parent pain ratings was not accounted for, this suggests that parents are basing their pain ratings on the preschoolers' initial high distress reaction to the needle, and not how the preschoolers calmed down. This has important implications for pain management, as parents may engage in heightened or prolonged use of pain management that may not be necessary if the child is regulating or returning to homeostasis quickly.

Given that the preschooler's pain behaviour did not comprehensively determine parental pain assessment, subsequent analyses examined parental factors that could also predict parental pain assessment. Previous research has suggested parent sensitivity-type variables and worry and fear have important links to child pain scores (10-13, 15); thus, these variables were key variables in our regression models. Contrary to our hypothesis, parental sensitivity was not a significant predictor of parental pain ratings after the needle nor was parental pre-needle assessment of their own worry and their child's worry. However, parental assessment of their own worry and their child's worry levels after the needle significantly predicted parental judgment of their preschooler's pain over and above child pain reactivity and regulation behaviours. The timing of these variables suggests a concurrent relationship such that parental ratings of pain are significantly related to their worry and their perception of their child's worry

post-needle.

After completing the primary regressions, the question arose as to whether the relationship between parent-reported worry post-needle and parent pain ratings led to more congruent ratings with child pain behaviours (i.e. parents who expressed more worry after a painful procedure have higher judgments of their child's pain because they were more attuned and based judgments on child pain behaviours) or less congruent ratings with child pain behaviours (i.e. parents have higher judgments based on their own negative affect state and were less attuned to child pain behaviour). To answer this question, we tested whether parental worry ratings (both their own and their rating of their child's worry) after the needle moderated the relationship between parental pain judgment and child's pain behaviour. Our results suggested different patterns based on whether it was parental self-report of worry post-needle or parental report of their child's worry post-needle. With self-report of worry, the interaction was significant right after the needle (15 seconds post-needle). With parental report of child worry, the interaction was significant during the regulation phase (1-2 minutes post-needle).

In our non-clinical sample (i.e. these were not parents known or suspected to have an anxiety disorder), both high and low levels of parental self-worry were related to a stronger relationship between child's pain behaviour and parental pain judgment during the reactivity phase. Thus, those parents who experience high or low levels of self-worry after the needle (i.e. parents that provided ratings near the extreme ends on the worry scale) were more attuned to their child particularly during the peak distress period, as seen through stronger relationships between parent pain rating and child pain behaviors. In line with our hypothesis and supported by implications from previous research (11,12,13), parents who experienced low worry were able to attend to and gauge their child's distress based on their child's pain behaviours. On the

other hand, part of our findings is in contrast to previous research that suggests that anxious parents are likely to be less emotionally sensitive to the child's needs and, most of all, can amplify and overestimate their child's pain (11, 12, 28). It appears reasonable to assume that parent worry could be adaptive, specifically during the peak distress period in an acute pain context, urging parents to be attuned to their child's pain cues. On the other hand, in a chronic pain context where there is no immediate solution for pain, parent worry may not be as adaptive and lead to the use of ineffective strategies for addressing pain, and greater distress and disability for the child (29). Future research should address whether parents with low and high levels of worry, who appear attuned to their child's pain cues in an acute pain context, are using effective caregiving behaviours while their child is in pain.

We also investigated whether congruence between parent pain ratings and child pain behaviours depends on perceived child worry. Indeed, at lower levels of parent perceived child worry, there was greater congruence between parent judgments of their child's pain and child pain behaviours. In other words, low levels of perceived child worry could be interpreted as making parents more attuned to their child's pain behaviours during regulation or return to baseline. However, this same pattern did not emerge for families whose child was rated as having high worry after the needle. This suggests that parents may discount a child's distress behaviours when they perceive the behaviours as a result of that child's worry as opposed to pain. In turn, this could reflect a very nuanced approach to pain assessment such that parents may be actually parsing out pain-related and non-pain related distress to synthesize a pain judgment.

Conclusions

Consistent with early studies on infants, a similar picture arose such that the preponderance of variance in parent pain ratings is not based on child pain behaviours, despite

the child being older and more capable of understanding and communicating their internal states. Moreover, the level of parental sensitivity in post-vaccination soothing behaviour also did not directly predict pain ratings nor did child's sex.

However, both parental post-needle reports of self-worry and child worry were significant predictors of parental pain ratings. Further probing this finding, post-hoc moderation analyses were conducted suggesting a sophisticated relationship between parental reports of worry, parental pain ratings and children's pain behaviour in our normative sample.

Parents with low and high levels of worry, in a normative sample, displayed more attunement during peak distress after the needle (i.e. the stronger the relationship between a child's pain behaviours and the parents pain rating). However, relatively speaking, when parents' ratings of their child's worry post-needle are higher, parents appear less attuned to their child's pain behaviours (i.e. a weaker association between child pain behaviour and parent pain ratings). These findings are of clinical significance, as they enable us to identify parents who may or may not be attuned to their child's needs, and when parents are most attuned to their preschooler's pain behaviours during immunizations (i.e., during peak distress). Ultimately, the ability to accurately assess a child's pain is particularly important for determining appropriate pain management. Supporting relationships hypothesized by the DIAPR model (5), this study suggests that it is vital to understand how caregiver factors influence ratings of their child's pain, as they may affect how the child's pain experience is assessed.

Although we examined how parent worry predicts parent judgments of their child' pain, we acknowledge that parent ratings of their child's pain could also contribute to their worry. Future research should consider conducting a time dependent analysis to better understand the direction of influence between parent worry and parent ratings of their child's pain. Given the

large amount of unexplained variance still present in our models of parental pain ratings, future work should examine other proximal parental variables such as general beliefs about acute pain or vaccination pain and the parent's own recall of their vaccination experiences to help us better understand what drives parental assessments of their young child's pain. Despite the large sample size, results of the current study should be interpreted with caution as the generalizability of our findings to high-risk samples has yet to be determined. Moreover, these relationships cannot be causative due to the methodologies used in this study.

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