



**A Longitudinal Examination of Verbal Reassurance During
Infant Immunization and Examination of Emotional
Availability as a Potential Moderator.**

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Abstract

Objectives: This study investigated the associations between caregiver verbal reassurance and infant pain-related distress during immunization over the first year of life. The relationships between verbal reassurance and caregiver emotional availability (EA) were also examined. Finally, EA was investigated as a moderator of the relationship between verbal reassurance and infant pain. **Methods:** A cross-sectional analysis was conducted with 606 infants (and their parents) at four different ages ($n = 376$ at two months, $n = 455$ at four months, $n = 484$ at six months, and $n = 407$ at 12 months). **Results:** Verbal reassurance was positively associated with infant distress across all four ages. Emotional availability was only negatively related to verbal reassurance at 12 months of age. Emotional availability was not a significant moderator at any age. **Conclusion:** Findings demonstrate consistent but small relationships between verbal reassurance and infant pain over the first year of life.

Keywords: verbal reassurance, infant pain, immunization, emotional availability

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A Longitudinal Examination of Verbal Reassurance during Infant Immunization and
Examination of Emotional Availability as a Potential Moderator.

The Importance of the Caregiver and Verbal Reassurance

Both healthy and ill infants endure various painful medical procedures throughout development. An important aspect to understanding how to manage pain in infancy is to explore the integral role of the caregiver (Pillai Riddell & Racine, 2009). Acknowledging the importance of parental behavior for infant pain responding during painful medical procedures, several studies have examined the impact of these behaviors on infant pain-related distress. Among parental soothing behaviors used during painful medical procedures, verbal reassurance has garnered significant attention (e.g., McMurtry, McGrath, & Chambers, 2006). Examples of verbal reassurance in the pain context include “it’s okay”, “you’re fine”, and “it’s almost over”. This trend in the literature can partially be attributed to the paradoxical association between parental use of apparently empathetic language and increased child and infant distress. Despite the parent’s obvious intention to soothe her or his infant by using reassuring statements, many studies have found a fairly consistent association between parental verbal reassurance and increased infant distress (Blount, Devine, Cheng, Simons, & Hayutin, 2008; Cohen, Bernard, McClellan, & MacLaren, 2005; Piira, Champion, Bustos, Donnelly, & Lui, 2007; Sweet & McGrath, 1998; Wolff et al., 2009). This finding has led researchers to attempt to understand the mechanism by which verbal reassurance has an impact on infant pain responding.

Verbal Reassurance and Pain Responses in Infancy

In contrast to the child literature, there is less research examining the role of verbal reassurance and its impact on pain in infants. Most studies in infancy have confirmed the positive relationship between infant pain-related distress and verbal reassurance (Cohen et al., 2005; Piira

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et al., 2007; Sweet & McGrath, 1998; Wolff et al., 2009) with the exception of one study (Bustos, Jaaniste, Salmon, & Champion, 2008). Additionally, Blount and colleagues (2008) showed that reassuring did not impact infant distress as there was no change in infant behavior from before to after these behaviors were enacted.

Factors having an impact on the relationship between verbal reassurance and pain in infancy remain largely unexplored. In children, some studies have suggested that parental use of verbal reassurance typically follows child pain-related distress (Spagrud et al., 2008; Kleiber & McCarthy, 1999), while others have suggested that there is most likely a cyclical bidirectional relationship between child distress and verbal reassurance, whereby verbal reassurance occurs both before and after child distress (Blount et al., 1989; Frank, Blount, Smith, Manimala, & Martin, 1995; Mahoney, Ayers, & Seddon, 2010; Manimala, Blount, & Cohen, 2000). On a more fine-grained level, some infant researchers have hypothesized that verbal reassurance in infancy communicates a message through associated nonverbal factors such as tone of voice, facial expression, body language, and touch (Bustos et al., 2008; Piira et al., 2007). However, taking a broader approach to understanding the mechanisms subsuming verbal reassurance has not been taken. A broader construct that encompasses both verbal and nonverbal caregiver behaviors could have an impact on the relationship between verbal reassurance and increased infant pain-related distress. Emotional availability (EA) is a broad construct encompassing parental sensitivity. Both verbal and nonverbal elements are included in this more global clinical judgment of how 'emotionally available' a parent is (including constructs such as parental hostility, intrusiveness, and how well they structure an interaction with their child). EA has been shown to be quite stable over the first year of life (Pillai Riddell et al., 2011), and given it describes the quality of the parent-infant interaction within the immunization setting, it has the

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3 potential to help explain the relationship between verbal reassurance and increased infant pain-
4 related distress. Emotional availability, based on attachment theory and parenting theory,
5 examines the quality of communication and connection between a caregiver and an infant or
6 child (Biringen, 2000). A caregiver who is less emotionally available may communicate fear and
7 anxiety to their infant during reassurance, thus exacerbating the relationship between verbal
8 reassurance and infant pain. Since increased infant pain-related distress is associated with verbal
9 reassurance (e.g., Cohen et al., 2005) and low parental emotional availability (Din, Pillai Riddell,
10 & Gordner, 2009), the possibility arises that emotional availability may moderate the relationship
11 between verbal reassurance and infant pain responses.
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24 Research has also yet to investigate the effect of verbal reassurance on infant pain
25 developmentally. Previous research has demonstrated that infant age accounted for a significant
26 amount of variance in infant pain-related responses, illustrating the importance of examining
27 development difference (Piira et al., 2007). Infancy is a period of rapid development, and it is
28 unknown whether reassurance is related to infant pain uniformly across age during infancy or
29 whether different relationships may emerge across age. Finally, another gap in the literature is
30 that most studies examining verbal reassurance in infancy have focused on immediate infant pain
31 response. Whether verbal reassurance has an effect on pain-related distress regulation after the
32 painful stimuli would provide important information for infant pain management. The current
33 study aims to help address some of these gaps in the literature.
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48 Current Study

49 The overarching goals of the current study were to examine the relationships, in an
50 immunization context, between parent verbal reassurance (before needle, minute 1, and minute 2
51 post-immunization needle) and infant pain responses (immediately after needle, 1 minute after
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3 needle, 2 minutes after needle) over the first year of life (at two, four, six, and 12 months of age);
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5 and to determine whether parental emotional availability (one global score at two, four, six, and
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7 12 months, respectively) moderates the relationship between verbal reassurance and infant pain.
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9 Data come from a longitudinal cohort examining the relationship between infant and caregiver in
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11 the immunization context between the ages of 2 months and 5 years. The current study has three
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13 main objectives: 1) to examine the bivariate relationships among parental use of verbal
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15 reassurance (before needle, minute 1, and minute 2 post-needle) and infant pain responses
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17 (immediately, 1 minute and 2 minutes after needle) over the first year of life; (2) to examine the
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19 relationships between verbal reassurance and emotional availability over the first year of life;
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21 and 3) to examine whether parental emotional availability moderates the relationship between
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23 parental use of verbal reassurance and infant pain responses to an immunization.
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30 Based on previously literature (Cohen et al., 2005; Piira et al., 2007; Sweet & McGrath,
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32 1998; Wolff et al., 2009), it was hypothesized that verbal reassurance and infant pain would be
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34 positively related and that these relationships would increase as infants got older, consistent with
35
36 infant receptive language development (Tincoff & Jusczyk, 2000). It was also hypothesized that
37
38 emotional availability and verbal reassurance would be negatively related due to the established
39
40 relationship between verbal reassurance and increased infant pain. More sensitive caregivers
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42 would be more likely to use other more effective strategies to soothe their infant rather than use a
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44 strategy that is ineffective (Blount et al., 2008). Emotional availability was hypothesized to
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46 function as a moderator whereby more emotionally available parenting would decrease the
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48 strength of the positive relationship between verbal reassurance and infant pain-related distress.
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51 The affectively positive and structuring manner in which the caregiver interacts with the child is
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3 thought to mitigate the negative effects or the fear and anxiety being communicated by the verbal
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5 reassurance. The moderating effect was hypothesized to increase with age.
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8 **Methods**

9 **Participants**

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11 The data for the current study come from an ongoing longitudinal cohort (the XX cohort)
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13 where caregiver-infant dyads are recruited from three pediatric clinics in the XXXX and
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15 naturalistically observed during their immunization appointment. The first four waves of the
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17 study, recruited from October 2007 to August 2011, have caregiver-infant dyads videotaped at
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19 their two-, four-, six-, and 12-month immunization appointments. The fifth wave of the study
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21 follows a subsample of the larger cohort at 12-to 18 months to measure attachment status. The
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23 sixth wave follows the cohort at the preschool (4-5 years) immunization appointment and also
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25 involves a psychoeducational and socioemotional assessment. The overarching goal of this
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27 cohort is to examine the interrelationships between caregiver factors, infant/child pain in the
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29 immunization context, and indicators of child health/mental health. No previously published
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31 (XXXXXX) or planned/submitted manuscripts from this cohort have hypotheses or analyses that
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33 overlap with the current manuscript.
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41 The current analysis is a cross-sectional examination and thus, dyads who were
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43 videotaped at least once during the infants' two-, four-, six-, or 12-month appointment for a
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45 routine immunization, and had complete data for caregiver emotional availability, caregiver use
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47 of verbal reassurance, and infant pain behavior, were included in the current study. Inclusion
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49 criteria for each dyad specified that the caregiver was able to speak English, the infant had no
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51 suspected developmental delays or chronic illnesses, and was born greater than 36 weeks. As
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53 such, 754 caregiver-infant dyads were screened for eligibility. A total of 148 participants did not
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3 have complete infant pain, emotional availability, and verbal reassurance data for at least one
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5 time point. Thus 606 parent infant-dyads were included in the present study (172 followed for
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7 four time points; 226 for three time points; 148 for two time points; and 60 for one time point).
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10 As a result of the cross-sectional nature of the study, there were 376 participants included at two
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12 months, 455 participants included at four months, 484 participants included at six months, and
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14 407 participants included at 12 months.
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17 Table 1 presents demographic variables for the caregiver-infant dyads included at two-,
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19 four-, six-, and 12-months of age. On average, the primary caregiver's age was 33.59 across time
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21 points. See Table 1 for other demographic information. Infants were almost equally split by
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23 gender at all four immunization appointments (on average 48.5% male). Infants received
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25 between one and three needles with more than 80% of infants receiving two needles across the
26
27 four time points.
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31 Procedure

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33 The Research Ethics Boards at the participating university and associated tertiary level
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35 pediatric hospital approved the protocol for the larger study. Caregivers with infants receiving
36
37 immunizations were provided a flyer by the medical receptionist and asked if they would like to
38
39 learn more about the study. If they indicated interest, informed consent was obtained and
40
41 caregivers were informed that their participation was confidential and voluntary, and that they
42
43 were free to end participation in the study at anytime. The caregiver subsequently completed a
44
45 demographic information form with the research assistant. The dyad was videotaped from the
46
47 moment the infant entered the room until five minutes after the immunization or when the
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49 caregiver and infant left the clinic room (naturalistic observation). This footage was used to code
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51 all caregiver and infant behaviors (see measures for exact times). At present, the withdrawal rate
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3 in the longitudinal study (waves 1 to 4) is 3%, with the most common reason for withdrawal
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5 being lack of interest and the second most common reason being that the family was relocating.
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Apparatus

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10 Two Canon HD Video Camcorders - HV20 were used. One camera was positioned on a
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12 tripod and fitted with a wide-angle lens to capture the entire interaction, specifically the infants'
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14 and the caregivers' behaviors. A second camera held by a research assistant was used to capture
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16 the infant's facial expressions.
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Measures

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21 **Demographic questionnaire.** Parents were asked to complete a brief demographic
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23 questionnaire as part of the larger research study. The questionnaire asked about personal
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25 information, such as relation to the infant, age, cultural background, profession, and education
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27 level, as well as information pertaining to the infant, such as infant age, gender, and previous
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29 medical conditions.
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34 **Infant pain behavior.** The Modified Behavior Pain Scale (MBPS; Taddio, Nulman,
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36 Koren, & Stevens, 1995) was used to assess the degree of infant pain and distress. This scale
37
38 uses behavioral indices to determine how much pain the infant is experiencing. There are three
39
40 subsections of the scale (facial expression, cry, and body movement), each requiring the coder to
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42 decide on a score based on overt infant behavior during a 15-second epoch. All sections of the
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44 measure are summed to get an infant pain score out of ten. Moderate to high concurrent and
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46 construct validity as well as item-total and inter-rater reliability have all been demonstrated in the
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48 immunization context (Taddio et al., 1995). Data for this scale were collected right after the
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50 needle (immediate MBPS), as well as one and two minutes after needle. MBPS was coded by
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3 trained primary coders who were blind to the study hypotheses. Inter-rater reliability was high
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5 with intraclass correlations ranging from .93 to .96.
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8 **Verbal reassurance.** Caregiver use of verbal reassurance was coded using the Measure
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10 of Adult and Infant Soothing and Distress (MAISD; Cohen et al., 2005). The MAISD is a
11
12 reliable and valid behavioral observation scale that was developed to evaluate the behaviors of
13
14 infants, parents, and health care professionals during painful pediatric medical procedures. For
15
16 the purposes of this study, only the verbal reassurance subscale was used. Verbal reassurance is
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18 coded as present (1) or absent (0) for five-second epochs during the following four phases: one
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20 minute prior to the first needle and three minutes after the last needle. Analyses used index
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22 scores representing the ratio of time each behavior was present to the total number of epochs
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24 available for coding. The index score ranged from 0 to 1, with higher scores reflecting greater
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26 frequency of behavior. Trained MAISD primary coders, blinded to the study hypotheses, coded
27
28 the data. Inter-rater reliability was high with an intraclass correlation of .82.
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34 **Emotional availability.** Emotional availability (EA) was coded using the fourth edition
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36 of the Infancy/Early Childhood Version of the Emotional Availability Scales (EAS; Biringen,
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38 2000). The EAS is a global clinical judgment of caregiving behavior. For a caregiver to have a
39
40 high EA score, he or she would have to engage in consistent and sensitive behaviors to address
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42 the infant's pain-related distress. The EAS has been well-validated in a variety of distressing
43
44 non-pain contexts, and examines four main caregiver subscales (sensitivity, structuring,
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46 nonintrusiveness, and non-hostility), which are summed to form an overall score (Biringen,
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48 2000).
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53 Footage from the entire immunization appointment was used to score the EAS. Scores
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55 from the subscales were subsequently summed to form a composite EA score on a scale from 28
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3 to 116. Higher scores represent more optimal interactions. When more than one caregiver
4 accompanied the infant for the immunization appointment, the caregiver who did the majority of
5 the caregiving was coded. When both caregivers provided equal care during the immunization
6 appointment, both caregivers were coded and an average score was obtained (2 months: 1.9%; 4
7 months: 1.3%; 6 months: 1.4%; 12 months: 3.7%). EAS coders were trained by the scale
8 developer during three days of intensive training. There were six coders for this study (three
9 main coders and three reliability coders). Inter-rater reliability was calculated between each main
10 coder and each of the reliability coders for 17% ($n = 291$ episodes) of the data. Intraclass
11 correlations for the caregiver EAS composite score ranged from .80 to .93.
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24 Reliability coding is conducted every two to four weeks by a graduate student in the lab
25 (reliability coder). When discrepancies arise, primary coders involved in the discrepancy meet
26 within the week to discuss discrepancies with the reliability coder, without using the actual case
27 on which the disagreement was based. Primary coders then re-code the original footage (blind to
28 the primary coder's actual codes) and reliability is calculated. Reliability codes are used in the
29 analysis dataset. This procedure is the same for MBPS, MAISD, and EAS.
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39 Results

40 Data Screening, Transformation and Cleaning

41 After the data file was reviewed for any data entry errors, descriptive statistics were used
42 to examine correlation and regression diagnostics. A family-wise error rate was not assigned due
43 to the exploratory nature of the analyses. Thus, an alpha level of .05 was used for each
44 correlation mentioned below. All assumptions for the multivariate analyses were met. A total of
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Objective 1: Examining relationships between verbal reassurance and infant pain responses.

In order to test the hypothesis that verbal reassurance and infant pain were positively related over the first year of life (with more relationships emerging with age), bivariate partial Pearson correlations were calculated at two-, four-, six-, and 12-months of age controlling for the number of needles the infant received.

Two months.

There were significant positive correlations between parental use of verbal reassurance two minutes following the needle and infant pain response both one ($r = .25, p < .001$) and two minutes following the needle ($r = .14, p = .01$, see Table 2).

Four months.

Parental use of verbal reassurance prior to the needle was significantly positively related to the immediate infant pain response variable ($r = .12, p = .01$, see Table 3). Parental verbal reassurance one minute following the needle was significantly positively related to infant pain response immediately following the needle ($r = .13, p = .004$). Parental verbal reassurance two minutes following the needle was significantly positively related to infant pain responses immediately ($r = .13, p = .005$), one minute ($r = .26, p < .001$), and two minutes following the needle ($r = .19, p < .001$).

Six months.

Parental verbal reassurance one minute following the needle was significantly positively related to infant pain response immediately following the needle ($r = .10, p < .05$, see Table 4). Parental verbal reassurance two minutes following the needle was significantly positively related

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3 to infant pain responses immediately ($r = .16, p < .01$), one minute ($r = .21, p < .001$), and two
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5 minutes following the needle ($r = .18, p < .001$).
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8 *Twelve months.*

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10 Parental verbal reassurance one minute following the needle was significantly positively
11 related to infant pain response immediately following the needle ($r = .16, p < .01$, see Table 5).
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13 Parental verbal reassurance two minutes following the needle was significantly positively related
14 to infant pain responses immediately ($r = .17, p < .001$), one minute ($r = .20, p < .001$), and two
15 minutes following the needle ($r = .10, p = .04$).
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22 **Objective 2: Examining the relationship between emotional availability and verbal** 23 **reassurance across the first year of life.** 24 25

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27 In order to test the hypothesis that verbal reassurance and emotional availability were
28 negatively related over the first year of life, bivariate partial Pearson correlations were calculated
29 at two-, four-, six-, and 12-months of age controlling for the number of needles the infant
30 received. It was hypothesized that verbal reassurance would be negatively related to caregiver
31 emotional availability. The only significant relationship between emotional availability and
32 verbal reassurance was a negative correlation between verbal reassurance two minutes post-
33 needle and the total caregiver emotional availability score at 12 months of age ($r = -.13, p = .01$).
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43 **Objective 3: Examining parental emotional availability as a moderator of the** 44 **relationship between parental use of verbal reassurance and infant pain.** 45 46

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48 In order to test the hypothesis that emotional availability moderates the relationship
49 between verbal reassurance and infant pain across the first year of life, twelve hierarchical
50 multiple regression models (one for each of the three pain measurements at all four of the age
51 time points) were estimated. It was hypothesized that total emotional availability would
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3 moderate the relationship between verbal reassurance and infant pain at all four ages. Moderation
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5 analyses were performed by: 1) centering the variables of interest; 2) entering the number of
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7 needles the infant received; 3) entering the predictor variable (verbal reassurance) and
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9 moderating variable (emotional availability); and 4) entering their interaction (Aiken & West,
10
11 1991). The interaction term was not significant for any of the 12 multiple regressions, indicating
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13 that emotional availability does not moderate the relationship between verbal reassurance and
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15 infant pain immediately, one, and two minutes post-needle at two-, four-, six-, or 12-months of
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17 age.
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22 Discussion

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24 There were three objectives to this study. The following will be a discussion of the three
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26 analyses in sequence.
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29 Objective 1: Relationships between verbal reassurance and infant pain.

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31 First, relationships among caregiver use of verbal reassurance and infant pain responses
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33 were examined over the first year of life. It was hypothesized that verbal reassurance would be
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35 positively associated with infant pain-related distress and that this relationship would be stronger
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37 for the older infants. Results showed that verbal reassurance was always associated with higher
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39 levels of infant pain-related distress across the first year of life. There was also an increase in the
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41 number of significant relationships with age, further supporting our hypotheses. This supports
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43 previous research with infants that demonstrated that the more verbal reassurance caregivers use,
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45 the more pain their infants express (Blount et al., 2008; Cohen et al., 2005; Piira et al., 2007;
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47 Sweet & McGrath, 1998; Wolff et al., 2009).
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53 However, novel information is provided by these analyses, owing to the analyses that
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55 examined the interrelationships between different temporal measures of verbal reassurance
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3 (before the needle, one minute after the needle, and two minutes after the needle) and pain
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5 responses over the appointment (15-second measurements of pain: right after needle, one minute
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7 after needle, and two minutes after needle) at each of the four age groups. In essence, because of
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9 measure timing (i.e., pre-needle verbal reassurance always preceded infant pain score right after
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11 needle; one minute verbal reassurance always preceded infant pain score one minute after
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13 needle; and two minute verbal reassurance always preceded infant pain score two minutes after
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15 needle), descriptions will be presented in a cross-lagged fashion and then contrasted over age. It
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17 should be noted that there was a 15-second overlap between pain measured right after needle and
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19 verbal reassurance one minute post-needle, and between pain one minute and verbal reassurance
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21 two minutes.
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27 Comparing the correlations between infant pain response and verbal reassurance for each
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29 age group over the first year of life, only at two months of age were there no relationships
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31 between verbal reassurance pre-needle or one minute after needle and any measure of infant pain
32
33 responding. The chain of relationships began with higher infant pain one minute following the
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35 needle positively relating to higher caregiver verbal reassurance during the second minute post-
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37 needle, which in turn was positively related to pain two minutes post-needle. This result suggests
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39 that at two months of age, compared to the other ages, the relationship between verbal
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41 reassurance and pain response begins with the infant's pain responding during the regulation
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43 phase post-needle, not with either infant or parent behaviors pre-needle or immediately after
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45 needle.
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50 At four, six, and 12-months of age, there is a consistent relationship pattern between
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52 verbal reassurance and pain responding during the entire post-needle period under analysis.
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54 Accordingly, for all three older ages studied, pain immediately after the needle was significantly
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3 related to verbal reassurance one minute after the needle; pain one minute after the needle was
4 significantly related to verbal reassurance two minutes post-needle, which was significantly
5 related to pain two minutes post-needle. In addition, pain right after the needle was also
6 positively related to verbal reassurance two minutes after the needle. However, four months was
7 the only age where verbal reassurance pre-needle was associated with a higher pain response
8 immediately after the needle. Thus, only at four months of age did the cyclical chain between
9 infant pain and parental verbal reassurance appear to begin with caregiver verbal reassurance.
10 Perhaps four months is a developmentally-sensitive period, whereby infants are particularly
11 sensitive to threat cues. This speculation is in line with the developing of an infant's ability to
12 differentiate emotions at this age (Montague & Walker-Andrews, 2001).
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27 In summary, the correlational analyses between caregiver reassurance and infant pain
28 responses showed three important overall findings. First, at two months of age, verbal
29 reassurance was only positively related to infant pain regulation, not pain reactivity, suggesting
30 that at this age verbal reassurance does not have an effect when an infant is most highly
31 distressed. Second, four months of age was the only time point where verbal reassurance pre-
32 needle was associated with higher pain reactivity immediately after the needle, suggesting a
33 potential developmentally-sensitive period to verbal reassurance. Third, at four, six, and 12-
34 months of age, a clear consistent bidirectional pattern was seen in the post-needle period
35 whereby infant pain responding predicted caregiver verbal reassurance, which in turn predicted
36 subsequent infant pain responding and so on. This finding provides support for the bidirectional
37 hypothesis of verbal reassurance, whereby infant distress leads to reassurance, and reassurance
38 leads to increased infant distress (Blount et al., 2008; Frank et al., 1995; Mahoney et al., 2010;
39 Manimala et al., 2000).
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3 While these analyses affirm the relationship of verbal reassurance and infant pain-related
4 distress over the first year of life, these effects are smaller than what has been previously
5 theorized and demonstrated in the literature. The differences in findings may be due to the fact
6 that some previous studies have examined both verbal and physical reassurance, including
7 patting and stroking (e.g., Wolff et al., 2009), whereas the current study only examined verbal
8 reassurance. Given that such small effects were found despite a large sample size, whether or not
9 verbal reassurance has a clinically significant impact on pain expression during infancy is
10 unknown.
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22 **Objective 2: Relationships between verbal reassurance and emotional availability.**
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24 Second, the relationships between caregiver emotional availability and verbal reassurance
25 were examined. It was hypothesized that verbal reassurance would be negatively related to
26 emotional availability across age. Support for this hypothesis was only found at 12-months of
27 age, two minutes post-needle. It is particularly interesting that this relationship only emerged two
28 minutes after the needle. This may suggest that not all verbal reassurance has the same effect on
29 pain response. For example, a small amount of verbal reassurance used immediately after the
30 painful stimuli may be empathic and sensitive with older infants, whereas higher levels of verbal
31 reassurance used long after the painful stimuli may serve to continue to draw attention to the pain
32 or may demonstrate a lack of other soothing strategies.
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46 **Objective 3: Moderating effect of emotional availability.**
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48 Third, whether parental emotional availability moderates the relationship between
49 caregiver use of verbal reassurance and infant pain responses to an immunization was explored.
50 It was hypothesized that emotional availability would moderate the relationships between verbal
51 reassurance and infant pain. Counter to our hypothesis, total caregiver emotional availability was
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3 not a significant moderator at any of the four time points. This indicates that emotional
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5 availability did not function to buffer or exacerbate the relationship between verbal reassurance
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7 and infant pain. One possible explanation is that more discrete caregiver behaviors that
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9 accompany the verbal reassurance (such as facial expression and body movements) may be more
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11 influential than the sensitivity of the caregiver who made the reassuring comments. Similar to
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13 what has been found in the child literature (McMurtry, Chambers, McGrath, & Asp, 2010),
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15 discrete behaviors such as facial expressions and body tension during reassurance may
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17 communicate fear to the infant, thus heightening the relationship between verbal reassurance and
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19 infant pain-related distress.
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24 **Conclusions and Clinical Implications**

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27 First, across all three analyses there were developmental differences between the different
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29 age groups over the first year of life. These findings suggest that researchers should be wary of
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31 collapsing across wide age ranges, especially in infancy when developmental changes occur
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33 rapidly. Second, it should be noted that in this study there were different results for pain
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35 reactivity (immediate pain following the needle) and pain regulation (pain one- and two- minutes
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37 after the needle). This is particularly important for nurses and physicians who are involved in
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39 assessing and managing infant pain. Assessing pain beyond the painful event, and encouraging
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41 parents to use pain management strategies effective for regulation are important. Lastly, although
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43 these findings support the well-established positive relationship between verbal reassurance and
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45 infant pain, these results call into question the clinical importance of verbal reassurance in
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47 infancy given the small relationships found with a large sample size. Although the use of verbal
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49 reassurance has begun to be discouraged by immunizing health professionals for older children,
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51 this research suggests that the impact during the first year of life may not be as great.
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Limitations and Directions for Future Research

The current study has several limitations that may influence the interpretation of the findings. First, although ethnically diverse, the majority of the sample was highly educated, with parents having completed undergraduate or graduate level university education. Given education has been linked to caregiver sensitivity, these findings may not be generalizable to other less educated and more high-risk clinical populations. Second, although most participants were observed to habituate to being videotaped, the possibility remains that videotaping may have altered caregiver behavior during the immunization. Third, we did not control for interactions between the infant and caregiver at previous time points, as not all participants had data at all four time points, and whether or not previous immunizations for these infants were received is unknown. The caregiver-infant interaction at previous visits may have contributed to the infant's behavior at future time points. Future research should examine the relationships and continuity between caregiver behavior and infant pain responses both in the immunization context and in other settings, as well as look at the potential influence of the immunizing health professional on both caregiver and infant behavior.

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Table 1

Demographic Characteristics

	<u>2 months</u>	<u>4 months</u>	<u>6 months</u>	<u>12 months</u>
	(<i>n</i> = 376)	(<i>n</i> = 455)	(<i>n</i> = 484)	(<i>n</i> = 407)
Age of caregiver present	33.56	33.65	33.65	33.48
Mother	52.1 %	63.3%	61.6%	55.5%
Mother and Father	38.3 %	28.6%	29.5%	26.4%
Father	2.1 %	1.3%	2.5%	10.3%
Parent(s) and Grandparent(s)	4.3 %	3.5%	3.3%	3.4%
Other	3.2 %	3.2%	3%	4.1%
Self-reported heritage culture				
European	36.7%	36.0%	35.1%	34.9%
Canadian/American	12.8%	13.4%	13.2%	10.1%
Asian	19.9%	19.1%	19.2%	20.1%
African/Middle Eastern	4.8%	3.5%	4.7%	5.7%
Other	24.3%	26.6%	25.6%	27.3%
Missing	1.5%	1.4%	2.1%	2.0%
Education level				
Graduate/Professional School	27.9%	31.0%	29.8%	30.7%
University/Partial University	47.1%	47.2%	46.3%	46.4%
Trade School/College	16.8%	14.3%	15.7%	15.5%
High School or less	7.9%	7.5%	7.4%	6.8%
Missing	0.3%	0.2%	0.8%	0.5%

Table 2

Bivariate Partial Pearson Correlations among Predictor, Moderator, and Outcome Variables at Two-Months

Variable	<i>M</i>	<i>SD</i>	<i>N</i>	1	2	3	4	5	6
1. Immediate infant pain response	8.74	1.03	376						
2. Infant pain response 1 minute post-needle	5.63	2.92	376	-	-	-	-	-	-
3. Infant pain response 2 minutes post-needle	4.95	3.10	376	-	-	-	-	-	-
4. Verbal reassurance pre-needle	.02	.05	376	-.00	-.09	-.08	-	-	-
5. Verbal reassurance 1 minute post-needle	.18	.21	376	.07	.05	.08	-	-	-
6. Verbal reassurance 2 minutes post-needle	.15	.21	376	.05	.25***	.14*	-	-	-
7. Total caregiver emotional availability score	91.60	10.56	376	-.16**	-.13*	-.13*	.06	.09	.08

Note. * $p < .05$, *** $p < .001$; (two-tailed).

Table 3

Bivariate Partial Pearson Correlations among Predictor, Moderator, and Outcome Variables at Four-Months

Variable	<i>M</i>	<i>SD</i>	<i>N</i>	1	2	3	4	5	6
1. Immediate infant pain response	8.44	1.12	455	-	-	-	-	-	-
2. Infant pain response 1 minute post-needle	4.63	2.69	455	-	-	-	-	-	-
3. Infant pain response 2 minutes post-needle	4.31	2.77	455	-	-	-	-	-	-
4. Verbal reassurance pre-needle	.02	.06	455	.12*	.05	.05	-	-	-
5. Verbal reassurance 1 minute post-needle	.16	.21	455	.13**	.08	.03	-	-	-
6. Verbal reassurance 2 minutes post-needle	.10	.17	455	.13**	.26***	.19***	-	-	-
7. Total caregiver emotional availability score	94.27	9.43	455	-.12*	-.13*	-.11*	.01	.03	-.02

Note. * $p < .05$, ** $p < .01$, *** $p < .001$; (two-tailed).

Table 4

Bivariate Partial Pearson Correlations among Predictor, Moderator, and Outcome Variables at Six-Months

Variable	<i>M</i>	<i>SD</i>	<i>N</i>	1	2	3	4	5	6
1. Immediate infant pain response	8.42	1.13	484	-	-	-	-	-	-
2. Infant pain response 1 minute post needle	4.57	2.74	484	-	-	-	-	-	-
3. Infant pain response 2 minutes post needle	3.90	2.87	484	-	-	-	-	-	-
4. Verbal reassurance pre-needle	.03	.09	484	.08	.07	.09	-	-	-
5. Verbal reassurance 1 minute post needle	.16	.19	484	.10*	.07	.08	-	-	-
6. Verbal reassurance 2 minutes post needle	.09	.15	484	.16**	.21***	.18***	-	-	-
7. Total caregiver emotional availability score	94.30	10.44	484	-.09	-.12*	-.10*	.01	-.03	-.07

Note. * $p < .05$, ** $p < .01$, *** $p < .001$; (two-tailed).

Table 5

Bivariate Partial Pearson Correlations among Predictor, Moderator, and Outcome Variables at 12-Months

Variable	<i>M</i>	<i>SD</i>	<i>N</i>	1	2	3	4	5	6
1. Immediate infant pain response	8.25	1.33	407	-	-	-	-	-	-
2. Infant pain response 1 minute post needle	5.49	2.62	407	-	-	-	-	-	-
3. Infant pain response 2 minutes post needle	4.32	2.86	407	-	-	-	-	-	-
4. Verbal reassurance pre-needle	.02	.06	407	-.01	.00	-.05	-	-	-
5. Verbal reassurance 1 minute post needle	.18	.19	407	.16**	.06	.03	-	-	-
6. Verbal reassurance 2 minutes post needle	.12	.19	407	.17***	.20***	.10*	-	-	-
7. Total caregiver emotional availability score	92.63	10.87	407	-.20***	-.21***	-.19***	.04	-.01	-.13*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$; (two-tailed).