

# Judgments of Infant Pain: The Impact of Caregiver Identity and Infant Age

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**Objective** To examine whether caregiver judgments of infant pain would vary systematically with different infant caregiver groups and infant age. **Methods** A total of 123 caregivers (41 parents, 41 in patient nurses, 41 pediatricians) viewed videotapes of the vigorous behavioral responses of healthy infants (aged 2, 4, 6, 12, and 18 months) to a routine immunization injection and provided ratings of both the affective distress and pain intensity observed. **Results** A principal components analysis of affective and intensity ratings yielded a weighted pain summary score for each injection event. Older infants were attributed significantly more pain than younger infants, even though the vigor of the behavioral reactions was experimentally controlled across age groups. A profile analysis contrasting observer groups indicated that pediatricians attributed significantly lower levels of pain than parents, while nurses were intermediate to the other groups, not significantly differing from either group. These systematic differences in judgments were consistent across infant age groups. **Conclusions** The findings reveal systematic sources of significant variations in observer judgments of infant pain. Despite an absence of differences in the behavioral reactions of the children, both the type of caregiver and their knowledge of the child's age systematically influenced attributions of pain to infants. This work suggests the important role of caregiver role variation and perceived developmental maturity as determinants of infant pain judgments and highlights potential areas of difficulty in controlling the unnecessary suffering of infants.

**Key words** infant pain; judgment; nurse; parents; physician.

Infants have suffered needlessly due to combinations of failure to recognize pain, inadequate assessment, underestimation of pain severity, and ensuing inadequate pain management (Anand & Craig, 1996; Craig, Korol, & Pillai, 2002; American Academy of Pediatrics and American Pain Society, 2001). To better understand the nature of pain experienced by infants and to improve delivery of care, the challenges caregivers confront when attempting to recognize and assess infant pain require study (Craig, Lilley & Gilbert, 1996). Well illustrated by the long history of infant pain denial (McGrath & Unruh, 1987; Derbyshire, 1999), a primary problem would appear to be the potential for biases in caregiver judgments. This investigation examined whether primary caregiver groups would systematically vary in how they perceive infant pain. Moreover, the role of infant age was also examined across the different caregiver groups to

further elucidate the influence on caregiver judgments. Parents, nurses, and pediatricians often accept significant caregiver roles; hence, it is important to understand whether there are differences within and among these groups in the capacity or willingness to attribute pain to infants. It is recognized that people within each of these groups are often dissimilar and that there is frequent overlap in roles, for example, nurses often also are parents; nevertheless, role differentiation and group identification tends to be substantial. Systematic differences would confirm this.

Parents, nurses, and physicians all play important and distinct roles in decoding and managing infant pain that deserve brief summary. Because of biological connectedness to their children and the commitments guardianship engender, parents play a primary role in infant caregiving. They typically approach infant pain

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empathizing with their child, yet often feel helpless when confronted with unfamiliar challenges of pain management (Franck, Scurr, & Couture, 2001). Unlike nurses and pediatricians, parents provide care with little to no formal professional training, relying heavily on personal, familial and cultural experiences and training (Pillai Riddell, Lilley, & Craig, 2004). Perhaps compensating for lack of formal training, relative to nurses or pediatricians, parents typically have more time to interact with their children in a variety of different contexts and come to know their children's character and idiosyncrasies well. These experiences could facilitate a deeper understanding of the cues that his/her infant would use to communicate pain (Bowlby, 1982; Emde, 1993).

While pediatricians also may be parents, their extensive training and specialized medical knowledge would be expected to lead to different approaches to assessing and offering treatment of infant pain. Furthermore, professional demands and patterns of practice often lead to pediatricians spending less time with infants under their care, although they would tend to see a greater number of infants, in comparison to inpatient nurses and parents (Huth & More, 1998).

Nurses would appear intermediate to parents and pediatricians in the use of specialized medical knowledge and direct time spent with infants under their care, particularly those nurses assuming inpatient duties (such as those studied in the current project). Similar to parents, but to a lesser extent, these nurses tend to spend extended amounts of time with an infant under their professional care. They are described as the health professional group spending the most time with individual patients (Huth & More, 1998). Their professional roles require routine care of ill infants (e.g., feeding, play, and medical procedures) and they can obtain experience with infants in both pleasurable and distressing contexts (Fuller, 1998). Akin to parents, they become involved in interpretation of a physician's orders for infant care (Fuller & Connor, 1996; Howard & Thurber, 1998), but similar to pediatricians, they apply a considerable amount of medical knowledge and training (Stevens & Gibbins, 2002). Setting them apart from parents and pediatricians, inpatient nurses also make pain assessments for a greater variety of children than would a parent, but typically less than pediatricians.

Minimal comparative work has addressed how these groups undertake pain assessment. Physicians appear more concerned about the consequences of multiple pain injections during one sitting than parents (Woodin et al., 1995), and health professionals (nurses, doctors,

residents and nurses' aids) were less able to correctly discriminate between photos of pain and nonpain infant faces than parents (Xavier Balda et al., 2000). Another study compared parent and nurse injection pain judgments, finding that parents judged their infants to be experiencing more pain than did nurses, with nurse and parent pain judgments unrelated (McClellan, Cohen, & Joseph, 2003). However, the insignificant correlation may have been due to inadequate statistical power.

A plethora of factors could contribute to variability in judgments of infant pain ratings. Craig and Pillai Riddell (2003) theorize that distal factors, such as culture, community, and family contexts, could influence pain judgments, as would more proximal factors, such as characteristics of the infant and the caregiver. Pillai Riddell, Badali and Craig (2004) found that parents reported infant factors such as facial activity, body movements, and cry, to be most important to their pain judgments. These features also were reported to be crucial to nurses' pain judgments (Fuller & Conner, 1996; Howard & Thurber, 1998). No work was found on infant factors that are integral to physicians' actual judgments of infant pain.

Furthermore, the potential impact of infant age on the judgments of any of the aforementioned infant caregivers has not yet been explored. Current longitudinal research on developmental changes in infant pain reactivity in immunization contexts has resulted in somewhat similar findings. When looking at pain reactivity, data suggests that healthy infants appear to mount less vigorous pain responses over time (e.g., Izard, Hembree, & Huebner, 1987; Axia & Bonichini, 1998). To explore if there were age biases inherent in caregiver judgments (not related to behavioral reactivity but rather caregivers' knowledge of infant age), experimental controls would be necessary.

## Study Overview

The purpose of this study was a comparative analysis of the severity of pain attributed to infants at five different ages (2, 4, 6, 12, and 18 months) by three different groups of caregivers (parents, nurses, and pediatricians) who viewed video clips of infants' reactions to immunization injections. The infant pain behavior shown in the video clips was controlled so that all infants displayed a similarly vigorous pain reaction. Behavioral variables (cry and facial activity) were controlled because, as reviewed earlier, caregivers self-reported them as most important to their pain judgments. In addition,

**Table I.** Mean and Standard Deviations for Neonatal Facial Coding Scale Scores for Each Age Group Score

	2 months	4 months	6 months	12 months	18 months
NFCS mean sum	31.25	28.5	31.5	28.25	28.25
Standard deviation	3.86	4.73	2.08	5.12	3.5

With seven facial actions coded for a 10-s epoch, a maximum sum is 35.

the background context for the needle injections was comparable, as the injections took place in the same health unit, by the same clinicians and all the children were characterized as healthy. However, one systematic variation was introduced between video clips. Caregivers were informed of the age of the infants to see whether this would influence caregiver pain judgments. Elucidating potential age biases in caregiver judgement was considered an important area of inquiry, as no work to date could be found that utilized experimental controls in a manner that could clarify the relationship between perceived infant age and caregiver pain judgments.

Although none of the caregivers in this study had a previous or continuing relationship to the infants they were judging, it was hypothesized that their differing breadth and depth of experience with infant pain and caregiving would influence infant pain judgment schemas (Huth & More, 1998; Xavier Balda et al., 2000; Monterosso et al., 2005). Accordingly, it was hypothesized that pediatricians would attribute lower levels of pain than both parents and inpatient nurses, as in their daily practice they have limited time to build emotional ties to infants under their professional care (Craig, Grunau & Aquan-Assee, 1988); a factor that is seen as integral to being sensitive to an infant's cues (Emde, 1993). It was also hypothesized, based on past research, that more pain would be attributed to older children as they are seen as more capable of mounting the full-pain response observed in older children and adults (e.g., Shapiro, 1993; Craig, 1997).

## Method

### Participants

Approval to conduct the study was obtained from the University of British Columbia Ethics Review Board and Children's & Women's Hospital Institutional Review Board (nursing sample only) for each caregiver sample. The parents were randomly selected from a sample of parents in an earlier paper (Pillai Riddell et al., 2004). None of the parents in the study were health professionals, although 20% of parents worked in an occupation with direct infant contact (e.g., day care centre). Consent forms were similar for all three samples, with the only difference being identification of the location for data

collection [i.e., a science museum (parents), a hospital Special Care Nursery (SCN nurses) or a physician's office (pediatricians)]. Basic demographic information for the three samples is presented in Table I.

### Procedure

The same study protocol was used with each group, regardless of location. All participants met alone with the experimenter in an enclosed room and were placed so as to not have a clear view of the experimenter's facial expression during the judgment phase. They were given an explanation of the study (participants were told that researchers were interested in how "caregivers made infant pain judgments"), asked to provide consent, and completed a demographic questionnaire. Participants then were familiarized with the judgment protocol via a structured script and shown a sample video clip. Each pain judgment followed after viewing a 10-s video clip of an infant reacting to the immunization. Each clip began immediately after injection needle skin penetration. The video was paused between clips, with participants allowed to take as long as needed to fill out the pain scales, but they only viewed each clip once. The judgment procedure took a maximum of 20 min. To examine the role of caregiver identity and infant age, the procedure and stimuli were designed to present judges with infants of differing ages that were from the same setting (health unit), undergoing the same pain stimulus (needle), had the same health status (healthy), and exhibited a similar level of behavioral reactivity (facial activity, body movement, and cry).

### Apparatus

#### Video Stimuli

All participants watched video clips of healthy babies receiving a routine immunization at a local health unit on a JVC portable TV/VCR with a 13" screen. In total, 20 babies (four clips in each of the five age groups) were selected from among 75 whose behavioral reactions were reported earlier (Lilley, Craig, & Grunau, 1997). Video clips were excluded if parental facial expressions were visible. Each baby selected demonstrated a loud, clear cry after needle insertion and continued to cry for the duration of the clip. The objective was to select babies

who were crying vigorously enough to be heard and seen by judges.

To ensure that behavioral activity did not differ among the video clips, each infant's reaction was coded for pain severity using the well-validated and reliable Neonatal Facial Action Coding System (Grunau & Craig, 1987; NFCS). Trained coders were blind to study hypotheses. Inter-rater reliability was excellent (.96). Consistent with earlier studies (Hadjistavropoulos, Craig, Grunau, & Whitfield, 1997; Grunau, Oberlander, Hosti, & Whitfield, 1998), seven facial actions were summed to provide an overall index of facial activity, with higher scores indicative of higher pain reactivity (maximal score for the 10 s interval was 35). NFCS scores across the clips indicated equivalent levels of pain facial display (see Table I for means and standard deviations for each age group).

Throughout the duration of each video clip, the baby's age appeared clearly in the upper right hand corner of the screen. Between each video clip, the RA paused video playback to provide time for participants to make ratings. Video clips of infants within the same age group were always grouped together on the judgment video. The age groups were presented to subjects in a random order to control for potential serial order effects of age and carry-over effects (Kazdin, 1998).

## Measures

### Video Judgment Package

*Pain Intensity and Affect. (Visual Analogue Scale; Differential Descriptor Scales).* Participants initially rated the severity of each child's pain by placing a mark on a 100 millimetre (mm) Visual Analogue Scale (VAS), anchored by "No Pain" and "Worst Pain Possible" (Hamers, Abu-Saad, van den Hout, Halfens, & Kester, 1996; Price, Bush, & Harkins, 1994). A VAS score exceeding 30 mm is generally accepted as indicating clinically significant pain (Collins, Moore, & McQuay, 1997). The VAS is considered a sensitive and reliable measure of pain intensity (Abu-Saad, Bours, Stevens, & Hamers, 1998). Previous research has demonstrated convergent validity between infant pain judgments using a VAS and other well-established behavioral indicators of pain, such as facial expressions, pain cry, and stiff posturing (Taddio, Nulman, Koren, Stevens, & Koren, 1995; Fuller, Thomson, Conner, & Scanlan, 1996; Buchholz, Karl, Pometto, & Lynn, 1998).

Although the VAS is a valid and reliable index of infant pain, it represents pain sensory intensity only. As pain is conceptualized as both a sensory and affective experience (IASP, 1994), modifications of the Descriptor

Differential Scales for pain intensity (DDS-I) and pain unpleasantness (DDS-U) (Gracely & Kwilosz, 1988) also were included. Judges selected the verbal descriptors best describing the child's experience from each of two series of adjectives graded in affective distress and pain severity. Each descriptor scale ordered descriptors from highest intensity (or unpleasantness) at the top of the scale to descriptors of the lowest intensity (or unpleasantness) at the bottom of the scale. These scales have been demonstrated to have strong reliability and validity (e.g., Melzack & Katz, 1999). Each of the verbal descriptors was assigned a rank value from 0 to 12 (intensity: 0 = no sensation of pain to 12 = extremely intense; unpleasantness: 0 = no discomfort to 12 = very intolerable).

## Results

### Demographics

Initial analyses contrasted demographic characteristics of the three groups providing judgment ratings. A one-way analysis of variance (ANOVA) and Tukey's post-hoc procedure were used to examine group differences in participant's age. Results revealed that pediatricians were significantly older than both parents and nurses ( $F_{2,120} = 9.20, p < .001$ ). A series of chi-square analyses examining group differences on categorical measures indicated that self-identified ethnicity did not differ among caregiver groups; but there were significant differences among the three groups in gender distribution ( $\chi^2_{(2)} = 36.77, p < .001$ ) and the proportion of participants who were parents [ $\chi^2_{(2)} = 23.89, p < .001$ ]; Table II].

### Relationships among Measures of Judged Pain

As the preponderance of zero order correlations between the VAS, DDS-I, and DDS-U were significantly greater than .60, the dependent variables were considered too strongly related to conduct a traditional MANOVA as originally planned (Tabachnick & Fidell, 2001). A principal components analysis (PCA) was run to determine if the three measures of pain were redundant and, if so, which one or more of the three pain scales could be excluded from further analysis. If they were deemed to be related but contributing independently to a principal component (i.e., pain), the weightings generated by the PCA would inform how the variables should be optimally combined to form a new variable (correlational tables available from author upon request).

The findings indicated that the three measures of pain were not redundant and that they could be

**Table II.** Demographic Characteristics by Sample Affiliation

	Parent (n = 41)	Nurse (n = 41)	Pediatrician (n = 41)
Participant's age	M = 39.61 SD = 7.60	M = 37.95 SD = 8.80	M = 45.68 SD = 9.28
Participant's gender	Female = 34 Male = 7	Female = 41 Male = 0	Female = 18 Male = 23
Participant's ethnicity			
White	n = 35	n = 27	n = 37
Asian	n = 3	n = 11	n = 3
Other	n = 3	n = 3	n = 1
Participant's parental status	Yes = 41 No = 0	Yes = 22 No = 19	Yes = 29 No = 12

optimally combined to form a meta-pain variable (note almost equal weightings; Table III). This summary index of judged pain (henceforth labeled 'meta-pain' variable) was created by weighting and summing scale ratings from the three different pain measures. To facilitate interpretation of findings, a linear transformation (which does not change the meaning of a variable) was utilized to have the new meta-pain variable approximate to the commonly accepted metric of a 0 to 10 scale. Mean pain ratings were utilized (i.e., collapsed over all infants within an age group) for analyses.<sup>1</sup> Scale scores ranged between 0.33 and 9.56, with higher values indicative of higher pain. The co-efficient alpha for this new variable, based on the eigenvalue of the first principal component (2.370) was .87, indicative of excellent reliability (Murphy & Davidshofer, 2001).

**Profile Analysis on the Meta-pain Variable**

Because of heterogeneity of the variance-covariance matrices of the meta-pain variable (Box's  $M = 114.137$ ,  $p < .001$ ), a profile analysis was conducted. Profile analysis is an alternative to the better known between-within ANOVA. While testing similar hypotheses,<sup>2</sup> it requires fewer assumptions. Multivariate outlier analyses indicated no extreme values. An overall family-wise error rate of  $\alpha = .15$  (.05 per test) was used for the three hypotheses tested in the profile analysis.

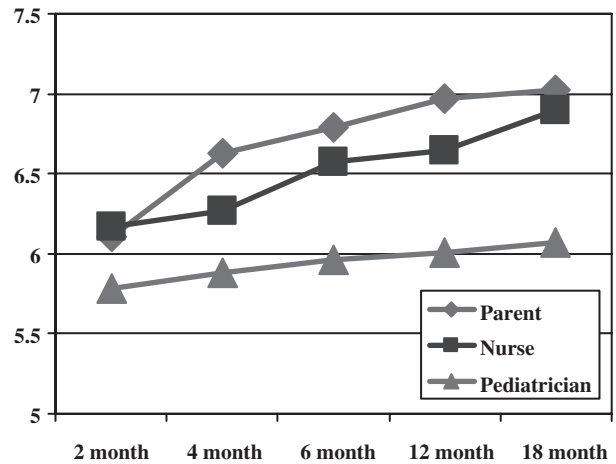
The test for parallelism indicated that the profiles indicating how each group judged pain across the age

<sup>1</sup>Missing values were replaced with the cell mean rating (15 cells total; 3 samples by 5 infant ages). One percent of values were missing mostly due to participants missing one of the three pain scales for a particular infant.

<sup>2</sup>In a between-within design, one tests for the interaction, the between-groups effect and the within-groups effect. The equivalents in a profile analysis, respectively, are the test for parallelism, the test of levels and the test of flatness.

**Table III.** Principal Component Weights and Pooled Standard Deviations

	VAS	DDS-I	DDS-U
Standardized principal component weight	.85	.93	.89
Pooled standard deviation	17.27	1.68	1.45



**Figure 1.** Means on the meta-pain variable: Caregiver sample by age groups.

groups did not differ ( $F_{8,480} = 2.08$ ,  $p > .05$ ). Both the tests for levels ( $F_{2,120} = 3.26$ ,  $p < .05$ ) and flatness ( $F_{4,480} = 17.27$ ,  $p < .001$ ) resulted in significant findings, indicating that there were significant differences among the three groups making judgments and that there were differences among the age groups in pain attributed to the children. Figure 1 depicts means on the meta-pain variable across caregiver and age groups.

Tukey's post-hoc procedure was used to follow up on the significant levels ( $\alpha = .05$ ) and flatness ( $\alpha = .05$ ) effects. The former analysis (group differences) indicated that pediatricians attributed significantly lower levels of pain than parents but nurses did not differ from either of the other two groups. In following up the flatness hypothesis (age differences), results indicated that the mean meta-pain ratings for 2-month olds and 4-month olds were significantly lower than the 18-month olds. Furthermore, the 2-month olds also were attributed significantly lower meta-pain ratings than the 12-month olds and the 6-month olds, while no differences existed in the meta-pain ratings of the 2 and 4-month olds nor the 4, 6 and 12-month olds. Overall, this pattern consistently demonstrated that older babies were attributed higher levels of pain than younger babies. Marginal means are provided in Table IV.

**Table IV.** Profile Analysis: Estimated Marginal Means of the Meta-pain Variable

	Parent	Nurse	Pediatrician	Age means
2-month olds	M = 6.10 SD = 1.82	M = 6.17 SD = 1.38	M = 5.79 SD = 1.46	<b>6.02<sup>c</sup></b>
4-month olds	M = 6.63 SD = 1.77	M = 6.27 SD = 1.21	M = 5.88 SD = 1.50	<b>6.26<sup>c,d</sup></b>
6-month olds	M = 6.79 SD = 1.84	M = 6.52 SD = 1.27	M = 5.97 SD = 1.52	<b>6.42<sup>d,e</sup></b>
12-month olds	M = 6.97 SD = 1.73	M = 6.65 SD = 1.13	M = 6.00 SD = 1.56	<b>6.54<sup>d,e</sup></b>
18-month olds	M = 7.02 SD = 1.70	M = 6.89 SD = 1.19	M = 6.07 SD = 1.48	<b>6.66<sup>e</sup></b>
Sample means	<b>6.70<sup>b</sup></b>	<b>6.50<sup>a,b</sup></b>	<b>5.94<sup>a</sup></b>	

Means having the same subscript do not significantly differ at  $p < .01$  or greater using the Tukey post-hoc comparison method.

### **Post-hoc Analyses of the Contributions of Gender, Parental Status, and Age to Pain Judgments**

Given significant between-group differences in sample demographic compositions on the categorical variables of gender and parental status, within-sample post-hoc analyses were conducted comparing males versus females and parents versus nonparents on meta-pain ratings for each age group. Bonferroni-corrected ( $\alpha = .01$  for each  $t$ -test; family-wise error rate of .20) independent samples  $t$ -tests<sup>3</sup> were run. No heterogeneity of variance accompanied the largely unequal  $n$ 's (Levene's test for Homogeneity of Variance) for any of the 20  $t$ -tests run<sup>4</sup>. In both the parent and pediatrician samples, no significant gender differences were found for any of the age group meta-pain ratings. Furthermore, no significant differences between parents and nonparents were found in either of the nurse or pediatrician samples. Finally, to explore the impact of judge age on pain judgments, correlations were run exploring the relationship between pain judgments and age within each caregiver group and for the total sample of caregivers. No individual

<sup>3</sup>Assumption violations precluded the use of a Hotelling's T-square procedure.

<sup>4</sup>**Gender:** Five  $t$ -tests compared males' versus females' meta-pain ratings (for 2, 4, 6, 12, or 18-month olds) in the parent sample. Five  $t$ -tests compared males' versus females' meta pain ratings in the pediatrician sample. No gender follow up was done on the nurse sample, as the sample was 100% female. Means available upon request.

**Parental status:** Five  $t$ -tests compared parents versus non-parents in the nurse sample. Five  $t$ -tests compared parents versus non-parents in the pediatrician sample. No parental status follow up was performed on the parent sample as the sample was entirely comprised of parents. Means available upon request.

correlation was significant, using an alpha level of .25, suggesting no relationship of age on pain ratings. Post-hoc analyses suggested that the between-group sample composition differences (gender and age) did not significantly contribute to the between-group pain rating differences.

## **Discussion**

Infants are vulnerable to disease and injury, yet generally incapable of directly controlling the circumstances that lead to pain; hence, they are heavily dependent upon adult caregivers to recognize pain, assess its severity and significance, and to intervene when appropriate. The present comparative analysis of major groups of caregivers disclosed important differences in how they perceived pain instigated by an acute painful event in infants of different ages.

### **Judges' Pain Ratings**

Before discussing significant between-group differences, it is important to highlight that judges in all categories believed immunization injections instigated significant pain for infants of all ages. In this study, scores  $>3.0$  were considered to represent clinically significant pain, because the meta-pain variable was scaled to parallel the range of values for the VAS (Collins et al., 1997). It was noteworthy and perhaps re-assuring that almost every single judge believed that all infants were experiencing clinically important pain. However, although the term 'clinically significant pain' is usually reserved for pain worthy of intervention, it is important to note that even infants who are deemed to be at this level of pain are often not treated appropriately with known analgesics or nonpharmacological controls (Anand, 1998).

### **Why Did Pediatricians Differ from Parents but Nurses Not Differ from Either Group?**

There were important differences in pain attributions between categories of caregivers. Parents attributed higher levels of pain than pediatricians, with nurses intermediate to and not differing from either of these two groups. Based on post-hoc analyses, these differences did not appear due to the differences in the gender or parental status compositions of each caregiver sample.

The differences between groups suggest that factors associated with group membership led to systematic differences in attributions of pain. Factors identified earlier as descriptive features of the caregiver groups would be expected to influence willingness to assess and sensitivity in judging infant pain. We noted biological or alternative relatedness to the child, personal or

professional commitments to guardianship and caregiving, professional training in caring for infants and children, time spent with a specific child, and experience with particular types of child contexts (e.g., ill children, children undergoing medical procedures).

The social perception literature provides integrating constructs useful in identifying important characteristics of caregivers that influence how they make a broader range of judgments about characteristics of infants. Emde (1993) synthesized major principles from the past three decades of the infant emotion attribution literature. Caregivers who were most emotionally and physically available were most sensitive in perceiving infant emotions. The concept of emotional availability translated into caregiver sensitivity and responsiveness to an infant's cues over time. Physical availability concerns the absolute amount of time spent with an infant. This indicates that the quality and quantity of time spent with an infant determines the understanding of how an individual infant expresses emotion.

In the context of sensitivity to infant pain, we would propose that related factors contribute to judgmental sensitivity, beyond the baseline empathic sensitivity described earlier. No person in any of the three groups studied here was a parent of any of the children; hence, biological relatedness, or kinship, would not have been a factor. As well, no participant had spent a substantial amount of time with any of the infants. Nevertheless, it is not unreasonable to assume that parents brought to the study a pain judgment schema created from interactions with their own children when in pain. It is also likely that being uncertain and unprepared as to how to address infant pain with effective interventions would enhance concern for the children or lead to a liberal preparedness to identify them as in pain (similar factors would come to play for these parents when judging their own children). This argument suggests parents have an overall enhanced willingness to attribute higher levels of pain to infants. It would be of interest to understand the beliefs, thoughts, and decision processes parents bring to the judgemental task of understanding infant pain. Recent work has found that parental emotional stress during a NICU stay is strongly related to parental assumptions about the severity of pain their child is experiencing (Franck, Cox, Allen, & Winter, 2004).

On the other hand, nurses and the pediatricians would have had greater exposure to children in pain, an understanding of what constitutes need for emergency care and an appreciation of available and effective analgesic control. Pediatricians and nurses working in

pediatric settings are well educated in medicine and health care and typically acquire vast experience in assessing and caring for children not their own. The task presented to the nurses and pediatricians would have been seen as somewhat resembling daily professional practice: judging the pain of infants that were not their own. It is important to note that while some of our health professionals were also parents, in addition to our preliminary post-hoc analyses, recent work suggests that parental status does not systematically relate to the pain management strategies utilized by pediatric health professionals (Pölkki, Laukkala, Vehviläinen-Julkunen, & Pietilä, 2003). Thus, returning to their role as health professionals, repetitive brief exposure to many different infants in pain could result in a judgment pattern whereby experienced professionals would attribute less pain to infants. In stark contrast to parents, who have little experience judging pain in children not their own, this "institutional insensitivity" (health professionals becoming slightly habituated to patient pain signs due to extended exposure) has been noted elsewhere in the infant literature (Xavier Balda et al., 2000). A similar phenomenon was also seen when comparing mothers' versus fathers' pain judgments, whereby authors linked mothers' lower pain ratings to having greater exposure to the child in pain (Craig et al., 1988).

The current findings differed from those of McClellan et al. (2003) who found significant differences in attributions of pain to infants between nurses and parents. However, these differences could also be seen as supporting the role of emotional availability. The SCN nurses in the current study were generally involved in continuous and routine care of infants, not unlike parents, whereas nurses in the McClellan et al. study used health unit nurses who could be seen as having similar levels of emotional and physical availability as the pediatricians in this study. Underscoring the proposition that it is not professional title *per se* that contributes to group differences but rather factors involved with different caregiver roles, further work exploring the differences in pain judgments between inpatient nurses versus nurses who work in clinic settings could add nuanced information regarding the relationship between time spent in the direct care of infants and pain judgments.

### **Why were Older Babies Judged to be in More Pain?**

Despite the fact that behavioral expressivity was comparable for all infants shown to the participants,

the three caregiver groups attributed more pain to older babies than younger babies. Suggestive of a systemic caregiver bias, these results are contrary to what would be indicated based on research studying immunization-invoked pain expression development in infancy (i.e., decreasing pain expression in healthy older infants; Izard et al., 1987). Shapiro (1993) found similar results in her sample comparing pre-term and full-term babies attributing this to the use of similar thresholds for pain cues in pre-term and full-term infants. Given that ill pre-terms mount less vigorous responses in terms of cry, body movements, and facial activity (Craig, Whitfield, Grunau, Linton, & Hadjistavropoulos, 1993; Johnston & Stevens, 1996), using the same threshold would result in lower pain attributions for younger infants. However, in the current study all the infants displayed similarly vigorous pain responses. Thus the systematic increase in pain judgments with increasing infant age cannot be attributed to differences in behavioral reactivity. A different explanation is necessary.

The pattern of differences suggests that perceived age-related developmental maturity is a key determinant of infant pain judgments. Older infants have a substantially greater capacity for perceiving, understanding, and remembering pain (Fitzgerald, 1991). Appreciating this may bias judges to report more pain in older infants, despite research supporting the converse reality that limited development (both physiological and cognitive) is associated with more severe pain experience (Mitchell & Boss, 2002). These results bolster previous observations by Craig (1997) that perhaps pain in infancy has been neglected because caregivers do not believe young infants are cognitively mature enough to be conscious of pain. This distorted perception of pain during infancy should be an area of concern as unrelieved pain has a long-term and conceivably destructive impact on the plastic nervous systems of infants (e.g., Taddio & Katz, 2004). These findings suggest that younger infants may be in greater danger of having their pain under-managed due to lower pain attributions.

### **Clinical Significance**

Benchmarks set in the adult (Gallagher, Liebman, & Bijur, 2001; Todd, Funk, & Funk, 1996) and verbal child literature (Powell, Kelly, & Williams, 2001) suggest clinically significant differences in pain severity using the VAS lie roughly between 7 and 17 mm. The statistically significant difference found between pediatricians and parents in this study was roughly 8 mm, while the age group difference between 2-month olds and

18-month olds was roughly 6.5 mm. Emerging evidence suggests that infants experience greater pain sensation during infancy than adults (Mitchell & Boss, 2002; Howard, 2003). Thus, differences found in this study could reasonably be considered clinically significant. Furthermore, given the experimental controls placed on the judgment stimuli (i.e., equivalent amount and type of exposure to the stimuli for all three groups), the differences found in this study could be an underestimate of the actual differences existing in real pain assessment scenarios. This is suggested because in naturalistic settings parents, nurses, and physicians have vastly different amounts and types of exposure to infants' pain signaling which would likely serve to increase the between-group differences.

Secondary analyses with this dataset (see Horton, Pillai Riddell, & Craig, 2006), suggest that it is not appropriate to assume that parents' higher judgments would be associated with better pain management. There was a higher incidence of suboptimal pain management beliefs in the parental sample. Together, these findings suggest that similar ratings on a pain scale may have different meanings for various caregiver groups thus translating into different management strategies for different groups of caregivers. Accordingly, even when using the same rating scale, caregivers in multi-disciplinary settings should regularly communicate the understood meanings and potential management implications of their pain assessments.

### **Limitations of the Study**

The pattern of results arising from the current study should be interpreted in the context of the following caveats. In order to pursue *a priori* hypotheses, the study artificially held constant various caregiver characteristics that would ordinarily be involved with infant pain judgments. As noted, parents were not biologically related to the children whose pain they were asked to judge. However, kinship to a child one is judging would be expected to introduce more concern and sensitivity, possibly resulting in even higher parental pain judgments and thus leading to an even greater distinction from health professionals. In addition, the recruitment of parents from a science museum may have resulted in the mean age of parents in the study being older than would be expected to be the mean age for parents of an infant. Another limitation is that the videotape methodology leads to a lack of immediacy; none of the caregivers interacted directly with the infants they judged and accordingly the influences of the reciprocal



interactions between caregiver and infant were not a part of the pain judgments made by the caregivers. Maternal and nurse behaviors have a substantial impact on infant pain expression (Sweet & McGrath, 1998; Sweet, McGrath, & Symons, 1999), which in turn could influence adult pain judgments. However given that one could speculate that pediatricians would be least influenced by reciprocal interactions with the child (as they objectively spend the least time interacting with a given infant), again it is hypothesized that when this is factored into the equation, this will serve to further distinguish them from parents and nurses in the direction found in this study. It is also noteworthy that each caregiver sample performed their pain judgments in different locations (albeit with the same methodology, video equipment and scripts), suggesting the possibility it was not group affiliation but location that caused group differences. However, in an attempt to equalize the settings, all participants were in an enclosed room with only the research assistant present. Moreover, to increase the representativeness of the sample, the deliberate choice was made 'to go' to participants. Rather than having all judges conduct pain judgments in a foreign environment, such as a university laboratory (which may end-up introducing a greater degree a recruitment bias), the experiment was conducted in settings where caregivers are naturally found (hospitals, clinics, and children's museums). Finally, post-hoc analyses examining within sample differences (i.e., parent versus nonparent, male versus female) used a per-test alpha level of  $<.01$ , to maintain a family-wise error rate of  $.20$ . These post-hoc analyses may have lacked power to detect difference and future research should examine the impact of parenting status and gender more in-depth.

Despite these limitations, the experimental controls employed in this study and the different samples of actual infant caregivers do elucidate potential sources of variability in infant pain judgments. Future work should work to validate both 'group identity' and 'infant age' findings in real-world assessment scenarios.

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