THE RELATIONSHIPS AMONG CAREGIVER CULTURE, CAREGIVER BEHAVIOURS, AND INFANT PAIN AT 12 MONTHS OF AGE

MONICA C. O'NEILL

A THESIS SUBMITTED TO THE FACULTY OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

GRADUATE PROGRAM IN PSYCHOLOGY
YORK UNIVERSITY
TORONTO, ON

September 2014

ABSTRACT

Objectives: The study aimed to discern whether caregiver culture influenced infant pain expression at the 12-month immunization through caregiver behaviours. A moderated mediation model was developed to examine how caregiver behaviours mediate the relationship between caregiver heritage culture and infant pain. Caregiver North American acculturation was introduced as a moderator to examine how the model was impacted when heritage cultural identification and North American acculturation were congruent or incongruent. **Methods:** Infants ($N = 393$) with immunization data at 12 months of age were examined. Caregiver behaviour measures were emotional availability rating and proximal soothing behaviour frequency. North American acculturation was measured with a numeric rating scale. Heritage culture was a novel index created from an objectively derived, 'individualism' rating assigned to the caregiver's self-reported heritage culture and the caregiver's self-reported identification with their heritage culture (i.e., the Heritage Culture Identification and Individualism Index [HCIII]). Two moderated mediation models were estimated, examining infant pain at 1 and 2 minutes post-needle. **Results:** Regardless, North American acculturation, caregivers who had higher identification with heritage cultures that were highly individualistic (higher HCIII) tended to show greater emotional availability, which in turn predicted decreased infant pain at both 1 and 2 minutes post-needle. Next, caregivers who had higher HCIII scores showed more proximal soothing behaviours, which in turn predicted higher infant pain at 1 minute. **Conclusion:** The present findings further our understanding of the mechanism by which caregiver culture (and identification with that culture) impacts infant acute pain.

ACKNOWLEDGEMENTS

There are many people I would like to thank for their contribution and support during the completion of this thesis. First and foremost, I would like to thank my supervisor, Dr. Rebecca Pillai Riddell, for her endless guidance, support, and mentorship throughout the completion of this project. I am truly grateful for everything you have done for me.

I would also like to thank my core committee member, Dr. David Flora, for all of your time, insightful feedback, and expertise. My appreciation also extends to my committee members, Dr. Mary Fox and Dr. Dale Stevens for their involvement in this project.

To my family and friends, thank you for your love, support, patience, and encouragement throughout these past two years. To my parents, I would like to thank you for being such wonderful and loving parents. To my husband, Dave, thank you for your love, kindness, and understanding. You are continuously patient and supportive, and I am truly blessed to have you in my life.

I would also like to thank my lab mates for their ongoing support, guidance, and friendship. I could not have asked for a more wonderful and caring group of people to work with.

Finally, to all of the families who participated in this project, none of this would have been possible without you. Thank you for allowing us to be a part of your experience.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

The Relationships Among Caregiver Culture, Caregiver Behaviours, and Infant Pain at 12 Months of Age

Beginning in infancy and continuing across the lifespan, individuals are exposed to many painful medical procedures (Kristjansdottir, Unruh, McAlpine, & McGrath, 2012). Improper management of pain has been associated with various long-lasting negative physiological and psychological consequences (Grunau, Holsti, & Peters, 2006; Kristjansdottir et al., 2012; Taddio, Katz, Ilersich, & Koren, 1997). Infants are particularly vulnerable to improper management of pain due to their inability to verbally communicate pain and their complete reliance on caregivers and medical professionals for pain management (Pillai Riddell & Racine, 2009). The complexity of assessing pain in infancy is exacerbated when compounded with cultural differences in pain expression, assessment, and management. Kristjansdottir and colleagues (2012) asserted that children from cultural minority groups are particularly at risk for undermanaged pain due to culturally insensitive measures of pain, cultural variability in expressions of pain, and cultural biases among health care providers. Further research is necessary to better understand the influence of culture in the infant pain context. The current paper seeks to elucidate the mechanism by which a caregiver's heritage culture (and strength of identification with that culture and mainstream North American culture) influences infant acute pain.

Theoretical Framework of the Proposed Study

The DIAPR Model (Pillai Riddell, Racine, Craig, & Campbell, 2013) was developed to provide a biopsychosocial framework in which to advance

understanding of the unique context of infant pain. Most relevant to the current study is that the model identifies larger social contexts (e.g., culture) as having an indirect impact on the infant's pain reactivity and regulation through the primary caregiver. The DIAPR model postulates that, over the first year of life, culture impacts the infant through its influence on the cognitions and behaviours of the caregiver. The DIAPR model identifies a number of feedback loops that reflect the dynamic nature of parent and infant interactions. However, most germane to present study is part of the *parental feedback loop.* This loop suggests that parents use existing schemas of pain, informed by their own external systems (e.g., cultural norms), to influence their caregiving behaviours. Pillai Riddell, Racine et al. (2013) acknowledge that one of the shortcomings of the DIAPR model is the preliminary understanding of exactly how the caregiver's external influences (e.g., culture) are filtered through the caregiver and impact infant pain reactivity and regulation. Thus, the focus of the current study was to explain a potential explanatory mechanism of how culture impacts the caregiver's behaviour toward the pained infant.

Examinations of Culture in the Immunization Context

To our knowledge, there are no studies that have examined the overall relationship proposed in the DIAPR model (i.e., examining how caregiver culture may impact infant immunization pain through the behaviours of the caregiver). However, a review of the existing research pertaining to some components of the overall model (e.g., culture and infant pain, culture and caregiver behaviours) lends some insight.

Caregiver culture and infant pain. Rosmus, Johnston, Chan-Yip, and Yang (2000) found that Canadian-born Chinese infants exhibited more behavioural expressions (facial actions and cry) of pain compared to non-Chinese infants during their 2-month immunization appointment. In contrast, Lewis, Ramsay, and Kawakami (1993) found that Caucasian-American infants had greater behavioural expressions of initial pain reactivity and slower pain regulation (i.e., a longer latency to quiet) during their 4-month immunization appointment than Japanese infants. However, Japanese infants showed higher cortisol levels (i.e., greater stress response) post-needle than Caucasian-American infants. Recently, Vinall, Pillai Riddell, and Greenberg (2011) examined the relationship between maternal heritage culture (individualist versus collectivist) and pain behaviours during infants' routine immunization appointments. In contrast to earlier studies, Vinall et al. found that infant pain-related distress, measured via duration of cry, did not differ as a function of maternal culture.

As will be discussed at the end of the review, the equivocal relationship between culture and infant needle pain expression may be explained by the variability in the operationalization of culture. However, prior to this discussion, research will be reviewed that targets understanding the relationship between culture and *how* a parent soothes their pained infant.

Caregiver culture and caregiver behaviours. Pillai Riddell, Stevens, Cohen, Flora, and Greenberg (2007) examined the relationships among maternal acculturation with heritage culture and North American culture (i.e., broad indicators of cultural stress), infant pain, and maternal assessments of infants' pain immediately and 1 day following

infants' immunizations. Although maternal acculturation was unrelated to infant pain and immediate pain ratings, low maternal acculturation (identification) with North American culture predicted mothers' ratings of their infants' pain 1 day after the immunization. Mothers with lower North American acculturation (i.e., greater cultural stress) rated their infants' pain as higher than mothers with higher acculturation. Pillai Riddell et al. (2007) speculated that mothers with higher cultural stress may have infants with higher stress, which in turn leads them to regulate more slowly following a needle.

Vinall and colleagues (2011) also examined the impact of cultural orientation (collectivist versus individualist) on maternal soothing behaviours (i.e., affection, touching, holding, rocking, vocalizing, caretaking and distracting) over 1 minute following infants' immunizations. Mothers from an individualist culture used a greater number of affection-related soothing behaviours to regulate their infants' pain-related distress compared to mothers from a collectivist culture.

Neither Pillai Riddell et al. (2007) nor Vinall et al. (2011) identified a direct relationship between maternal culture and infant pain. Logically, if there is a relationship between caregiver culture and soothing behaviours (Vinall et al., 2011), and a relationship between caregiver soothing behaviours and infant needle-pain expression (Blount, Devine, Cheng, Simons, & Hayutin, 2008; Campbell, Pillai Riddell, Garfield, & Greenberg, 2013), it follows that caregiver culture could be impacting infant needle pain indirectly through the caregiver's behavior. Presently there are no studies that have synergistically examined the relationship between caregiver culture, caregiver behaviours, and infant pain in one unified model. However, to examine these

relationships effectively, it was deemed essential to first examine definitions of culture both within and outside the pain context to inform the present operationalization of culture.

Defining Culture in the Pain Context

The term "culture" is vague, which is apparent from the range of definitions that have been offered both outside (Berry, Poortinga, Segall & Dasen, 1992; Cole & Tan, 2007; Wintre, Sugar, Yaffe, & Costin, 2001) and within (Craig & Pillai Riddell, 2003) the area of infant pain. In the context of pain, Craig and Pillai Riddell (2003) identified the family, ethnic identity, religion, and community as "differing groups [that] all operate through transmission of culture-specific patterns of ways of thinking, feeling, and behaving" (p. 162). The authors further define culture as "belief systems and patterns of learned behavior that are shared and transmitted within a group across generations or to new members" (p. 162).

The previous literature on culture and infant immunization pain has defined culture according to country of origin (Lewis et al., 1993; Rosmus et al., 2000), cultural perspective (individualist versus collectivist; Vinall et al., 2011) and acculturation (Pillai Riddell et al., 2007). Individualism is a construct that may be especially germane to the study of caregiver behaviours toward an infant in pain, as it represents a broad way of operationalizing how an individual would prioritize others when making decisions to enact behaviour. Individualism (as opposed to collectivism) has been defined as the degree to which people live and behave as individuals as apposed to members of groups (Hofstede, 1980). As such, individualistic cultures are more motivated by their own

interests, while in collectivist cultures people belong to an "in-group" (e.g., extended family) and are motivated by the interests of the members of this group (Hofstede, 1980; Taras, Steel, & Kirkman, 2012). Halberstadt and Lozada (2011) suggest that caregivers who identify with individualistic values are likely to socialize their children differently than those with collectivistic values. It was for this reason that the construct of individualism was included in the current study; it provided a mechanism by which culture could cause differences in infant acute pain expression. Simply knowing whether a caregiver's heritage culture is more individualistic or collectivistic, however, may be somewhat limited. Understanding how strongly a caregiver actually identifies with their heritage culture and, when it differs from their heritage culture, how they identify with the mainstream culture in which they live is a more comprehensive way to approaching culture.

Operationalizing Individualism and Adding Self-Reported Identification

The importance of understanding mainstream and heritage acculturation. For this study, a number of previous research approaches was incorporated to provide a more encompassing operationalization of culture, with acculturation being the key construct. Berry (2005) defines acculturation as "the dual process of cultural and psychological change that takes place as a result of contact between two or more cultural groups and their individual members" (p. 698). Berry acknowledges that to understand culture it is important to understand both an individual's identification with the mainstream (e.g., North American) culture and concurrently an individual's identification with their heritage culture (i.e., a culture that has influenced the individual and earlier

generations of her family). Berry's (2003) model of acculturation identifies a four-group taxonomy (i.e., assimilation, integration, separation, and marginalization) that integrates an individual's identification with both her mainstream and heritage culture. Assimilation occurs when individuals have a low identification with their heritage culture and a high identification with another culture. Separation occurs when an individual has a high identification with her heritage culture and a low identification with another culture. Integration occurs when individuals choose to identify with both their heritage culture and other cultures. Finally, marginalization occurs when individuals have a low identification with their heritage culture and other cultures. While choosing to avoid a categorical approach to acculturation, the present study chose to incorporate a continuous measure of both a caregiver's identification with North American culture and a measure of a caregiver's identification with their heritage culture to better understand how culture influences infant acute pain expression, through parent soothing behaviour.

Focusing on individualism within heritage culture. In order to tease apart the mechanism by which caregivers' heritage culture could influence their soothing behaviour, the present study focused on individualism using an objective rating system (The Individualism Scale; Taras et al., 2012). Previously, Hofstede (1980) developed a survey which facilitated assessment of various countries on an individualist dimension, ultimately assigning a numerical value to represent the degree to which an identified country was considered an individualist culture. More recently, Taras et al. (2012) completed an updated meta-analysis incorporating Hofstede's values and studies employing models and methodology similar to Hofstede's. The end result was an

individualist scale ranging from -2 to +2 identifying the individualism status of 41 countries and eight regions that incorporated combined meta-analytic data from 1970 to 2010. Higher scores indicated that a country was higher on individualism, while lower scores reflected low individualism orientation, with middle scores reflecting a mix of both individualistic and collectivistic aspects. Thus, in the current study, the measure of caregiver heritage culture (HCIII) incorporated both an objectively derived rating of the caregiver's heritage culture's individualism orientation and a subjective report of how strongly the caregiver identified with their heritage culture. In contrast, the indicator of North American culture in this study is solely a self-report of identification with North American culture.

The Present Study

The DIAPR model identifies and highlights the need to investigate the mechanisms through which caregiver culture impacts infant acute pain through the behaviours of the caregiver. Our infant immunization data came from a larger study that followed infants through immunizations over the first year of life. The focus of the current study is on the 12-month immunization appointment, based on previous work suggesting that the influence of caregiver behaviour on infant pain behaviour develops over the first year of life and is most readily discerned at 12 months of age (Campbell et al, 2013; Pillai Riddell et al., 2011). The primary goal of the present study was to address one general research question: Does caregiver culture impact infant pain expression via the caregiver's behaviours? Broadly speaking, as guided by the DIAPR model, it was hypothesized that caregiver's culture would predict infant pain expression indirectly

through the caregiver's behaviour rather than having a direct effect on the infant pain expression.

In order to address our primary research goal, two separate moderated mediation models were developed (see Figures 1 and 2). Model 1 examined if caregiver behaviours mediated the relationship between caregiver culture and infant pain at 1 minute post-needle. Model 2 examined if caregiver behaviours mediated the relationship between caregiver culture and infant pain at 2 minutes post-needle. Both models operationalized culture by defining a variable that took into account a caregiver's self-identification with their heritage culture and the heritage culture's level of individualism (HCIII measure). Moreover, both models incorporated the level of self-identification with North American culture (North American acculturation) as a potential moderator of HCIII scores. Including North American acculturation as a moderator of caregiver HCIII scores facilitated an integration of Berry's (2003) model of acculturation in the analyses. As such, using the moderated mediation models, we were able to examine the indirect effect of a nuanced variable of heritage culture (that accounts for both the individualism level of the heritage culture and the individual caregiver's identification with that heritage culture; HCIII) on infant pain through the behaviours of the caregiver at varying levels of North American acculturation.

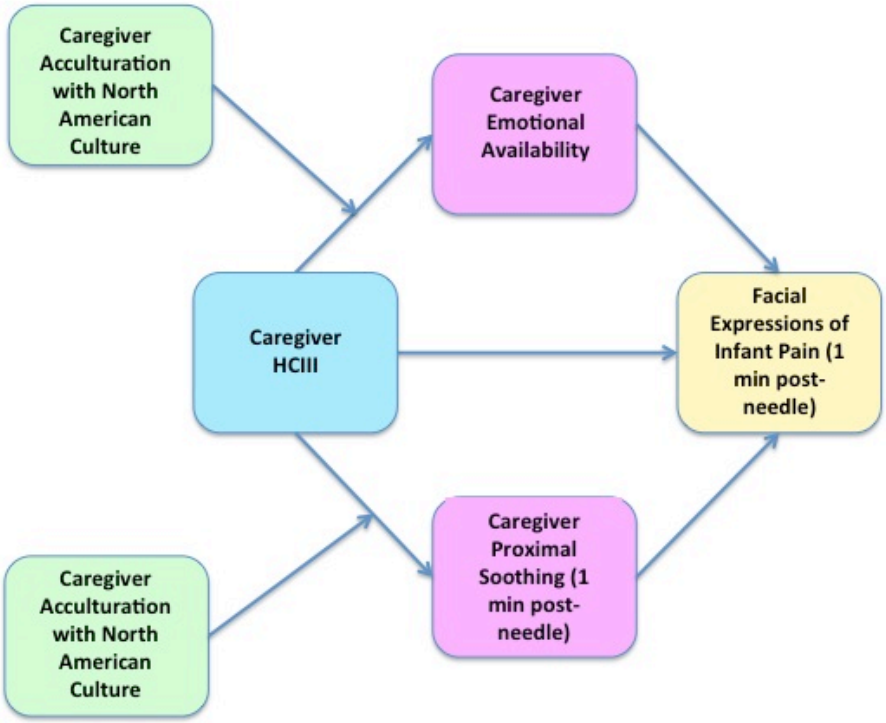

Figure 1. Moderated mediation model for the relationship between the caregiver Heritage Culture Identification and Individualism Index (HCIII) and facial expressions of infant pain at 1 minute post-needle.

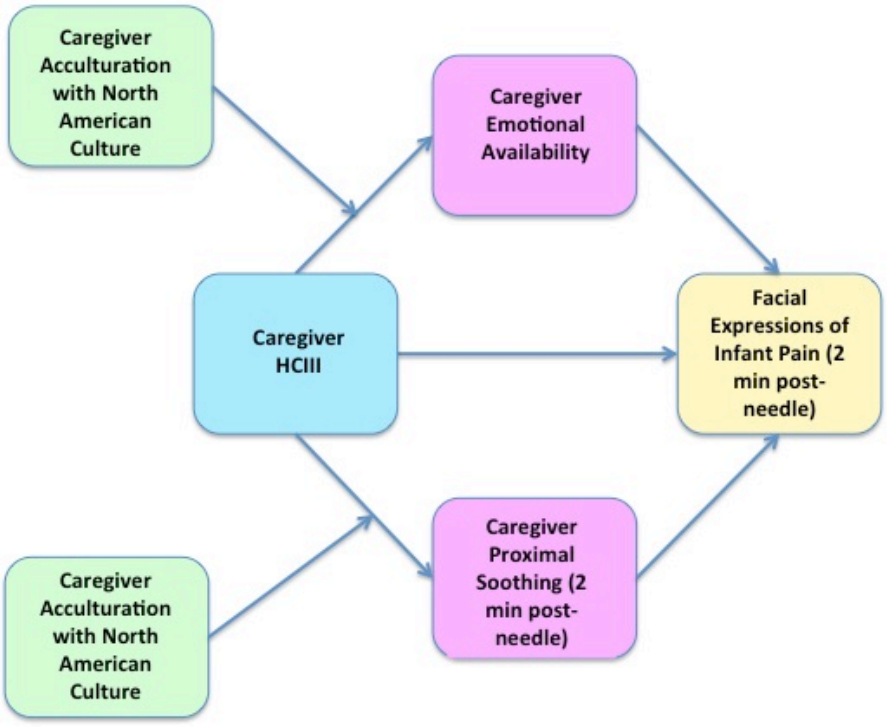

Figure 2. Moderated mediation model for the relationship between the caregiver Heritage Culture Identification and Individualism Index (HCIII) and facial expressions of infant pain at 2 minutes post-needle.

Broadly addressing our overarching research question, it was hypothesized that when caregivers had high or low HCIII scores (i.e., they highly identified with a culture that was high on individualism or low on collectivism, respectively) and high North American acculturation (a combination reflective of integration) infant pain scores would be lowest. However, when caregiver HCIII scores were in the middle (e.g., the caregiver did not have a strong identification with either a strongly individualistic or strongly

collectivistic culture) and North American acculturation was low (a combination reflective of marginalization) infant pain would be the highest. Finally, in the case where caregiver HCIII scores were in the middle and North American acculturation was high (a combination reflective of assimilation), or caregiver HCIII scores were high or low and North American acculturation was low (a combination reflective of separation), it was hypothesized that infant pain would be in the middle.

Each model involved three main constructs: 1) caregiver culture, 2) caregiver behaviours, and 3) infant pain. See Figures 1 and 2 for a representation of these constructs within each moderated mediation model. As described above, caregiver culture consisted of two variables within each model: 1) the HCIII and 2) identification (acculturation) with North American culture. Caregiver behaviours were also represented by two variables in each model: 1) caregiver emotional availability (EAS total score) and 2) caregiver proximal soothing from the MAISD. Infant pain was represented by one variable, the NFCS score, in each model. Model 1 and 2 examined infant pain at 1 and 2 minutes post-needle, respectively.

To answer our primary research question, eight specific questions (four per model) were used to structure and present the preliminary analyses from both of these models that lead up to the full model.

Model 1 examined if caregiver behaviours mediated the relationship between caregiver culture and infant pain at 1 minute post-needle at different levels of North American acculturation. The first three questions are preliminary because they pertain to the pieces of the model that are required to calculate the main mediated effect of the

fourth overall research question. As such the following research questions were addressed:

(1) Is caregiver emotional availability predicted by HCIII and North American acculturation?

(2) Is caregiver proximal soothing 1 minute post-needle predicted by HCIII and North American acculturation?

(3) Is infant pain 1 minute post-needle predicted by caregiver emotional availability, caregiver proximal soothing 1 minute post-needle, and HCIII?

(4) Is the relationship between HCIII and infant pain 1 minute post-needle mediated by caregiver behaviours (emotional availability and proximal soothing 1 minute post-needle) at particular levels of North American acculturation?

Model 2 examined whether caregiver behaviours mediated the relationship between caregiver culture and infant pain at 2 minutes post-needle at different levels of North American acculturation. As such, the same four research questions as those presented above were addressed based on the 2-minute infant pain epoch instead of the 1-minute post-needle epoch.

Methods

Participants

The present study examined a subsample (N = 393) of infant-caregiver dyads from the OUCH cohort with 12-month immunization data. The OUCH cohort was a longitudinal sample observed in three pediatric clinics in Toronto, Canada between 2007 and 2012. Further details of this longitudinal study are published elsewhere (e.g.,

Campbell et al., 2013; Pillai Riddell et al., 2011; Pillai Riddell, Flora, et al., 2013). Infants' 12-month immunization data were available for 547 infants. However, several cases (n = 100) were dropped due to a mismatch between the caregiver whose cultural information was obtained (e.g., self-reported heritage culture, heritage and North American acculturation ratings) and the caregiver who actually did the majority of soothing during the 12-month immunization appointment. Additional cases were dropped (n = 54) due to an inability to code the self-reported cultural information reported by the caregiver into the HCIII measure or code infant and/or caregiver behaviours during the immunization appointment. Caregivers were fluent in English. Infants had no suspected developmental delays or chronic illnesses, had never been admitted to a neonatal intensive care unit, were not born more than 3 weeks premature, and had no other siblings participating in the study. Refer to Table 1 for the demographic information on the subsample of participants for the current analysis.

Summary of Procedure

The research ethics boards at York University and the Hospital for Sick Children approved the described procedure. Overall, caregivers filled out information on their cultural background in the waiting room. Caregiver behaviours and infant pain behaviours were coded from video footage before, during, and after the 12-month immunization. For a full description of the procedures, see Pillai Riddell and colleagues (2011).

Table 1
Demographic Variables

	N (%)
Caregivers present at 12-month immunization	
Mother	267 (67.9)
Mother and father	91 (23.2)
Father	8 (2.0)
Parent(s) and grandparents(s)	15 (3.8)
Other	12 (3.1)
Caregivers Coded for Emotional Availability and Proximal Soothing	
Mother	375 (95.4)
Father	9 (2.3)
Equally between caregivers	9 (2.3)
Education level at recruitment	
Graduate school or professional training	122 (31.1)
University graduate	167 (42.6)
Partial university	16 (4.1)
Trade school or community college	61 (15.6)
High school graduate	23 (5.9)
Did not graduate from high school	3 (0.7)
Infant Gender at Recruitment	
Male	193 (49.1)
Female	200 (50.9)

Measures

Caregiver culture. As described earlier, culture was operationalized with two separate variables: 1) An objectively derived score of the caregiver's heritage culture's individualism (HCIII) based on the caregiver's self-reported heritage culture; and 2) a rating (from 1 to 11) representing the caregiver's acculturation (identification) with North American culture.

Heritage Culture Identification and Individualism Index (HCIII). To create the HCIII, caregivers were asked in the waiting room, prior to the immunization, two questions about their heritage culture that were adapted from the Vancouver Index of Acculturation (VIA; Ryder et al., 2000). First, they were asked what their heritage culture

was and, second, they were asked to identify the extent to which their way of life reflected their heritage culture. Ratings were provided on a scale of 0 to 10, with a higher score indicative of greater identification with their heritage culture. Scores were shifted from a scale of 0 to 10 to a scale of 1 to 11 to avoid having HCIII scores equal to zero when multiplying heritage culture ratings with self-reported heritage culture individualism scores to create the HCIII variable.

Then, after the study was complete, a trained rater classified each caregiver's self-reported heritage culture according to the Taras et al. (2012) Individualism scale described earlier (Table 2 outlines the frequency of caregivers assigned to each region or country). A second trained rater double coded 50% of the caregivers' self-reported heritage culture. Intraclass correlation for individualism coding of self-reported heritage culture was .90. Complex cases were identified in advance and coded by consensus, with additional input from the senior author. As noted earlier, the scale is designed to range from -2 to +2. However, in the current sample the range for the particular countries and regions listed is from -1.39 to +1.13.

To create a single index reflecting both caregivers' self-identification with a heritage culture and that heritage culture's individualism orientation (i.e., the HCIII), a composite score was calculated multiplying the two variables. The composite score ranged from -15.29 to +11.30 with higher scores indicating that the caregiver strongly identifies with an individualistic heritage culture and lower scores indicating that the caregiver strongly identifies with a heritage culture which is low on individualism (high on collectivism). Scores at the middle of the index (around 0) reflected that the caregiver

did not have a strong identification with either a strongly individualistic or strongly collectivistic culture. See Figure 3 for the distribution of scores on the HCIII variable.

Table 2
Caregivers' Self-Reported Heritage Culture

Country/Region	*N* (%)
Africa	10 (2.5)
Arab Countries	10 (2.5)
Asian USSR	10 (2.5)
Australia	1 (0.3)
Baltic USSR	1 (0.3)
Bulgaria	2 (0.5)
Canada	35 (8.9)
Caribbean	22 (5.6)
Central America	9 (2.3)
China	14 (3.6)
Czech Republic.	3 (0.8)
Germany	6 (1.5)
Greece	11 (2.8)
Hong Kong	8 (2.0)
Hungary	3 (0.8)
India	19 (4.8)
Indonesia	2 (0.5)
Ireland	7 (1.8)
Israel	38 (9.7)
Italy	27 (6.9)
Japan	5 (1.3)
Korea	6 (1.5)
Netherlands	3 (0.8)
New Zealand	1 (0.3)
Norway	1 (0.3)
Philippines	20 (5.1)
Poland	8 (2.0)
Portugal	16 (4.1)
Romania	5 (1.3)
Slavic USSR	25 (6.4)
South America	18 (4.6)
Spain	2 (0.5)
Sweden	1 (0.3)
Taiwan	2 (0.5)
Turkey	4 (1.0)
UK	34 (8.7)
USA	2 (0.5)
Yugoslavia	1 (0.3)

Note. Caregivers' heritage culture may have been assigned a country/region according to Taras et al.'s (2012) coding system, if self-reported heritage culture was not on the list.

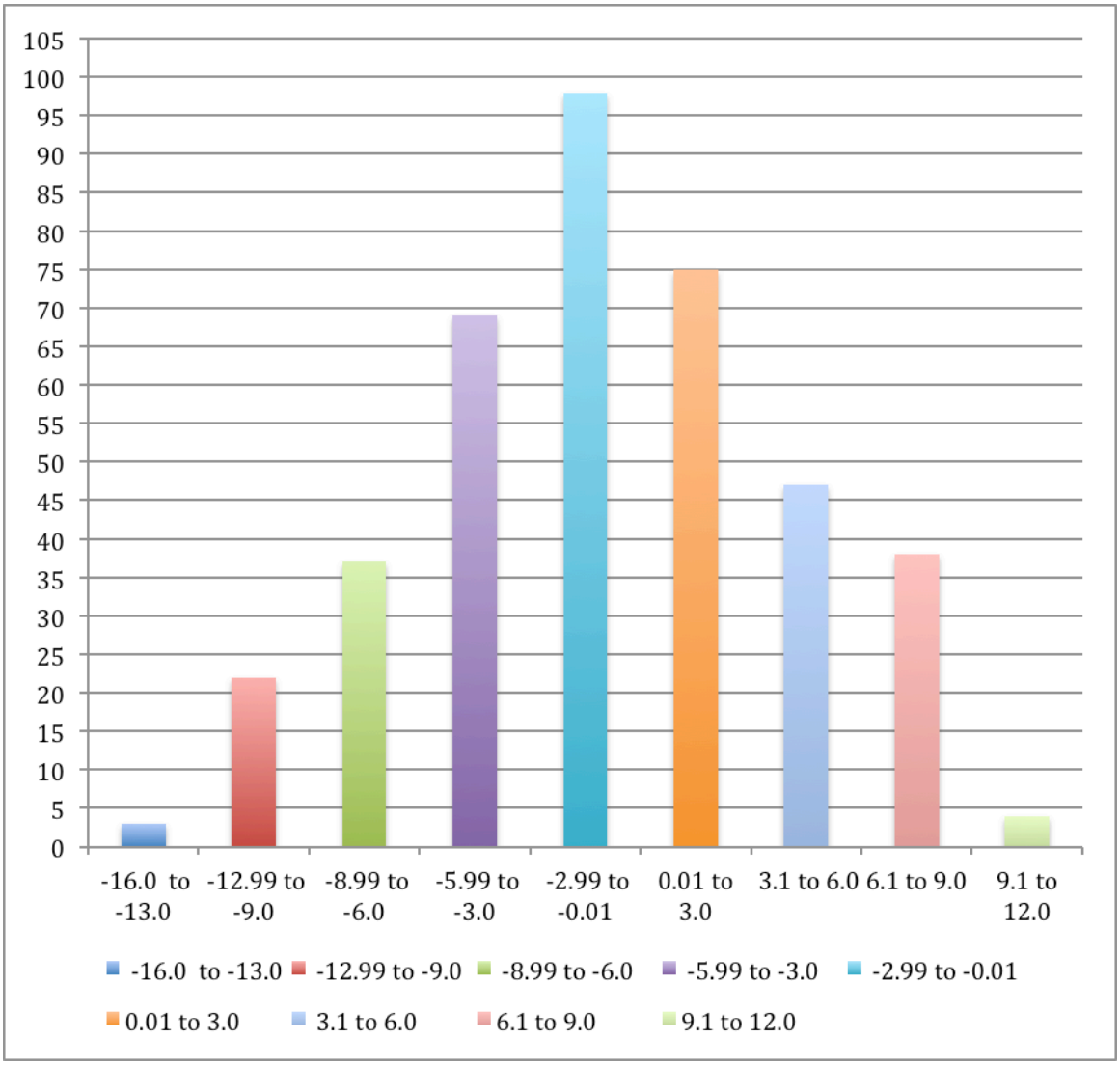

Figure 3. Frequency distribution of the number of scores on the Heritage Culture Identification and Individualism Index (HCIII) for each range of values.

Caregiver North American Acculturation. Caregiver's North American acculturation was measured by asking caregivers a question adapted from the Vancouver Index of Acculturation (VIA; Ryder et al., 2000). Caregivers were asked to indicate the extent to which their way of life reflects mainstream 'North American or Canadian' culture. Ratings were provided on a scale of 0 to 10, with higher a score indicative of

greater identification with mainstream North American or Canadian culture. Scores were shifted from a scale of 0 to 10 to a scale of 1 to 11 to maintain consistency with the self-reported heritage culture rating used to calculate caregivers' HCIII scores.

Caregiver behaviours. Infants' 12-month immunization footage was coded to evaluate caregiver behaviours on two separate measures: emotional availability and caregiver proximal soothing. This provided a more comprehensive representation of caregiver behaviours as emotional availability provides a global clinical judgment of the quality of the caregiving, while proximal soothing provides an indication of the quantity of a key soothing behavior (Pillai Riddell & Racine, 2009).

Caregiver emotional availability. Caregiver emotional availability was measured using the Emotional Availability Scales (EA Scales 4th Edition; Biringen, 2008). This clinical assessment tool provides an evaluation of a caregiver's ability to interact with her infant, it is a global evaluation based on the entirety of the immunization appointment. The EAS examines the emotional availability of the caregiver on four dimensions: sensitivity, structuring, nonintrusiveness, and nonhostility. The sum of the four dimensions represents overall caregiver emotional availability throughout the entire immunization appointment. Higher scores are indicative of greater emotional availability. The EAS was coded by four trained coders. Intraclass correlations for overall caregiver emotional ability ranged from .88 to .93 (Pillai Riddell et al., 2011).

Caregiver proximal soothing behaviours. To assess caregivers' proximal soothing behaviours (physical comfort and rocking), immunization footage was coded by seven trained coders using the Measure of Adult and Infant Soothing and Distress

(MAISD; Cohen, Bernard, McClellan, & MacLaren, 2005). Physical comfort and rocking were coded as absent (0) or present (1) for 5-second epochs for two phases: 1 minute following the last needle, and 2 minutes following the last needle. The proximal behaviour score was calculated by first summing the frequency of 5-second epochs where the behaviour of interest was observed over both the 1 and 2 minutes post-needle period and then dividing by the total number of codable epochs (usually 12 epochs per minute). A composite score for proximal soothing was calculated by summing the index score for the two target behaviours (physical comfort and rocking) at 1 and 2 minutes following the last needle. Higher scores are indicative of a higher incidence of these soothing behaviours. As previously reported (Campbell et al., 2013), intraclass correlations ranged from .91 to .95 (rocking), and .75 to .88 (physical comfort).

Infant pain. Infants' 12-month immunization footage was coded to evaluate facial expressions of infant pain post-needle.

Facial expressions of infant pain. The Neonatal Facial Coding System (NFCS; Grunau & Craig, 1987) was designed to measure infants' facial responses to painful stimuli and is a well-validated measure of pain. Based on previous studies (Oberlander et al., 2000; Pillai Riddell, Badali, & Craig, 2004; Pillai Riddell et al., 2007), seven indicators (brow bulge, eye squeeze, naso-labial furrow, open lips, vertical stretch mouth, horizontal stretch mouth, taut tongue) were utilized to create a facial pain score. Each of the NFCS facial actions is coded as 0 (absent) or 1 (present) for every second within a 10-second epoch. The facial pain score was obtained for two 10-second epochs (1 and 2 minutes post-needle) by calculating the proportion of time NFCS facial actions were

present. In order to be included in this analysis, infants were required to have data available for a minimum of 50% of the total epoch. Therefore, scores range from 0 to 1, and indicate the proportion of time during the 10-second period in which facial actions were present. Higher scores indicate greater facial pain expression. The NFCS was coded by eight trained coders. Reliability was high with percentage agreement for the seven coded facial actions ranging from .85 to .97 (Campbell et al., 2013).

Data Analysis

The present study focused on one overall question: Is the relationship between caregiver culture and infant post-needle immunization pain at 12 months mediated by caregiver behaviours? In order to answer the primary research question, two separate moderated mediation models were estimated (one for the 1 minute infant pain measure and one for the 2 minute pain measure), employing the bootstrap method for inferences about indirect effects (Hayes, 2009; Preacher & Hayes, 2008a, 2008b; Preacher, Rucker, & Hayes, 2007).

As indicated earlier, each moderated mediation model implemented the HCIII as the primary predictor variable and North American acculturation as the moderator variable. The North American acculturation variable was used as the moderator between caregivers' HCIII and caregiver behaviours to determine if the mediated relationship (i.e., the relationship between heritage culture and infant acute pain mediated through caregiver behavior) depended on the level of caregivers' North American acculturation.

The models were estimated using Hayes' (2013) macro (PROCESS Procedure for SPSS, Version 2.11) for moderated mediation models. In sum, two separate models were

estimated (1-minute infant pain score; 2-minute infant pain score) and four research questions were examined within each model, with the first three questions being preliminary as they pertain to the pieces of the model that are required to calculate the indirect effect of the fourth overall research question.

Results

Model 1: The moderated mediation relationship between culture and infant pain at 1 minute post-needle.

Table 3 presents the overall means and standard deviations, and Table 4 presents the bivariate correlations for all of the variables in Model 1. The unstandardized coefficients, direct, indirect, and total effects for Model 1 are presented in Table 5. The four research questions were addressed within Model 1 to answer the overall research question for the 1-minute post-needle pain outcome.

First, a multiple regression model was estimated with caregiver emotional availability predicted by caregiver HCIII, North American acculturation, and their interaction. There was a significant positive relationship between caregiver HCIII scores and caregiver emotional availability ($B = .39$, $p < .001$), such that as the HCIII score increased, caregiver emotional availability also increased. The relationship between caregiver North American acculturation and caregiver emotional availability was non-significant ($p = .24$). Additionally, the interaction between HCIII and caregiver North American acculturation was non-significant ($p = .67$).

Next, a multiple regression model was estimated with caregiver proximal soothing at 1 minute post-needle predicted from HCIII scores, North American

acculturation, and their interaction. There was a significant positive relationship between HCIII scores and caregiver proximal soothing behaviours (B = .02, p = .003), such that as the index became higher, a greater proportion of caregiver proximal soothing behaviours were observed over 1 minute post-needle. Neither caregiver North American acculturation (p = .90) nor the interaction between caregiver HCIII scores and North American acculturation (p = .12) was a significant predictor of proximal soothing.

Another multiple regression model was estimated with infant pain at 1 minute post-needle predicted from caregiver proximal soothing 1 minute post-needle, caregiver emotional availability, and HCIII scores. There was a significant negative relationship between caregiver emotional availability and infant pain 1 minute post-needle (B = -.01, p < .001), such that as caregiver emotional availability increased, infant pain decreased. Caregiver proximal soothing was positively related to infant pain 1 minute post-needle (B = .06, p = .01), such that as proximal soothing increased, infant pain increased. There was also a significant, positive direct relationship between HCIII scores and infant pain 1 minute post-needle (B = .01, p = .03), such that as HCIII scores increased, infant pain 1 minute post-needle increased.

Finally, indirect effects were estimated to examine the relationship between HCIII scores and infant pain at 1 minute post-needle, as mediated by caregiver behaviours (emotional availability or proximal soothing 1 minute post-needle) at different levels of North American acculturation.

Caregiver emotional availability. Bias-corrected bootstrap confidence intervals based on 10,000 bootstrap samples were used to test the significance of the indirect effect

of HCIII scores on infant pain 1 minute post-needle through the emotional availability mediator at low, medium, and high values of North American acculturation. Low, medium, and high values on North American acculturation were defined as one standard deviation below the mean of North American ratings, the mean of North American ratings, and one standard deviation above the mean of North American ratings, respectively. The indirect effect was significant when North American acculturation was low (*AB* = -.002; 95% CI [-.0039, -.0004]), at mean value (*AB* = -.002; 95% CI [-.0039, -.0009]), and high (*AB* = -.002; 95% CI [-.0048, -.0007]). Thus, at all levels of North American acculturation, higher HCIII scores predicted higher caregiver emotional availability which, in turn, predicted lower infant pain 1 minute post-needle; that is, emotional availability mediated the relationship between HCIII scores and infant pain.

Caregiver proximal soothing 1 minute post-needle. Bias-corrected bootstrap confidence intervals were also used to test the significance of the indirect effect of HCIII scores on infant pain 1 minute post-needle through the proximal soothing mediator. The indirect effect was only significant when North American acculturation was low (*AB* = .002; 95% CI [.0004, .0034]) and at mean value (*AB* = .001; 95% CI [.0002, .0023]), but not high (*AB* = .001; 95% CI [-.0003, .0019]). In sum, when North American acculturation ratings were low or average, higher HCIII scores predicted higher caregiver proximal soothing, which in turn predicted higher infant pain 1 minute post-needle; that is, proximal soothing mediated the relationship between HCIII scores and infant pain among caregivers with low or average North American acculturation. Although two of these simple mediated effects (low and average North American ratings) were

significantly different from zero and one was not (high North American ratings), the three simple mediated effects did not significantly differ from each other.

Table 3
Means and Standard Deviations for all Model 1 Variables

	N	*M*	*SD*
Model 1			
Caregiver HCIII	384	-0.93	5.12
North American Ratings	384	8.54	2.13
Proximal Soothing 1 Min Post	384	.70	.48
Emotional Availability	384	92.63	10.38
Pain 1 Min Post	384	.34	.24

Note: HCIII = Heritage Culture Identification and Individualism Index

Table 4
Bivariate Correlations among all Model 1 Variables

	1	2	3	4	5
1. Caregiver HCIII	1	.37*** (.000)	.16** (.001)	.22*** (.000)	.08 (.12)
2. North American Ratings		1	.07 (.18)	.13* (.01)	.09 (.07)
3. Proximal Soothing 1 Min Post			1	.14* (.01)	.11 (.03)*
4. Emotional Availability				1	-.19*** (.000)
5. Pain 1 Min Post					1

Note. p values are in parentheses
Note. * $p < .05$. ** $p < .01$,*** $p < .001$ (two tailed).
Note: HCIII = Heritage Culture Identification and Individualism Index

Table 5

Model 1 conditional indirect effect of caregiver HCIII scores in relation to infant pain 1 minute post-needle through proximal soothing and emotional availability

	B	*SE*	T	*p*	Upper Level CI	Lower Level CI
Mediator variable model (DV = emotional availability)						
Constant	92.53	.56	165.31	.000	91.44	93.64
Caregiver HCIII	.39	.11	3.56	.000	.17	.61
North American ratings	.32	.27	1.19	.236	-.21	.84
HCIII x NA	.02	.05	.42	.673	-.08	.13
Mediator variable (DV = proximal soothing 1 min)						
Constant	.72	.03	27.62	.000	.67	.77
Caregiver HCIII	.02	.01	3.05	.003	.01	.03
North American ratings	-.002	.01	-.13	.90	-.03	.02
HCIII x NA	-.004	.002	-1.57	.12	-.01	.001
Dependent variable model (DV = pain 1 min)						
Constant	.80	.11	7.23	.000	.58	1.01
Emotional availability	-.01	.001	-4.58	.000	-.01	-.003
Proximal soothing	.06	.03	2.54	.01	.01	.115
Caregiver HCIII	.01	.002	2.15	.03	.00	.01

Conditional indirect effect of Caregiver HCIII at values of the moderator (*DV* = pain 1 min)	NA	*AB*	Bootstrap *SE*	Bootstrap Lower Level CI	Bootstrap Upper Level CI
Emotional Availability					
Low NA ratings	-2.13	-.002	.001	-.0039	-.0004
Average NA ratings	.00	-.002	.001	-.0039	-.0009
High NA ratings	2.13	-.002	.001	-.0048	-.0007
Proximal Soothing (*1 min*)					
Low NA ratings	-2.13	.002	.001	.0004	.0034
Average NA ratings	.00	.001	.001	.0002	.0023
High NA ratings	2.13	.001	.001	-.0003	.0019

Note: HCIII = Heritage Culture Identification and Individualism Index

Note. NA = North American Acculturation Ratings

Model 2: The moderated mediation relationship between culture and infant pain at 2 minutes post-needle.

Table 6 presents the overall means and standard deviations, and Table 7 presents the bivariate correlations for all of the variables in Model 2. The unstandardized coefficients, direct, indirect and total effects for Model 2 are presented in Table 8. The four research questions were addressed within Model 2 to answer the overall research question for the 2-minute post-needle pain outcome.

First, a multiple regression model was estimated with caregiver emotional availability predicted by caregiver HCIII, North American acculturation, and their interaction. The same model was previously estimated within Model 1 and is not re-presented here.

Next, a multiple regression model was estimated with caregiver proximal soothing at 2 minutes post-needle predicted from HCIII scores, North American acculturation, and their interaction. Caregiver HCIII scores were not a significant predictor of proximal soothing (p = .17). Furthermore, neither caregiver North American acculturation (p = .33) nor the interaction between caregiver HCIII scores and North American acculturation (p = .71) were significant predictors of proximal soothing.

Another multiple regression model was estimated with infant pain at 2 minutes post-needle predicted from caregiver proximal soothing 2 minutes post-needle, caregiver emotional availability, and HCIII scores. There was a significant negative relationship between caregiver emotional availability and infant pain 2 minutes post-needle (B = -.004, p = .004), such that as caregiver emotional availability increased, infant pain

decreased. Caregiver proximal soothing was positively related to infant pain 2 minutes post-needle (B = .08, p = .03), such that as proximal soothing increased, infant pain increased. The direct relationship between HCIII scores and infant pain 2 minutes post-needle was non-significant (p = .19).

Finally, indirect effects were estimated to examine the relationship between HCIII scores and infant pain 2 minutes post-needle, as mediated by caregiver behaviours (emotional availability and proximal soothing 2 minutes post-needle) at different levels of acculturation with North American culture.

Caregiver emotional availability. Bias-corrected bootstrap confidence interval based on 10,000 bootstrap samples were again used to test the significance of the indirect effect of HCIII scores on infant pain 2 minutes post-needle through the emotional availability mediator at low, medium, and high values of North American acculturation. As in Model 1, low North American ratings were one standard deviation below the mean, medium North American ratings were the mean value, and high North American ratings were one standard deviation above the mean. The indirect effect was significant when North American acculturation was low (AB = -.002; 95% CI [-.0043, -.0003]), at mean value (AB = -.002; 95% CI [-.0043, -.0005]), and high (AB = -.002; 95% CI [-.0054, -.0005]). Thus, at all levels of North American acculturation, higher HCIII scores predicted higher caregiver emotional availability which, in turn, predicted lower infant pain 2 minutes post-needle; that is, emotional availability mediated the relationship between HCIII scores and infant pain.

Caregiver proximal soothing 2 minutes post-needle. Bias-corrected bootstrap confidence intervals were also used to test the significance of the indirect effect of HCIII scores on infant pain 2 minutes post-needle through the proximal soothing mediator. The indirect effect was non-significant when North American acculturation was low (*AB* = .001; 95% CI [-.0002, .0022]), at mean value (*AB* = .001; 95% CI [-.0001, .0017]), and high (*AB* = .000; 95% CI [-.0006, .0019]). In sum, at all levels of North American acculturation, proximal soothing did not mediate the relationship between HCIII scores and infant pain.

Table 6
Means and Standard Deviations for all Model 2 Variables

	N	*M*	*SD*
Model 2			
Caregiver HCIII	364	-.88	5.15
North American Ratings	364	8.57	2.10
Proximal Soothing 2 Min Post	364	.37	.43
Emotional Availability	364	92.72	10.41
Pain 2 Min Post	364	.27	.29

Note: HCIII = Heritage Culture Identification and Individualism Index

Table 7
Bivariate Correlations among all Model 2 Variables

	1	2	3	4	5
1. Caregiver HCIII	1	.36***	.10	.22***	.05
		(.000)	(.06)	(.000)	(.36)
2. North American Ratings		1	.09	.13*	.04
			(.10)	(.02)	(.50)
3. Proximal Soothing 2 Min Post			1	-.004	.12*
				(.93)	(.02)
4. Emotional Availability				1	-.14*
					(.01)
5. Pain 2 Min Post					1

Note. p values are in parentheses
Note. * $p < .05$. ** $p < .01$,*** $p < .001$ (two tailed).
Note: HCIII = Heritage Culture Identification and Individualism Index

Table 8

Model 2 conditional indirect effect of caregiver HCIII scores in relation to infant pain 2 minutes post-needle through proximal soothing and emotional availability

	B	*SE*	*T*	*p*	Upper Level CI	Lower Level CI
Mediator variable model (DV = emotional availability)						
Constant	92.62	.57	161.69	.000	91.50	93.75
Caregiver HCIII	.40	.11	3.59	.000	.18	.62
North American ratings	.30	.27	1.08	.28	-.24	.84
HCIII x NA	.03	.05	.47	.63	-.08	.13
Mediator variable (DV = proximal soothing 2 min)						
Constant	.37	.02	15.39	.000	.323	.417
Caregiver HCIII	.01	.005	1.38	.169	-.003	.016
North American ratings	.01	.01	.98	.326	-.011	.034
HCIII x NA	-.001	.002	-.37	.709	-.005	.004
Dependent variable model (DV = pain 2 min)						
Constant	.634	.139	4.554	.000	.360	.907
Emotional availability	-.004	.002	-2.887	.004	-.007	-.001
Proximal soothing	.077	.035	2.176	.030	.007	.146
Caregiver HCIII	.004	.003	1.321	.187	-.002	.010
Conditional indirect effect of Caregiver HCIII at values of the moderator (*DV* = pain 2 min)	NA	*AB*	Bootstrap *SE*	Bootstrap Lower Level CI		Bootstrap Upper Level CI
Emotional Availability						
Low NA ratings	-2.096	-.002	.001	-.0043		-.0003
Average NA ratings	.000	-.002	.001	-.0043		-.0005
High NA ratings	2.096	-.002	.001	-.0054		-.0005
Proximal Soothing (*2 min*)						
Low NA ratings	-2.096	.001	.001	-.0002		.0022
Average NA ratings	.000	.001	.000	-.0001		.0017
High NA ratings	2.096	.000	.001	-.0006		.0019

Note: HCIII = Heritage Culture Identification and Individualism Index

Note. NA = North American Acculturation Ratings

Discussion

To our knowledge, this is the first time that the relationship between caregiver culture, caregiver behaviours, and infant immunization pain has been comprehensively examined in theoretically driven statistical models. Key advantages of the integrative models were: the use of both quality and quantity measures of caregiver behaviours; a well-validated measure of infant pain measured at two distinct time points; and an innovative measure of culture that incorporated not only a bi-dimensional view of acculturation (caregiver identification with both their heritage and mainstream culture), but also included a mechanism hypothesized to be crucial to explaining how caregiver's heritage culture may impact infant pain (i.e., extent of individualism ideology within one's heritage culture).

The primary aim of the present study was to answer one overall research question: Is the relationship between caregiver culture and infant immunization pain mediated by caregiver behaviours post-needle at 12 months of age? The present study demonstrated that it depended on the type of caregiver behavior (quality versus quantity) and the timing of the infant pain measurement. The first model showed that the relationship between HCIII scores and infant pain at 1 minute post-needle was mediated by caregiver emotional availability at all levels of North American acculturation and by caregiver proximal soothing but only at low and average North American acculturation. Of note, although two of these simple mediated effects (low and average North American acculturation) were significantly different from zero and one was not (high North American acculturation), the three simple mediated effects did not significantly differ

from each other. Accordingly, the weak moderation effect of North American acculturation reported in the analysis is dismissed from the interpretation of the results described below. The second model showed that the relationship between HCIII scores and infant pain at 2 minutes post-needle was mediated by emotional availability, but not proximal soothing, at all levels of North American acculturation. Owing to these differences, the discussion will present each model (minute 1 and minute 2) in turn.

Model 1: Minute 1 Post-Needle

Model 1 showed that caregiver emotional availability and proximal soothing over 1 minute post-needle mediated the relationship between caregiver HCIII scores and infant pain expression at all levels of North American acculturation. Simply put, regardless of how much a caregiver's life reflected North American culture, caregiver behaviours mediated the relationship between HCIII and infant immunization pain 1 minute post-needle. As such, the present findings did not support the contention that different levels of North American acculturation with different levels of heritage cultural identification altered the mediated effects of caregiver behaviours on infant pain post-needle. Moreover, the present study did not provide evidence that Berry's (2003) identified taxonomy of acculturation strategies (i.e., assimilation, integration, separation, and marginalization) are relevant to the infant immunization pain context with regards to the model explored in the present study.

Caregiver emotional availability and proximal soothing both mediated the relationship between HCIII scores and infant pain expression. However, the mediated relationships differed, highlighting the importance of measuring both caregiver quality

(emotional availability) and quantity (proximal soothing). Higher HCIII scores predicted higher emotional availability and higher proximal soothing over the first minute post-needle, but the resulting impact on infant pain expression varied. Specifically, higher HCIII scores (meaning the individual highly identified with a culture that is high on individualism) predicted higher caregiver emotional availability, which in turn predicted lower infant pain 1 minute post-needle. In contrast, higher HCIII scores predicted higher proximal soothing over the first minute post-needle, which in turn predicted higher infant pain 1 minute post-needle.

Higher values on these caregiver variables reflect greater prioritization of the infants' individual experience of distress (rather than prioritization of what is best for the family unit or clinic staff), a key tenet of parenting in accordance with an individualist cultural perspective (Greenfield & Suzuki, 1998; Hofstede, Hofstede, & Minkov, 2010; Triandis, 1995). Simple bivariate analyses in the current study suggested that higher HCIII scores (i.e., highly identified with a highly individualistic culture) were associated with greater emotional availability and soothing behaviours 1 minute post-needle. This suggestion is also consistent with Vinall et al.'s (2011) finding that mothers from an individualist culture used a greater number of affection-related soothing behaviours to regulate their infants' pain-related distress over 1 minute following infants' immunizations, compared to mothers from a collectivist culture. Moreover, studies examining the relationship between caregiver emotional availability and caregiver culture outside the immunization context suggest that our findings are congruent with the broader literature (Fouts, Roopnarine, Lamb, & Evans, 2012; Ispa et al., 2004).

In terms of Model 1, it is also pertinent to examine and interpret why emotional availability and proximal soothing mediated the relationship between caregiver HCIII scores and infant pain 1 minute post-needle in opposite directions. Perhaps this finding may be explained by exploring what each of the caregiver behaviours reflects about the caregiver and also the implications of the time frame that each behaviour was measured. While emotional availability is based on the caregiver-infant interaction over the course of the entire immunization appointment, proximal soothing is based on the presence or absence of soothing behaviours over the first minute post-needle. The differences in the measurement and meaning of these behaviours could explain what appear to be, on the surface, inverse relationships when in fact they are not.

Emotional availability, the measure used to identify the quality of caregiver behaviour, likely reflects a broad approach to parenting (Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014; Pillai Riddell et al., 2011), whereby consistent, contingent caregiving across situations leads to lower infant distress within the immunization situation. This was demonstrated in a previous examination of the OUCH Cohort whereby Pillai Riddell and colleagues (2011) found that caregiver sensitivity to infant immunization pain predicted caregiver sensitivity in subsequent immunization appointments over the first year of life.

In terms of proximal soothing, the measure employed to examine the quantity of caregiver soothing behaviours, the mediated effect on infant pain was likely the result of more context driven effects. Akin to emotional availability, greater proximal soothing behaviours are logically reflective of greater attention to the infant's individual needs.

Due to the timing of the measure (over the minute 1 post-needle), it may appear that proximal soothing has mediating effects that are contrary to those of emotional availability in the current model, but we assert that this is not the case.

As previously mentioned, higher HCIII scores predicted higher proximal soothing *in the minute* that preceded the 1 minute pain score, which in turn resulted in greater pain at 1 minute post-needle. Previous investigations with the OUCH Cohort have shown that higher pain immediately following the needle (i.e., the first 10 seconds post-needle) strongly predicted higher pain 1 minute post-needle and higher caregiver proximal soothing (Campbell et al., 2013). Therefore, it is probable that higher proximal soothing during the first minute was due to greater initial pain immediately after the needle, which resulted in the greater pain expression observed at 1 minute post-needle. In other words, when infants were in greater pain or pain-related distress, this was signaled to the caregiver, thereby eliciting greater proximal soothing from the caregiver. Consistent with this interpretation, the preliminary specific effects in the model showed that higher identification with a culture that was high on individualism was related to both higher proximal soothing and higher pain expression post-needle.

Overall, the Model 1 analyses showed that higher identification with a culture that is highly individualistic (i.e., higher HCIII scores) significantly predicts infant pain expression at 1 minute post-needle, and that caregiver behaviours are one significant mechanism that explains this relationship. The inverse relationships identified between the two measures of caregiver behaviour and infant pain reflect the importance of examining both a broad assessment of the quality of caregiver sensitivity behaviours and

a specific assessment of the quantity of soothing behaviours responsive to the infant's needs. Moreover, the present findings support the theoretical framework of the DIAPR Model (Pillai Riddell, Racine et al., 2013), which postulates that culture has an indirect effect on infant pain responses, being mediated by the caregiver's behaviours.

Model 2: Minute 2 Post-Needle

In contrast to the findings across the specific and overall effects in Model 1, the relationships with culture and other important variables did not occur for all of the specific effects and overall effects in Model 2, in which the dependent variable was pain scores at 2 minutes post-needle. These inconsistencies could suggest that cultural factors are more important in either directly or indirectly influencing infant pain during the more immediate regulatory period (i.e., minute 1), when infant distress is highest. However, one exception was that higher HCIII scores led to higher emotional availability, which in turn led to lower pain, which replicates one of the indirect effect results seen for the minute 1 post-needle pain outcome. Again, the finding with emotional availability but not proximal soothing, adds credence to the above interpretation suggesting that emotional availability is more reflective of an overall caregiving approach (within and outside the immunization appointment), while a quantification of the amount of proximal soothing is likely more based on direct situational determinants (such as amount of infant distress).

Summary and Clinical Implications

Overall, the present findings tested and supported the DIAPR Model (Pillai Riddell, Racine et al., 2013), revealing not only cultural influences on infant pain, but

validating a mechanism by which this influence occurs (i.e., caregiver behavior). The present study found a significant relationship between caregiver culture (as operationalized by a combination of identification with a heritage culture and the individualism level of that particular heritage culture) and infant immunization pain that was mediated through the behaviours of the caregiver. Specifically, caregivers who more highly self-identified with a more highly individualist culture (i.e., higher HCIII scores) showed greater emotional availability during the immunization appointment resulting in lower pain scores at 1 and 2 minutes following the needle. The evidence that caregivers who highly self-identified with a highly individualistic culture show greater emotional availability, which in turn predicted lower infant pain is a novel finding for the literature. These results occurred regardless of the level of North American acculturation and at both 1 and 2 minutes post-needle. The present study also found that higher caregiver self-identification with a more highly individualist culture was related to higher proximal soothing during the first minute post-needle and in turn greater infant pain at the 1 minute post-needle mark. These caregivers were potentially responding to high behavioural expressions of infant pain earlier and therefore exhibiting greater proximal soothing.

Limitations and Future Directions

In some instances, the process of assigning caregivers' self-reported heritage culture to the countries and regions identified by Taras et al. (2012) may have been problematic. Given the multitude of heritage cultures reported by caregivers and the limited number of countries or regions that were provided using Taras et al.'s coding system, the assignment of caregivers' cultures to the listed countries was not always a

perfect match. It is likely that on occasion, given the opportunity, some caregivers might have identified more with a different country or region on Taras et al.'s list. Thus, future studies may address this limitation by providing Taras et al.'s list of countries and regions to caregivers and asking them to indicate the one that they identify with most as their heritage culture.

Another limitation pertains to interpretation of the caregivers' behaviours. The caregiver behaviours (emotional availability and proximal soothing) were coded and interpreted within a North American individualist context. Therefore, caregiver behaviours considered sensitive or as effective pain management strategies may not be equivalent to those considered sensitive or effective within another cultural context. Future studies may address this issue by replicating this study cross-culturally to determine if our findings are replicable within other cultural contexts.

Despite these limitations, this study stands alone in the infant acute pain context owing to the examination of both heritage and mainstream acculturation, the caregiver's strength of identification with these respective cultural milieus, and the mechanism by which these contextual factors could impact infant pain response (i.e., caregiver behaviours). Given that improper management of pain is a considerable risk for children of culturally diverse backgrounds (Kristjansdottir et al., 2012) and the known long-lasting negative physiological and psychological consequences of such undermanaged pain (Grunau, Holsti, & Peters, 2006; Kristjansdottir et al., 2012; Taddio, Katz, Ilersich, & Koren, 1997) future research is necessary to identify other factors (e.g., behaviours of health care professionals, caregivers' assessments or perceptions of infant pain) that may

impact the mediated effects of the current study. Advancing our understanding of the role of culture on infant pain responding will contribute to the improvement of assessment and management strategies within the context of infant acute pain, and lay the groundwork for research in other infant pain contexts.

References

Berry, J. W. (2003). Conceptual approaches to acculturation. In K.M. Chun (Ed.), *Acculturation: Advances in theory, measurement, and applied research.* (pp. 17-37). Washington, DC: American Psychological Association. doi: 10.1037/10472-004

Berry, J. W. (2005). Acculturation: Living successfully in two cultures. *International Journal of Intercultural Relations, 29,* 697-712.

Berry, J. W., Poortinga, Y. H., Segall, M. H., & Dasen P. R. (1992). *Cross-cultural psychology: Research and applications.* New York, NY: Cambridge University Press.

Biringen, Z. (2008). The emotional availability (EA) scales. 4th ed. Published by emotionalavailability.com

Biringen, Z., Derscheid, D., Vliegen, Closson, L., & Easterbrooks, M. A. (2014). Emotional availability (EA): Theoretical background, empirical research using the EA Scales, and clinical applications. *Developmental Review, 34,* 114-167. doi: 10.1016/j.dr.2014.01.002

Blount, R. L., Devine, K. A., Cheng, P. S., Simons, L. E., & Hayutin, L. (2008). The impact of adult behaviors and vocalizations on infant distress during immunizations. *Journal of Pediatric Psychology, 33(10),* 1163-1174. doi: 10.1093/jpepsy/jsn030

Campbell, L., Pillai Riddell, R., Garfield, H., & Greenberg, S. (2013). A cross-sectional examination of the relationships between caregiver proximal soothing and infant pain over the first year of life. *Pain, 154,* 813-823.

Cohen, L. L., Bernard, R.S., McClellan, C.B. & MacLaren, J.E. (2005). Assessing Medical Room Behaviour During Infants' Painful Procedures: The Measure of Adult and Infant Soothing and Distress (MAISD). Children's Health Care, 34, 81-94.

Cole. P. M., & Tan. P. Z. (2007). Emotion socialization from a cultural perspective. In J. Grusec & P. Hastings (Eds.), *Handbook of Socialization: Theory and Practice.* New York: Guilford Press. (pp. 516-542).

Craig, K.D., & Pillai Riddell, R. (2003). Social influences, culture, and ethnicity. In P.J. McGrath & G.A. Finley (Eds.), *Pediatric Pain: Biological and Social Context* (pp. 159-182). Seattle: IASP Press.

Fouts, H. N., Roopnarine, J. L., Lamb, M. E., & Evans, M. (2012). Infant social interactions with multiple caregivers: The importance of socioeconomic status. *Journal of Cross-Cultural Psychology, 42*(2), 328-348.

Greenfield, P. M. & Suzuki, L. K. (1998). Culture and human development: Implications for parenting, educating, pediatrics, and mental health. In I.E. Sigel & K.A. Renninger (Eds.), W. Damon (Series Ed.), *Handbook of personality psychology in practice* (5th ed., pp. 1059-1109). New York: Wiley.

Grunau, R.V. & Craig, K.D. (1987). Pain expression in neonates: facial action and cry. *Pain, 28*, 395-410.

Grunau, R. E., Holsti, L., Peters, J. W. B. (2006). Long-term consequences of pain in human neonates. *Seminars in Fetal & Neonatal Medicine, 11,* 268-275. doi:10.1016/j.siny.2006.02.007

Halberstadt, A. G., & Lozada, F. T. (2011). Emotion development in infancy through the lens of culture. *Emotion Review, 3,* 158-168. doi: 10.1177/1745073910387946

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Comminication Monographs, 76,* 408-420.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values.* Beverly Hills, CA: Sage Publications.

Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind.* (3rd ed.). New York: McGraw-Hill.

Ispa, J. M., Fine, M. A., Halgunseth, L. C., Harper, S., Robinson, J., et al. (2004). Maternal intrusiveness, maternal warmth, and mother-toddler relationship outcomes: Variations across low-income ethnic and acculturation groups. *Child Development, 75*(6), 1613-1631.

Kristjansdottir, O., Unruh, A. M., McAlpine, L., & McGrath, P. J. (2012). A systematic review of cross-cultural comparison studies of child, parent, and health professional outcomes associated with pediatric medical procedures. *The Journal of Pain, 13,* 207-219. doi:10.1016/j.pain.2011.12.008

Lewis, M., Ramsay, D. S., & Kawakami, K. (1993). Differences between Japanese infants and Caucasian American infants in behavioral and cortisol response to inoculation. *Child Development, 64,* 1722-1731. doi: 10.1111/j.1467-8624.1993.tb04209.x

Oberlander, T. F., Grunau, R., Whitfield, M. F., Fitzgerald, C., Pitfield, S., Saul, J. P. (2000). Biobehavioral pain responses in former extremely low birth weight infants at four months' corrected age. *Pediatrics, 105,* 1-10.

Pillai Riddell, R. R., Badali, M. A., & Craig, K. D. (2004). Parental judgments of infant pain: Importance of perceived cognitive abilities, behavioral cues and contextual cues. *Pain, 9,* 73-80.

Pillai Riddell, R., Campbell, L., Flora, D. B., Racine, N., Din Osmun, L., Garfield, H., & Greenberg, S. (2011). The relationship between caregiver sensitivity and infant pain behaviors across the first year of life. *Pain, 152,* 2819-2826. doi: 10.1016/j.pain.2011.09.011

Pillai Riddell, R., Flora, D. B., Stevens, S. A., Stevens, B., Cohen, L. L., Greenberg, S., & Garfield, H. (2013). Variability in infant acute pain responding meaningfully obscured by averaging pain responses. *Pain, 154,* 714-721. doi: 10.1016/j.pain.2013.01.015

Pillai Riddell, R., & Racine, N. (2009). Assessing pain in infancy: The caregiver context. *Pain Research & Management: The Journal of the Canadian Pain Society, 14,* 27-32.

Pillai Riddell, R., Racine, N., Craig, K. D., & Campbell, L. (2013). Psychological theories and biopsychosocial models in pediatric pain. In P. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), The Oxford Textbook of Pediatric Pain.

Pillai Riddell, R. R., Stevens, B. J., Cohen, L. L., Flora, D. B., & Greenberg, S. (2007). Predicting maternal and behavioral measures of infant pain: The relative contribution of maternal factors. *Pain, 133,* 138-149.

Preacher, K. J., & Hayes, A. F. (2008a) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879-891.

Preacher, K. J., & Hayes, A. F. (2008b). Contemporary approaches to assessing mediation in communication research. In A.F. Hayes, M.D. Slater, & L.B. Snyder (Eds.), *The Sage Sourcebook of Advanced Data Analysis Methods for Communication Research* (pp. 13-54). Los Angeles, CA: Sage Publications.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42,* 185-227. doi: 10.1080/00273170701341316

Rosmus, C., Johnston, C. C., Chan-Yip, A., Yang, F. (2000). Pain response in Chinese and non-Chinese Canadian infants: is there a difference? *Social Science & Medicine, 51,* 175-184. doi: 10.1016/S0277-9536(99)00447-5

Ryder, A. G., Alden, L.E., & Paulhus, D. L. (2000). Is acculturation unidimensional or bidimensional? A head-to-head comparison in the prediction of personality, self-identity, and adjustment. *Journal of Personality & Social Psychology, 79,* 49-65.

Taddio, A., Katz, J., Ilersich, A. L., & Koren, G. (1997). Effect of neonatal circumcision on pain response during subsequent routine vaccination. *The Lancet, 349,* 599-603. doi: 10.1016/S0140-6736(96)10316-0

Taras,V., Steel, P., & Kirkman, B. L. (2012). Improving national cultural indices using a longitudinal meta-analysis of Hofstede's dimensions. *Journal of World Business, 47,* 329-341.

Triandis, H.C. (1995). *Individualism & Collectivism.* Boulder, CO: Westview Press.

Vinall, J., Pillai Riddell, R., & Greenberg, S. (2011). The influence of culture on maternal soothing behaviours and infant pain expression in the immunization context. *Pain Research & Management: The Journal of the Canadian Pain Society, 16,* 234-238.

Wintre, M. G., Sugar, L. A., Yaffe, M., & Costin, D. (2001). Generational status: A Canadian response to the Editors' Consortium Statement with regard to race/ethnicity. *Canadian Psychology, 41,* 244-256. doi: 10.1037/h0086872