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## Children’s physical pain: relations with maternal and paternal pain and prediction from maternal depressive symptoms and hope during infancy

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### Abstract

Chronic pain is common in children and increases their risk for developing a chronic pain condition in adulthood, yet relatively little is known about early parental psychosocial factors that predict the development of chronic pain in childhood. We examined the extent to which chronic pain frequency in a community sample of 6-year-old children was related to frequency of chronic pain in their parents, and was prospectively predicted by early maternal risk (i.e., depressive symptoms) and promotive (i.e., hope) factors. Fifty primary caregivers (94% mothers) of 6-year-old twin children who were enrolled in a larger study during children’s infancy were randomly selected to complete a telephone interview regarding their own, their partner’s, and their children’s pain symptoms and functioning. Pain symptom scores were derived by summing the number of seven possible body areas that were painful at least monthly during the prior 6 months. Pain symptoms at three or more sites were coded as multisite pain. Prior maternal depressive symptoms and hope were assessed when children were aged 12-months. Pain symptom scores were positively correlated within families, and risk of child pain increased in a dose-response fashion according to whether neither, one, or both parents experienced multisite pain. Maternal hope but not depressive symptoms prospectively predicted fewer painful body regions in children five years later. Findings suggest that pain runs in families and pain in childhood may be influenced by early maternal psychosocial factors. Future research should focus on how parents’ own health and psychological attributes influence risk for children’s chronic pain.

### Keywords

children; chronic pain; depressive symptoms; hope

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**Ethical Approval:** “All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.”

**Informed Consent:** Informed consent was obtained from all individual participants included in the study.

## Introduction

Chronic pain is common among children and is associated with concurrent disability as well as a higher risk for having a chronic pain syndrome in adulthood (Brattberg, 2004). In line with commonly used definitions, we refer to recurrent or persistent pain exceeding three months in duration as chronic pain (King et al., 2011). Median prevalence rates of weekly to monthly chronic pain in community samples of children range from 11-38% (King et al., 2011). However, rates can be substantially higher; in one community sample of children aged 6 to 13, 64% reported pain occurring at least monthly (Petersen, Brulin, & Bergström, 2006). Childhood chronic pain is associated with poorer quality of life, including interference with academics, peer relationships, and family functioning (Palermo, 2000). Furthermore, the literature suggests that childhood chronic pain is stable and persists into adulthood (Brattberg, 2004). Thus, identifying psychosocial factors associated with risk for childhood chronic pain is critical to informing prevention and treatment efforts.

One risk factor for chronic pain in children is parental pain. Children who have neither, one, or two parents with chronic pain experience increased risk of pain in a dose-response pattern (Hoftun, Romundstad & Rygg, 2013). Although the mechanisms underlying the parent-to-child transmission of chronic pain remain unclear, environmental influences may be especially impactful during infancy and early childhood, as rapid brain development represents a sensitive developmental period (Fox, Levitt, & Nelson, 2010) during which learning and formation of health habits occur (Sallis & Nader, 1988). Maternal psychosocial characteristics are one environmental factor thought to influence the development of children's physical (Taylor et al., 2004) and emotional well-being (Bowlby, 2008). Maternal depression has been associated with increased pain experiences in children, particularly recurrent headaches and abdominal pain (Zuckerman, Stevenson, & Bailey, 1987). The causal direction of these relations is unclear, but evidence suggests that maternal depression may increase risk of benign pain in children through coercive parenting styles, modeling of somatization, and/or reinforcement of children's illness behaviors (Feldman et al., 2010; Zuckerman et al., 1987).

Little is known about whether positive maternal attributes prevent the development of chronic pain in children, but some findings suggest that maternal positive attributes are indirectly related to better pain-related child outcomes through parenting behaviors (Stone & Wilson, 2016). For example, parental optimism toward their child's pain condition is linked with lower levels of catastrophizing about their child's pain (Noel, Beals-Erickson, Law, Alberts & Palermo, 2016), a known risk factor for pediatric chronic pain (Stone & Wilson, 2016).

A related but less studied promotive factor is hope, defined as "the perceived capability to derive pathways to desired goals and to motivate oneself via agency thinking to use those pathways" (Snyder, 2002). Though closely related to optimism, hope is a better predictor of life satisfaction than is optimism (Bailey, Eng, Frisch & Snyder, 2007). Hope represents expectations about efficacy to carry out goals whereas optimism represents expectations about outcomes (Bailey et al., 2007). Hope is linked with higher pain tolerance and lower pain severity among healthy adults (Snyder et al., 2005), and more effective pain

management among adults with chronic pain (Laird, 1992; Tennen & Affleck, 1999). Based on these findings, we posited that early maternal hope would predict fewer child pain symptoms. To the best of our knowledge, this is the first study to examine early maternal hope as a predictor of later child pain outcomes.

The present study interviewed mothers regarding themselves, their partners, and their twin offspring to investigate whether: 1) pain symptoms are associated among family members, 2) presence of parental multisite pain predicts offspring pain in a dose-response fashion, and 3) maternal depressive symptoms and hope measured at child age 12-months predict pain at child age 6 years.

## Methods

### Participants and Procedure

The sample comprised 50 primary caregivers and their 6-year-old twins ( $N=100$ ) randomly selected from a larger ongoing study to participate in an assessment of pain in parents and their children. The larger study consisted of 303 families recruited from state birth records, enrolled during twins' infancy, and represent families living in both rural and urban environments. The current study focused on chronic pain in children, and was not powered to determine the genetic contributions to children's health.

The sample was balanced in terms of sex (51% female) and was ethnically diverse (60% Caucasian, 24% Latino, 10% multi-racial, 2% African American, 2% Asian, 2% American Indian). Primary caregivers averaged 36.56 years ( $SD = 4.48$ ) when the children were age 6, and reported a median annual household income of \$50,000 and a median education level of a four-year college degree. The 50 families were similar to the remaining families in the parent study on child gender and ethnicity ( $\chi^2 < 1.44$ , *ns*), and parent education and family income level ( $ts < -1.93$ , *ns*). The study protocol was approved by the institution's review board. All 50 families contacted by phone agreed to participate, provided verbal consent, and were compensated for their participation. Data regarding maternal psychological attributes were obtained from questionnaires completed during an earlier assessment that occurred at child age 12-months. Single-parent households made up 12% ( $n=6$ ) of the sample. Parental informants of pain symptoms primarily consisted of mothers ( $n=47$ ; 94%), and most families used the same parental informant at child age 12-months and child age-6 years ( $n=47$ ; 94%).

### Measures

**Pain and functioning.**—An adapted structured pain questionnaire previously used to assess back pain, headache, stomach pain, and facial pain in a population-based sample of 11 to 17 year old children and their parents was used (Saunders, Von Korff, LeResche & Mancl, 2007). Adaptations included adding items to assess limb, throat, and other pain, and adding a frequency rating adopted from another community-based study of pain in children ages 9 to 11 (Mikkelsen, Salminen & Kautiainen, 1997). Mothers were asked to rate their own, their partner's, and each of their children's pain frequency over the past 6 months for each of the seven body regions. Items were rated on the following 5-point scale: 1 (*daily*), 2

(*more than once per week*), 3 (*weekly*), 4 (*monthly*), 5 (*rarely or never*). Informants were asked to include only pain episodes that lasted a whole day or more, or that occurred several times in a year (Saunders et al., 2007). Pain symptom scores were computed by summing the number of possible body regions in which pain was rated as occurring at least monthly over the prior six months, yielding scores that could range from 0 to 7, with higher scores reflecting greater number of body regions with at least monthly pain. Consistent with Hoftun et al. (2013), presence of multisite pain was coded for mothers and fathers if three or more body regions were experienced as painful at least monthly over the prior six months. Pain intensity was not assessed.

Mothers also indicated whether pain experiences had interfered with attending school/work/volunteer duties (0 = no, 1 = yes) for themselves, their partners, and their children, and how many times they sought medical treatments for their own pain, their partners' pain, and their children's pain during the prior 6 months.

**Maternal depressive symptoms.**—Symptoms of maternal depression were assessed by self-report at child age 12-months using the 20-item Center for Epidemiologic Studies Depression scale (CES-D; Radloff, 1977). The frequency of experiencing each depression symptom over the past week was rated on a scale ranging from 0 (*rarely or none of the time*) to 3 (*most or almost all of the time*). Items were summed, yielding a total score that could range from 0 to 60. The measure had excellent internal consistency in the current sample ( $\alpha = .91$ ).

**Maternal hope.**—Maternal hope was assessed by self-report at child age 12-months using the Temporality & Future (10 items; “I believe that each day has potential”) and Positive Readiness (10 items; “I can see a light even in a tunnel”) subscales of the Herth Hope Scale (Herth, 1991). Participants rated how often in the past week each item applied to them on scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were summed, yielding a total score that could range from 20 to 100, with higher scores reflecting higher levels of hope. The measure had excellent internal consistency in the current sample ( $\alpha = .92$ ).

### Analytic Strategy

Pearson correlations were computed to evaluate the strength of associations between parents' and twins' pain symptoms. Because of the hierarchical data structure, we used multilevel modeling (Gelman & Hill, 2006) with twins clustered within families (controlling for twin dependence) to evaluate relations: between the number of parents with multisite pain and child number of areas of pain, and between early maternal depressive symptom and hope scores and subsequent child pain. Models included child sex and ethnicity (0=boys, 1=girls; 0=Caucasian, 1=other) as covariates, and the latter model additionally controlled for maternal pain at child age 6-years. Dependence between children within families was ignored for correlations and descriptive statistics. All analyses were conducted using SPSS Version 22.

## Results

### Descriptive Statistics, Correlations, and Pain Prevalence

Table 1 lists the descriptive statistics and correlations of the primary study variables. The CESD maternal depression mean score assessed at child age 12-months was 10.72, falling below the cut-off score of 16 that indicates clinical levels of depression (Weissman et al., 1977). Nevertheless, 20% of mothers had CESD scores of 16 or greater, a range consistent with clinically significant depression. As expected, maternal hope was inversely related to maternal depressive symptoms, maternal pain, paternal pain, and child pain. Maternal depressive symptoms were positively related to maternal pain and child pain but were unrelated to paternal pain.

The most common types of at least monthly pain in children were abdominal pain (33%), limb pain (21%), and headache (19%); in mothers were headache (64%), backache (54%), and limb pain (26%); and in fathers were backache (52%), headache (40%), and stomach and limb pain (both 29%). For children, the prevalence of at least monthly pain in one or more regions was 54%, in two or more regions was 29%, and in three or more regions was 15%. In mothers and fathers, the prevalence rates of at least monthly pain in one or more regions were 82% and 80%, two or more regions were 66% and 58%, and in three or more regions were 38% and 26%, respectively. Regarding the interference of pain in daily life during the prior 6 months, 16% of children missed school due to pain, and 20% of parents missed work or other scheduled activities due to pain. Regarding treatment seeking, 39% of parents and 31% of children sought medical treatment for pain over the last 6 months.

### Prediction of Pain Symptoms

Pain symptom scores correlated between parents ( $r=.37$ ), between siblings ( $r=.68$ ), and between children and their mothers ( $r=.21$ ) and fathers ( $r=.34$ ), all  $ps < .05$ . Risk of child pain increased in a dose-response fashion according to whether none, one, or both parents reported multisite pain ( $F(1,39) = 5.30, p < .05$ ), controlling for child sex and ethnicity. The relation between parent multisite pain and child pain is depicted in Figure 1. Mean number of body regions in children with at least monthly pain increased from 0.74 ( $SD=1.08$ ) to 1.03 ( $SD=1.14$ ) to 1.92 ( $SD=0.79$ ) according to whether neither, one, or both parents reported multisite pain, respectively.

Table 2 presents findings of the regression model examining the relations between maternal depressive symptoms and hope at child age 12-months, and child pain scores at age 6 years. Maternal hope but not depressive symptoms prospectively predicted fewer painful body regions in children ( $F(1,40) = 7.44, p < .01$ ). In a model predicting child pain at age 6 years from early maternal depressive symptoms (without maternal hope), depressive symptoms remained non-significant ( $F(1,43) = 3.24, p = .079$ ).

## Discussion

This study examined the prevalence, consequences, and clustering of chronic pain within families in a community sample of 6-year old children and their parents, and examined whether maternal depressive symptoms and hope prospectively predicted child pain.

Findings indicate that chronic pain in children and their parents was common, with over half of children and three-quarters of parents having at least monthly pain in one or more body regions. These prevalence rates are consistent with those observed in a community sample of adolescents and their mothers (Saunders et al., 2007), suggesting that young children are experiencing prevalence rates of at least monthly pain that are similar to those seen in samples of adolescents.

Findings also suggest that there are meaningful consequences of childhood chronic pain, including interference with daily living activities and utilization of health care services to specifically address pain. Consistent with the literature, pain in this sample was linked to interference with attending school (Palermo, 2000; Smith et al., 2001) and with medical attention seeking to manage child pain (Huguet & Miró, 2008). Together, the emerging evidence suggests that chronic pain in early to middle childhood may have immediate impacts on daily functioning and may impose meaningful costs on families and the healthcare system.

Pain symptoms were significantly and positively associated between siblings, parents, and parents and their offspring, indicating clustering of pain within families. The association between parental pain and child pain was such that the risk of pain in children increased according to whether neither, one, or both parents experienced multisite chronic pain, similar to the pattern observed previously in adolescents (Hoftun et al., 2013). Thus, the increased risk for child pain that is associated with parent pain may begin well before adolescence.

We examined the contributions of parental psychosocial factors to child pain by testing the extent to which maternal characteristics assessed when children were 12-months old related to child pain at age six. Maternal hope prospectively predicted fewer painful body regions in offspring, a relation sustained even when controlling for maternal depressive symptoms, current maternal pain, child sex, and child ethnicity. To our knowledge, this is the first study to examine whether positive maternal attributes evident during children's infancy predict pain later in childhood. One possible mechanism accounting for this association is the mother's own stress and pain management, as hope is related to greater agency and ability to problem-solve (Snyder et al., 2005), as well as more effective chronic pain management (Laird, 1992; Tennen & Affleck, 1999). Another possibility is that better family functioning and parenting practices mediate the relation between maternal hope and child pain, as poor family functioning, family conflict, maternal stress, and coercive parenting styles have been linked with more pain in children (Feldman et al., 2010; Juang, Wang, Fuh, Lu & Chen, 2004; Lewandowski, Palermo, Stinson, Handley & Chambers, 2010). Although the literature is limited, one study reported that parental hope is linked with better family functioning and more parental warmth in families with children with externalizing disorders (Kashdan et al., 2002). Additional research is needed to both replicate and explain the relation between maternal hope and subsequent child pain.

In contrast to hope, maternal depressive symptoms assessed in children's infancy were not related to pain at age six, whereas other investigations have reported cross-sectional relations between maternal depression and child pain (Zuckerman et al., 1987). The lack of correspondence of findings between studies is not likely due to low levels of depressive

symptoms in the current sample. Indeed, 20% of mothers in the present study had depression scores in the clinical range, a rate that is slightly higher than the rates seen in other community samples (Knight, Williams, McGee, & Olaman, 1997), but in line with literature suggesting that mothers of twins may have higher rates of depression than mothers of singletons (Thorpe, Golding, MacGillivray & Greenwood, 1991). One notable difference between the two maternal factors, hope and depressive symptoms, is that hope is trait-like and less subject to change, whereas depressive symptoms may be more variable (Matthey, Barnett, Ungerer & Waters, 2000; Snyder et al., 1991). Therefore, maternal hope may represent a more reliable predictor of child pain assessed five years later than depressive symptoms. Together, the current findings highlight the value of considering not only risk but also promotive attributes of parents as factors that may contribute to subsequent child pain.

This study has a number of important strengths. First, the community-based sample was diverse and included participants from a range of ethnic and socioeconomic backgrounds. Moreover, recruitment of community residents rather than individuals seeking treatment made it possible to assess the full range of pain symptoms in both parents and children. Finally, the longitudinal design allowed us to test the prospective relations between maternal hope and depressive symptoms and child pain, a rare opportunity in research on the development of pain in early childhood.

Although intriguing, the findings should be interpreted with the methodological limitations in mind. First, the sample size was small, limiting our ability to test complex developmental models or evaluate heritability of pain. Second, reports of children's and parents' pain were provided by a single reporter, leaving open the possibility that common method variance accounts for at least part of the familial clustering of pain reports. Of note, parent reports of child symptoms are commonly used, as young children lack sufficient cognitive skills to be able to answer questions effectively (De Leeuw, 2011). Finally, the causes of family members' pain experiences, which could include disease, injury, or other factors (Treede et al., 2015), were unknown, precluding examination of whether findings varied as a function of pain etiology. Future work replicating these findings in a larger sample using multiple reporters and more detailed methods of assessment is needed.

In summary, pain is common in early childhood and clusters within families. Child pain is related in a dose-response fashion to the presence of parental multisite pain, highlighting the need to uncover mechanisms involved in the intergenerational transmission of pain. One avenue we explored was maternal depressive symptoms and hope during infancy as predictors of subsequent child pain. Our findings point to the potential importance of early maternal attributes that promote healthy development, rather than solely risk, for targeted efforts to prevent the development of chronic pain in childhood.

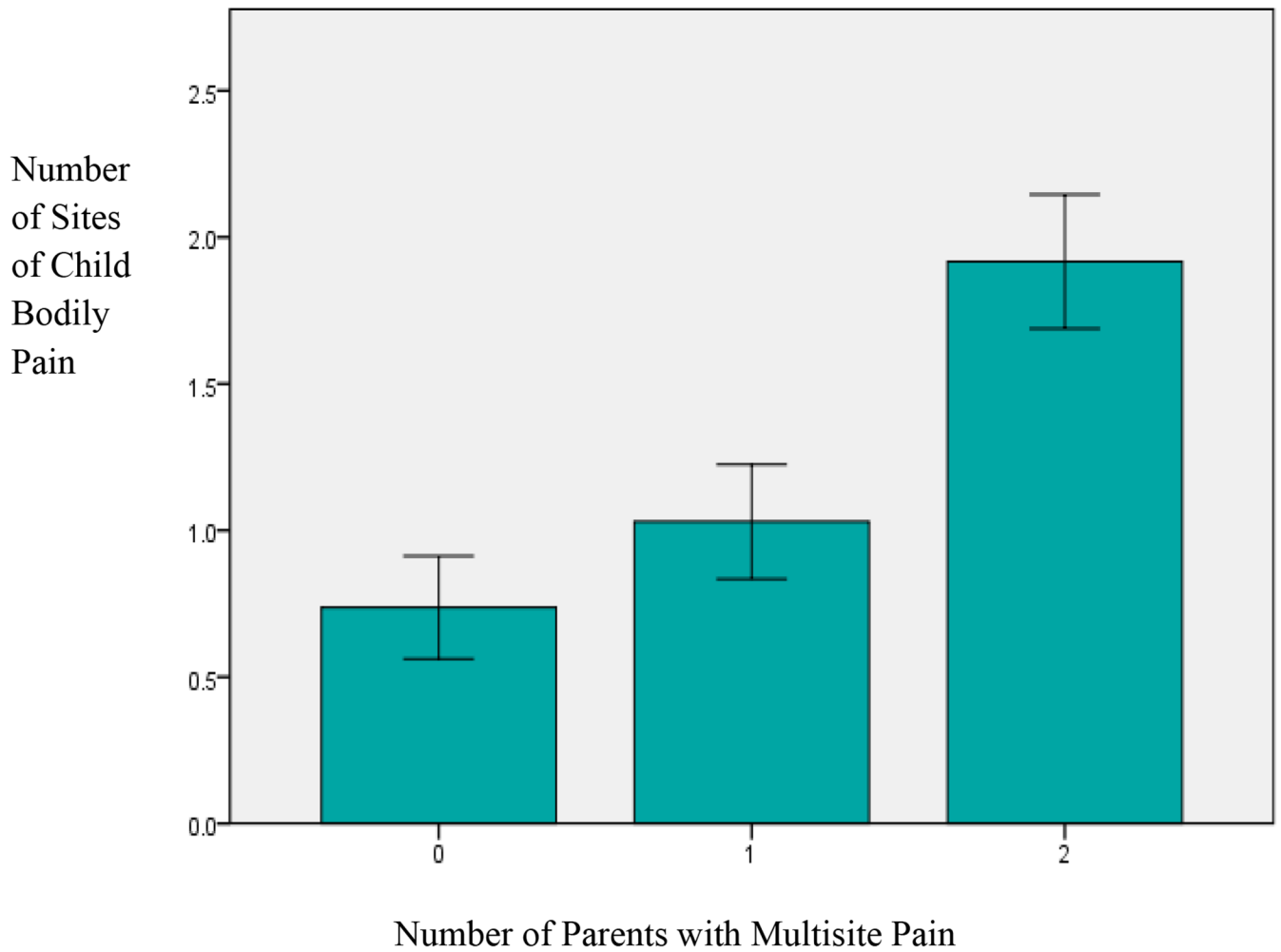
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**Figure 1.**

Relation between presence of parental multisite pain and child pain symptoms: mean number of pain sites with monthly+ pain among twins with 0 ( $n=38$ ), 1 ( $n=34$ ), or 2 ( $n=12$ ) parents with multisite pain (3+ body regions).

Note: Bars represent  $\pm 1$  standard error. Subsample  $n=84$  children with data available for both parents.

**Table 1.**

Descriptive statistics and correlations for main study variables.

Variable	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Min, Max	Correlations			
						2	3	4	5
1 Maternal hope	82.91	11.47	-0.55	-0.38	56, 100	-.58**	-.43**	-.30**	-.42**
2 Maternal depressive symptoms	10.72	9.68	1.50	1.60	0, 39	-	.55**	.22	.24*
3 Maternal pain	2.08	1.43	0.19	-0.69	0, 5	-	-	.37**	.21*
4 Paternal pain	1.71	1.44	0.42	-0.91	0, 5	-	-	-	.34**
5 Child pain	1.02	1.19	0.95	-0.16	0, 4	-	-	-	-

Note: Maternal hope and depressive symptoms assessed at child age 12 months; all pain variables assessed at child age 6 years. Pain scores are sum of seven possible body regions in which pain was experienced at least monthly during the prior six months, with higher scores reflecting greater number of body regions with at least monthly pain.

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 $p < 0.05$ ;

\*\*  
 $p < 0.01$ .

**Table 2.**

Results of multilevel regression analysis with maternal hope and depressive symptoms measured at child age 12-months predicting child pain at 6 years (n=45 families and 90 children).

Variable	Betas	Std. Error	<i>p</i> -value
<b>Predictors</b>			
Maternal hope (child-12 mo)	-.042	.015	.009
Maternal depressive symptoms (child-12 mo)	-.004	.020	.851
<b>Covariates</b>			
Current maternal pain <sup>a</sup>	.008	.126	.949
Child sex (0=male; 1=female)	.122	.200	.543
Child ethnicity (0=Caucasian; 1=other)	-.677	.308	.034

<sup>a</sup>Child and maternal pain scores are the sum of seven possible body regions in which pain was experienced at least monthly during the prior 6 months, with higher scores reflecting greater number of body regions with at least monthly pain.