



# Intergenerational examination of pain and posttraumatic stress disorder symptoms among youth with chronic pain and their parents

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## Abstract

**Introduction:** Posttraumatic stress disorder (PTSD) symptoms are prevalent among youth with chronic pain, and associated with poorer pain outcomes and health-related quality of life (HRQoL). Conceptual models suggest that parent factors, including parents' own chronic pain, may be linked to higher co-occurring pain and PTSD symptoms and lower HRQoL in children. However, this has not been empirically examined.

**Objectives:** The aim of this study was to examine the relationship between parental chronic pain and (1) parent PTSD symptoms, (2) child PTSD symptoms, (3) child pain outcomes, and (4) child HRQoL in a sample of treatment-seeking youth with chronic pain and their parents.

**Methods:** Youth (n = 173) aged 8 to 18 years and parents (n = 204) recruited from a tertiary-level pediatric chronic pain program completed psychometrically-sound measures of pain and PTSD symptoms. Youth also completed measures of pain interference and HRQoL.

**Results:** Half of the parents in this sample reported chronic pain. A series of analyses of covariances revealed that parents with vs without chronic pain reported significantly higher PTSD symptoms, and children of parents with vs without chronic pain reported significantly higher PTSD symptoms and pain interference and lower HRQoL.

**Conclusion:** Findings from this study suggest that having a parent with chronic pain may confer additional risk for children with chronic pain experiencing higher PTSD symptoms, poorer pain outcomes, and lower HRQoL than having a parent without chronic pain. This could be due to genetics or social learning. Future longitudinal research is needed to understand how parental pain influences co-occurring pain and PTSD symptoms, and HRQoL, in children.

**Keywords:** Pediatric chronic pain, Parental chronic pain, PTSD, Quality of life, Adolescents

## 1. Introduction

Posttraumatic stress disorder (PTSD) symptoms occur after exposure to a traumatic event or major life stressor. Elevated PTSD symptoms occur with a prevalence of 30% in youth with chronic pain and are associated with greater pain intensity, pain

interference, and lower quality of life.<sup>30</sup> Parents of youth with chronic pain are also more likely to report clinically elevated PTSD symptoms than parents of youth without chronic pain (20% vs 1%), and higher parent PTSD symptoms are linked to worse child pain outcomes.<sup>30</sup> These findings suggest that important associations exist among parent and child pain, PTSD symptoms, and quality of life. However, little is known about why this co-occurrence exists and what factors may drive it.

Literature on the co-occurrence of chronic pain and PTSD symptoms in children and adolescents is nascent. A recent conceptual framework identifies several factors that may contribute to the development and maintenance of co-occurring pain and PTSD symptoms in youth.<sup>20</sup> Within this framework, parent factors such as parental affect (distress), cognitions (pain catastrophizing), and behaviours (avoidance) are proposed as important mechanisms for understanding children's symptom co-occurrence. Indeed, greater parental distress (anxiety and depressive symptoms, and stress), catastrophizing about child pain, and protective behaviours are related to greater pain and disability in children with chronic pain.<sup>33</sup> Moreover, in nonchronic pain populations, parent factors including parental affect (higher distress and PTSD symptoms) and behaviour (lower

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acceptance and helpfulness) and genetics are associated with higher child PTSD symptoms.<sup>13,22,38,44</sup>

Parents' own chronic pain status may confer risk for children's co-occurring pain and PTSD symptoms, and lower quality of life. A recent review found that children whose parents have chronic pain are more likely to report greater pain complaints, experience poorer psychological outcomes (anxiety and depressive symptoms), and have poorer social abilities and self-esteem than children of parents without chronic pain.<sup>19</sup> A conceptual model on the intergenerational transmission of chronic pain from parents to children identifies potential parental mechanisms, such as pain-specific social learning and parenting behaviours, through which parental chronic pain status may influence children's own pain and psychological functioning.<sup>39</sup> These models suggest that parent factors, including parents' own chronic pain status, may be linked to higher co-occurring pain and PTSD symptoms in children.

Although research has found that chronic pain and PTSD symptoms co-occur at high rates in adults and children,<sup>1,30</sup> and that parental chronic pain is related to greater anxiety and depressive symptoms and lower self-esteem and social functioning in children,<sup>19</sup> research has yet to examine the relations between parent and child pain and PTSD symptoms and child quality of life. The aim of this study was to examine whether parental chronic pain status was linked to higher child and parent PTSD symptoms as well as poorer pain outcomes and lower health-related quality of life (HRQoL) in youth with chronic pain. We hypothesized that parents with chronic pain would report higher PTSD symptoms and have children who reported higher PTSD symptoms, greater pain interference, and lower HRQoL, respectively, than parents without chronic pain and their children.

## 2. Method

### 2.1. Study population

Youth and parents were recruited from a tertiary-level pediatric chronic pain program at a children's hospital in Western Canada. Youth were eligible if they were referred for a multidisciplinary pain assessment, had a chronic pain diagnosis (ie, pain lasting 3 months or more), were 8 to 18 years old, and had English language fluency. Exclusion criteria included having a diagnosis of a developmental disorder. Parents were eligible if they had English language fluency. Parents were excluded if they were not the biological parent of the child ( $n = 5$ ). Overall, 263 parents and youth were invited to participate, with 239 parents and 222 youth consenting to participate and 21 parents and 38 youth declining participation. Three families were not eligible.

### 2.2. Procedure

At the time of booking their initial clinic appointment, parents provided clinic staff with permission for a member of the research team to contact them. A research assistant then contacted permitting parents over the telephone with information about the study. A consent call was conducted with interested parents to determine eligibility and answer questions. Once verbal consent was obtained from parents, online consent and assent forms were emailed to parents and youth through Research Electronic Data Capture (REDCap), a secure online data collection tool.<sup>18</sup> Hardcopy, written consent, and assent were also obtained from parents and youth.

Before their initial clinic appointment, self-report questionnaires were administered to parents and youth through REDCap.

Participants were instructed that parent surveys were to be completed by the parent, and youth surveys were to be completed by the child. Participants did not receive compensation. All study procedures were approved by the institutional research ethics board.

## 2.3. Measures

### 2.3.1. Sociodemographics

Sociodemographic information on child age, child and parent gender, ethnicity, and annual household income were collected by parent report.

### 2.3.2. Parent and child pain

The commonly used Pain Questionnaire was administered to measure the presence and characteristics of parent and child pain.<sup>34</sup> Parents reported on their chronic pain status using a single yes/no item that asked about a pain problem that had been present for at least 3 months and had been greater than 0 on a 0 to 10 scale in the last month. This assessment of chronic pain is consistent with the current definition endorsed by the International Association for the Study of Pain<sup>28</sup> and aligns with previous epidemiological research.<sup>40</sup> Parents rated the average frequency ("not at all" to "daily"), duration ("less than 1 hour" to "all day"), and intensity ("no pain" to "worst pain possible") of their pain. Parents and youth reported on the duration of their pain problem in months and years and the locations of their pain using a validated body map.<sup>2,37</sup> Youth rated their average pain intensity using a validated 11-point Numerical Rating Scale ("no pain" to "worst pain you can think of").<sup>6</sup>

### 2.3.3. Parent posttraumatic stress disorder symptoms

Parent PTSD symptoms were assessed using the PTSD Checklist for DSM-5 (PCL-5).<sup>42</sup> The PCL-5 is a widely used 20-item measure that assesses the presence and severity of PTSD symptoms according to DSM-5 diagnostic criteria. Participants were asked to think about a very stressful event they have experienced and then rate how much they were bothered by specific symptoms in the past month on a 5-point Likert scale from "not at all" to "extremely." Total symptom severity scores were obtained by summing the 20 items (range: 0–80), with higher scores indicating higher PTSD symptoms. A score of 33 is suggested as the cutoff for clinically elevated PTSD symptoms.<sup>5,41,46</sup> The PCL-5 has demonstrated strong internal consistency, test-retest reliability, and convergent and discriminant validity<sup>3</sup> and has been used with parents of children with chronic pain.<sup>30</sup> The PCL-5 demonstrated excellent internal consistency in this sample ( $\alpha = 0.95$ ).

### 2.3.4. Child posttraumatic stress disorder symptoms

Child PTSD symptoms were assessed using the Child PTSD Symptom Scale (CPSS-V).<sup>15</sup> The CPSS-V is a 27-item measure that assesses PTSD symptoms in the past month according to DSM-5 diagnostic criteria. Youth were asked to report a scary or upsetting event that happened to them that still bothers them and then respond to 20 items that assess PTSD symptoms on a 5-point Likert scale from "not at all" to "6 or more times a week/almost always." Total symptom severity scores were obtained by summing the scores of the 20 items (range: 0–80), with higher scores indicating higher PTSD symptoms. A score of 31 or above

indicates clinically elevated PTSD symptoms.<sup>15</sup> The remaining 7 items assess impairment in functioning. The CPSS-V has demonstrated excellent internal consistency, good test-retest reliability, and good convergent validity.<sup>15</sup> The CPSS-V achieved excellent internal consistency in this sample ( $\alpha = 0.95$ ).

### 2.3.5. Child pain interference

The pain interference subscale of the Patient-Reported Outcomes Measurement Information System (PROMIS)-25 Profile was used to assess pain interference experienced by youth in the past week. The 4-item subscale is rated on a 5-point Likert scale from “never” to “almost always.” Pain interference scores were obtained by transforming the summed scores into standardized T-scores. The subscale has excellent psychometric properties and has been used in youth with chronic pain.<sup>21,30</sup> The pain interference subscale demonstrated good internal consistency in the current sample ( $\alpha = 0.86$ ).

### 2.3.6. Child health-related quality of life

Child HRQoL was assessed using the Pediatric Quality of Life Short Form (PedsQL-SF).<sup>7</sup> The PedsQL-SF is a 15-item measure that assesses health-related physical, emotional, social, and school functioning in the past month using a 5-point Likert scale from “never” to “almost always.” Total scores were obtained by transforming responses to a 0 to 100 scale. Higher scores indicate greater HRQoL. The Peds-QL has been widely used in children with chronic conditions, demonstrating excellent psychometric properties.<sup>7</sup> The PedsQL-SF achieved excellent internal consistency in this sample ( $\alpha = 0.90$ ).

## 2.4. Statistical analyses

Analyses were conducted using IBM SPSS version 24 (Armonk, NY). Frequency and descriptive statistics were conducted to obtain characteristics of the sample. Types of traumatic events reported by youth were coded by 2 independent coders according to categories used by Noel et al.<sup>30</sup> Independent-samples *t* tests and  $\chi^2$  tests were conducted to examine group differences between parents and children of parents with vs without chronic pain on sample characteristics (ie, age, sex, household income, and ethnicity). Chi-square tests were conducted to examine whether parents with chronic pain and their children were more likely to report PTSD symptoms that met or exceeded clinical cutoff scores than parents without chronic pain and their children. For these analyses, the PTSD measures were scored dichotomously (ie, scores below the cutoff and scores above the cutoff). All other analyses used the scores from the PTSD measures continuously. Bivariate Pearson correlations and independent-samples *t* tests were conducted between sample characteristics and outcome variables (ie, parent and child PTSD symptoms, child pain interference, and child HRQoL) to justify their inclusion as covariates in the subsequent analyses. Univariate analyses of covariance (ANCOVA) were conducted to assess the observed difference on outcome variables because of parent chronic pain while controlling for significant covariates.

Data were examined for missing values using Little’s missing completely at random (MCAR) test.<sup>24</sup> No imputation procedures were used for missing values. As such, sample sizes vary across analyses. Data were then screened for outliers and violations of assumptions for ANCOVA. Significant covariates that violated assumptions were not included in analyses. Skewness and kurtosis fell within the normal range, and variances did not differ

substantially across groups. As sample sizes were large and equal across groups, the F-statistic depicted is likely conservative and robust to minor violations of normality and equal group variance.<sup>14,35</sup>

## 3. Results

Of the 239 parents and 222 youth enrolled in the study, 16 parents and 30 youth did not complete their questionnaires, one family withdrew their data, and 18 families were excluded from analyses because of ineligibility (eg, youth reporting less than 3 months of pain). Thus, in total, 204 parents and 173 youth were included in the analyses.

Missing data on the PCL-5, pain interference subscale of the PROMIS-25 Profile, and PedsQL-SF were determined to be MCAR. Data on the CPSS-V were not MCAR,  $\chi^2(85) = 120.62$ ,  $P < 0.05$ . Participants with missing data on the CPSS-V reported significantly lower pain intensity,  $t(165) = 2.58$ ,  $P < 0.05$ , than participants who completed the CPSS-V, but did not differ on age, sex, household income, ethnicity, pain duration, or pain interference. In total, 25% of youth did not complete the CPSS-V, with 13% not completing the entire measure (ie, did not report an event and did not respond to the items), 6% not completing any of the items after reporting that they could not identify an event, and 6% not completing the full measure (ie, missed one or more items).

### 3.1. Sample characteristics

**Table 1** presents the sociodemographic data of youth and parents. Youth (67% female,  $M_{\text{age}} = 13.43$ ,  $SD = 2.53$ , range = 8–17) and parents (91% mothers) were enrolled from abdominal pain (3%), complex pain (35%), and headache (62%) clinics within the chronic pain program. Most participants identified as white (80%) and reported an annual household income greater than \$90,000 (54%).

### 3.2. Parent and child pain characteristics

Youth reported an average pain duration of 3.10 years ( $SD = 2.73$  years, range = 0–12 years) and pain intensity of 5.04/10 ( $SD = 2.38$ ). Almost half (43%) of youth reported that their pain was always present. Most youth (70%) reported more than one pain location, with the most frequently reported pain locations being head (63%), stomach (19%), and lower back (13%). Parents reported that youth had missed an average of 9 days of school ( $SD = 13.85$ , range 0–93) in the past 3 months because of their pain, with 6% missing more than 30 days.

Among the parents in the study, 50% reported having a pain problem that had been present for at least 3 months. Among parents reporting a pain problem, 41% reported having had aches and pains every day in the past week, and 57% reported that their pain usually lasts all day. The average pain intensity for parents with chronic pain was 5.89/10 ( $SD = 2.01$ ). Parents reported an average pain duration of 10.25 years ( $SD = 10.47$  years, range = 0–40 years), with 32% of parents having had chronic pain their child’s entire life and 68% of parents having developed chronic pain at some point during their child’s life. Almost half (43%) of parents with chronic pain reported 4 or more pain locations, with head (55%), lower back (45%), and shoulder (40%) being the most frequently reported pain locations.

Parents identifying as nonwhite (or reporting a second ethnicity in addition to white) were significantly more likely to report a chronic pain problem than parents identifying as white,

**Table 1**

**Descriptive statistics and mean comparisons of sociodemographic and pain characteristics between parents and children of parents with vs without chronic pain.**

Sociodemographic and pain characteristics	Parents with chronic pain	Parents without chronic pain	<i>P</i>
Child age, mean (SD) y	13.50 (2.43)	13.30 (2.62)	0.571
Child gender (% female)	62	71	0.133
Parent gender (% female)	91	90	0.827
Ethnicity (%)			0.009
White	73	87	
Nonwhite	25	11	
Aboriginal	6	2	
Arab	6	1	
Latin American	5	1	
South East Asian	2	2	
Other	6	6	
Do not want to answer	1	2	
Annual household income (%)			0.099
<\$29,999	7	3	
\$30,000–\$59,999	10	9	
\$60,000–\$89,999	10	9	
>\$90,000	48	61	
Do not want to answer	24	18	
Child pain intensity, mean (SD) out of 10	5.33 (2.03)	4.72 (2.68)	0.104
Child pain duration, mean (SD) y	3.39 (2.99)	2.80 (2.43)	0.175
School missed in last 3 mo, mean (SD) d	9.20 (14.31)	9.01 (13.60)	0.924

Independent-samples *t* tests were used to compare group means on child age, annual household income, child pain intensity, child pain duration, and school days missed. Chi-square tests were used to compare group means on child and parent gender (female and male) and ethnicity (white and nonwhite).

$\chi(1) = 6.84, P < 0.05$ . Children of parents with chronic pain did not differ from children of parents without chronic pain on age, sex, household income, pain intensity, pain duration, or school days missed (**Table 1**).

### 3.3. Parent and child posttraumatic stress disorder symptoms

Across the entire sample, child PTSD symptom scores averaged 15.86/80 (SD = 16.47, range = 0–60), and parent PTSD symptom scores averaged 9.83/80 (SD = 11.89, range = 0–56). Among children of parents with chronic pain, PTSD symptom scores averaged 19.27/80 (SD = 18.53, range = 0–60), whereas for children of parents without chronic pain, PTSD symptom scores averaged 12.31/80 (SD = 13.43, range = 0–51). Among parents with chronic pain, PTSD symptom scores averaged 12.48/80 (SD = 14.42, range = 0–56), whereas for parents without chronic pain, PTSD symptom scores averaged 7.28/80 (SD = 8.10, range = 0–36).

Of those who completed the PTSD measures, 26/130 (20%) youth and 12/188 (6%) parents reported PTSD symptoms that met or exceeded cutoff scores, suggesting clinically elevated PTSD symptoms. Parents with chronic pain were significantly more likely,  $\chi(1) = 9.37, P < 0.05$ , to report clinically elevated PTSD symptoms than parents without chronic pain ( $n = 11$  vs  $n = 1$ ). Children of parents with chronic pain were also significantly more likely,  $\chi(1) = 8.40, P < 0.05$ , to report clinically elevated PTSD symptoms than children of parents without chronic pain ( $n = 19$  vs  $n = 6$ ). The types of traumatic events reported by youth are presented in **Table 2**.

**Table 2**

**Types of traumatic events endorsed by youth.**

Traumatic event	%
Other	13
Physical illness or hospitalization	12
Chronic pain problem	8
Fear/anxiety	7
Social difficulties	6
Accident	5
Death	5
Family-related conflict	3
Sexual abuse	3
Physical abuse	3
Verbal conflict or abuse	2
Academic difficulties	1
Divorce	1
Fire	1
Pet or animal	1
Relocation	1
Robbery	1

Percentages are based on the number of events ( $n = 157$ ) reported by youth. Overall, 23% of youth did not report an event (ie, they left the question asking to identify the event blank). Among youth that reported an event, 32% could not identify a traumatic event (ie, they wrote "nothing," "not applicable"), 55% identified one event, and 13% identified more than 1 event.

### 3.4. Analyses of covariances

The descriptive statistics and results of the ANCOVAs are presented in **Table 3**. The associations between sample characteristics and outcome variables are reported in **Table 4**.

#### 3.4.1. Parent pain and parent posttraumatic stress disorder symptoms

Analyses of covariance were used to assess the observed difference in PTSD symptoms between parents with and without chronic pain. Household income ( $r = -0.22, P < 0.01$ ) was significantly negatively correlated with parent PTSD symptoms (ie, PTSD symptoms increased as household income decreased) and was thus included as a covariate. Findings revealed that, while controlling for income, parents with chronic pain reported significantly higher PTSD symptoms than parents without chronic pain,  $F(1, 143) = 7.44, P < 0.05$ .

#### 3.4.2. Parent pain and child posttraumatic stress disorder symptoms

Analyses of covariance were used to assess the observed difference in PTSD symptoms between children of parents with vs without chronic pain. Child age ( $r = 0.25, P < 0.01$ ) was significantly positively correlated with child PTSD symptoms (ie, PTSD symptoms increased as age increased) and was thus included as a covariate. Findings revealed that, while controlling for age, children of parents with chronic pain reported significantly higher PTSD symptoms than children of parents without chronic pain,  $F(1, 123) = 4.47, P < 0.05$ .

#### 3.4.3. Parent pain and child pain interference

Analyses of covariance were used to assess the observed difference in pain interference between children of parents with vs without

**Table 3**  
**Descriptive statistics (estimated mean values and SEs) and results of ANCOVA analyses.**

Outcome variable	Parents with chronic pain		Parents without chronic pain		ANCOVA results	
	Parent report, mean (SE)	Child report, mean (SE)	Parent report, mean (SE)	Child report, mean (SE)	F (df)	P
1. Parent PTSD symptoms	13.40 (1.44)		8.01 (1.34)		7.44 (143)	0.007
2. Child PTSD symptoms		18.88 (2.00)		12.84 (2.03)	4.47 (123)	0.037
3. Child pain interference		58.09 (1.07)		54.48 (1.11)	5.47 (156)	0.021
4. Child HRQoL		67.71 (2.49)		74.87 (2.43)	4.20 (113)	0.043

Covariates included in each ANCOVA are as follows: 1. household income; 2. child age; 3. child age and gender; and 4. child age and household income. ANCOVA, analyses of covariance; HRQoL, health-related quality of life; PTSD, posttraumatic stress disorder.

chronic pain. Child age ( $r = 0.19$ ,  $P < 0.05$ ) was significantly positively correlated with child pain interference (ie, pain interference increased as age increased), and child sex ( $t(85) = 3.58$ ,  $P < 0.01$ ) was significantly correlated with child pain interference (ie, girls were more likely to report greater pain interference than boys), and were thus included as covariates. Findings revealed that, while controlling for age and sex, children of parents with chronic pain reported significantly greater pain interference than children of parents without chronic pain,  $F(1, 156) = 5.47$ ,  $P < 0.05$ .

#### 3.4.4. Parent pain and child health-related quality of life

Analyses of covariance were used to assess the observed difference in HRQoL between children of parents with vs without chronic pain. Child age ( $r = -0.26$ ,  $P < 0.01$ ) was significantly negatively correlated with child HRQoL (ie, HRQoL decreased as age increased), and household income ( $r = 0.19$ ,  $P < 0.05$ ) was significantly positively correlated with child HRQoL (ie, HRQoL increased as household income increased), and were thus included as covariates. Findings revealed that, while controlling for age and income, children of parents with chronic pain reported significantly lower HRQoL than children of parents without chronic pain,  $F(1, 113) = 4.20$ ,  $P < 0.05$ .

## 4. Discussion

This was the first study to examine the relationship between parental chronic pain status and child and parent PTSD symptoms, child pain outcomes, and child HRQoL among a sample of youth referred to a tertiary-level chronic pain program. In our sample, half of parents reported having chronic pain (50%), which is consistent with previous research.<sup>25</sup> Parents with chronic pain reported significantly higher PTSD symptoms than parents without chronic pain. In

addition, in our sample of youth with chronic pain, those children whose parents also had chronic pain reported significantly higher PTSD symptoms than children whose parents did not have chronic pain. Finally, children whose parents had chronic pain reported significantly greater pain interference and lower HRQoL than children of parents without chronic pain. Thus, intergenerational connections between chronic pain and PTSD symptoms were found to be present, and parental chronic pain status was associated with poorer functioning in this already vulnerable group of children.

Children with chronic pain have an increased risk of presenting with co-occurring PTSD symptoms when compared with children without chronic pain.<sup>30</sup> Although cross-sectional in design, the current findings suggest that having a parent with chronic pain may confer additional risk for children with chronic pain to experience co-occurring PTSD symptoms. A recent conceptual framework on pediatric chronic pain and PTSD symptoms posits that parent factors, including parental distress, cognitive biases, and protective responses to child pain, may contribute to the development and maintenance of comorbid chronic pain and PTSD symptoms in children.<sup>20</sup> This framework does not include parental chronic pain as a factor contributing to children's symptom co-occurrence. Our findings suggest that parental chronic pain status plays a critical role in the co-occurrence of chronic pain and PTSD symptoms in children, especially considering the high prevalence (50%) of chronic pain in parents of youth with chronic pain. As such, future iterations of this conceptual framework should include parental chronic pain as a key factor that may influence children's PTSD symptoms and pain outcomes.

Parents with chronic pain may influence their child's experience of chronic pain and PTSD symptoms in a number of ways. A recent conceptual model on the intergenerational transmission of chronic pain from parents to children identifies potential mechanisms through which parental chronic pain may influence children's pain

**Table 4**  
**Associations between sample characteristics and outcome variables.**

	1	2	3	4	5	6	7	8	9
1. Parent pain	1	$t(142) = 3.03^{**}$	$t(115) = 2.43^*$	$t(156) = -2.66^{**}$	$t(161) = 1.95$	$t(196) = 0.57$	$\chi(1) = 2.26$	$\chi(1) = 6.84^{**}$	$t(138) = -1.66$
2. Parent PTSD		1	$r = 0.26^{**}$	$r = -0.31^{**}$	$r = 0.27^{**}$	$r = 0.15^*$	$t(185) = -0.20$	$t(182) = -3.09^{**}$	$r = -0.22^{**}$
3. Child PTSD			1	$r = -0.55^{**}$	$r = 0.26^{**}$	$r = 0.25^{**}$	$t(125) = -0.34$	$t(122) = -0.81$	$r = -0.31^{**}$
4. Child HRQoL				1	$r = -0.63^{**}$	$r = -0.26^{**}$	$t(155) = -1.72$	$t(152) = 0.39$	$r = 0.19^*$
5. Child pain interference					1	$r = 0.19^*$	$t(83) = 3.38^{**}$	$t(157) = -1.54$	$r = -0.13$
6. Child age						1	$t(197) = 2.00^*$	$t(194) = 0.87$	$r = 0.07$
7. Child gender							1	$\chi(1) = 0.63$	$t(153) = 0.38$
8. Ethnicity								1	$t(150) = 0.46$
9. Income									1

\* $P < 0.05$ , \*\* $P < 0.01$ .

HRQoL, health-related quality of life; PTSD, posttraumatic stress disorder.

and psychological functioning.<sup>39</sup> Specifically, the model suggests that parental chronic pain may increase children's risk for chronic pain and poor psychological functioning through genetics, neurobiological factors (eg, maternal stress during pregnancy), modeling and reinforcement of maladaptive pain cognitions and behaviours (eg, pain catastrophizing and protective responses to pain), parenting behaviours (eg, responding to child distress), family health habits, and the family environment. Indeed, research has found that parents with chronic pain engage in more catastrophic thinking (ie, magnify the threat value of pain, feel helpless in the context of pain, and ruminate on pain-related thoughts<sup>36</sup>) and protective behaviours in response to their child's pain than parents without chronic pain.<sup>43</sup> Higher parental catastrophizing and protective responses to child pain are associated with greater somatic symptoms, pain intensity, and pain-related disability in youth.<sup>10,17,45</sup> Future research is needed to further examine how parental cognitions and responses to child pain and distress, especially among parents with chronic pain, influence the development and maintenance of co-occurring child pain and PTSD symptoms.

Our findings also revealed that parents with chronic pain reported significantly higher PTSD symptoms than parents without chronic pain. This co-occurrence, and the similarities of the 2 conditions, may confound the influence that parental chronic pain on its own has on child outcomes. Indeed, higher parent PTSD symptoms may serve to fuel many of the same processes as parental chronic pain (eg, catastrophizing and responding to distress) because of heightened threat perception/vigilance and avoidance, which are core features of this internalizing presentation, and would likely manifest in parental responses to child stress and pain. Parent PTSD has consistently been associated with parenting challenges (eg, less positive engagement and more parenting stress) as well as increased child PTSD and internalizing symptoms.<sup>8,23,47</sup> More recently, parent PTSD symptoms have been examined within samples of youth with chronic pain and have been shown to influence pain outcomes in youth.<sup>29</sup> Holley et al's.<sup>20</sup> conceptual model on the co-occurrence of pediatric chronic pain and PTSD symptoms identifies similar mechanisms through which parents may influence the development and maintenance of co-occurring pain and PTSD symptoms in their offspring. Higher parental distress due to parents' own trauma and pain, in addition to parenting a child with chronic pain, may impede other oriented efforts to respond adaptively to child pain. In the face of high emotional distress, self-oriented behaviors that prioritize avoidance of distress and pain may dominate their resources. Furthermore, measures of PTSD symptoms and other pain-related fear and anxiety (eg, pain catastrophizing and fear of pain) have overlapping constructs that may also confound the relationship between chronic pain and PTSD symptoms. Future research should examine the role of parental distress and responses to pain and threat (eg, in a laboratory setting where this pain is evoked and responses can be observed) in the interrelationships between, and independent influences of, parental chronic pain status, child and parent PTSD symptoms, and child outcomes.

In addition to conferring risk for poor psychological functioning, our findings suggest that parental chronic pain is related broadly to worse physical, social, and emotional functioning (ie, greater pain interference and lower HRQoL) in children with chronic pain. Previous findings have demonstrated that children with chronic pain are at risk for poor quality of life.<sup>16</sup> Despite this, research on pediatric chronic pain largely focuses on children's functional or pain-related disability and does not examine the broader physical, emotional, and social functioning of children with chronic pain. Indeed, children's HRQoL is not typically a core outcome in pediatric pain research, despite its inclusion in the PedIMPACT recommendations for chronic/recurrent pain clinical trials.<sup>26</sup> Children's physical, social, and

emotional functioning is critically important for their overall well-being. Our results suggest that, among children with chronic pain, these broader domains of functioning may be more impacted for children whose parents also have chronic pain. Parental chronic pain poses unique stressors for the family, which may impact children's broader quality of life. For example, parents with chronic pain may have difficulty involving their children in opportunities for physical activity,<sup>43</sup> an important aspect of quality of life. Furthermore, parents' protective responses to child pain (eg, letting their child stay home from school) may restrict children's opportunities for social, emotional, and physical growth. Finally, children whose parents have chronic pain may experience greater emotional burden if their primary caregiver is in a constant state of suffering and distress. Future research is required to better understand how parental chronic pain status may impact children's HRQoL.

The associations between covariate variables included in the ANCOVAs, and outcome variables were all in the expected direction. Consistent with literature that has found strong associations between socioeconomic status and exposure to traumatic events and the development of PTSD,<sup>11</sup> in our sample, parent PTSD symptoms increased as household income decreased. Among youth in our sample, PTSD symptoms increased as age increased. This is consistent with previous research that has shown children are more likely to develop PTSD after exposure to a traumatic event in adolescence than early childhood.<sup>27</sup> Older children were also more likely to report greater pain interference and lower HRQoL than younger children. This is expected as older children are more likely to experience stressors that could interfere and decrease their quality of life (eg, demanding schoolwork and bullying) than younger children. Children's HRQoL was also found to decrease as household income decreased. Children from lower-income families may also be more likely to experience stressors, as compared to children from higher-income families, and may have fewer resources to manage these stressors, thus leading to decreased quality of life. Finally, girls were also more likely to report greater pain interference than boys. This is consistent with previous literature on sex differences in pediatric pain.<sup>4</sup>

Overall, the current findings provide evidence for the importance of tailoring interventions for youth with chronic pain. First, given that clinically significant anxiety among children with chronic pain has been linked to poorer response to pain treatment,<sup>9</sup> clinically significant PTSD symptoms may also impede treatment response. As such, interventions for pediatric chronic pain may consider screening for PTSD symptoms. For youth with clinically significant PTSD symptoms, a combined treatment for chronic pain and PTSD may be efficacious in treating both the child's pain and PTSD symptoms. Indeed, Dunne et al.<sup>12</sup> found that a trauma-focused intervention improved both PTSD symptoms and pain outcomes for adults with chronic pain. Future research is needed to examine the efficacy of a combined treatment for co-occurring pediatric chronic pain and PTSD symptoms. Second, incorporating interventions for parental pain and mental health into pediatric chronic pain treatment may improve treatment outcomes. Treatments for pediatric chronic pain may be more efficacious if they target parents' pain, mental health, and distress, which may be impeding parents' ability to engage in adaptive responses and behavior change. Indeed, addressing parental distress has been suggested for pediatric pain interventions,<sup>31</sup> and new interventions show promise for reducing parental depression and pain catastrophizing.<sup>32</sup> However, it is unknown how treatment efficacy for interventions might differ as a function of PTSD symptoms and chronic pain status. Future research should examine whether co-

occurring pain and PTSD symptoms in both parents and children are tied to poorer treatment efficacy for youth with chronic pain.

This study had limitations that can be addressed in future research. Similar to previous studies using samples from tertiary-level chronic pain programs,<sup>25</sup> our sample was predominately white and of high socioeconomic status. As such, the findings may not generalize to other ethnic groups or families with lower socioeconomic status. Furthermore, the study was cross-sectional, and thus the temporality and directionality of the relationships between parent and child chronic pain and functioning could not be examined. Future longitudinal research is needed to examine whether parental chronic pain status predicts the development and maintenance of co-occurring chronic pain and PTSD symptoms, and lower quality of life, in youth with chronic pain. Parents in this study did not report on their type or diagnosis of chronic pain. This is an important area of assessment for future research on parental chronic pain. Finally, a significant minority of children in this study did not respond on the PTSD measure, as our ethical protocol ensured that they could opt out of rating any items they did not want to rate. Thus, conclusions cannot be drawn about the likelihood of PTSD in nonresponders. In addition, parents did not report on the nature of their traumatic event. It is possible that parents responded to the PTSD measure based on an event that did not meet Criterion A (exposure to death, threatened death, actual or threatened serious injury, and actual or threatened sexual violence) in which their PTSD symptoms may be better attributed to other psychological causes (eg, anxiety). In future research, parents should report the traumatic event that occurred to ensure that Criterion A is met.

## 5. Conclusions

This study was the first to examine how parental chronic pain status relates to PTSD symptoms, pain outcomes, and HRQoL in youth with chronic pain. Our findings revealed that parental chronic pain was prevalent and related to higher PTSD symptoms in parents as well as higher PTSD symptoms and pain interference and lower HRQoL in children. These findings have important clinical implications in terms of identifying factors that could predict which youth are most at risk for poor outcomes and treatment response. Future longitudinal research is needed to examine the directionality of these associations and specify the dyadic factors and processes that may contribute to the development and maintenance of co-occurring PTSD symptoms in youth with chronic pain.

## Disclosures

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