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Post-Traumatic Stress Disorder Symptoms in Youth with versus without Chronic Pain

Melanie Noel, PhD¹, Anna C. Wilson², Amy Lewandowski Holley², Lindsay Durkin³, Michaela Patton⁴, and Tonya M. Palermo, PhD^{3,5}

¹Department of Psychology, University of Calgary and Alberta Children's Hospital Research Institute

²Oregon Health and Science University, Institute on Development and Disability

³Center for Child Health, Behavior and Development, Seattle Children's Hospital Research Institute

⁴Department of Psychology, Oklahoma State University

⁵Departments of Anesthesiology, Pediatrics, and Psychiatry, University of Washington

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Post-traumatic stress disorder (PTSD) and high levels of PTSD symptoms have been documented in adults with chronic pain [4] and pain is commonly reported among individuals with PTSD [5]. It has been proposed that traumatic events and subsequent PTSD reactions might increase risk for development or worsening of chronic pain, and that PTSD symptoms and chronic pain are mutually maintaining [3; 4; 29; 44]. Additionally, adverse early life events (e.g., abuse, neglect, maltreatment) have been associated with pain in adulthood [13; 23; 25; 40; 43; 47], suggesting that associations between trauma and chronic pain may exist earlier in development. Some research with children and adolescents supports the association between pain and PTSD symptoms. Indeed, among youth with traumatic brain injuries, PTSD symptoms predict pain symptoms over time [8].

Although interest in the topic of PTSD and chronic pain in youth has recently emerged [48], empirical research has not yet examined the prevalence of PTSD symptoms in adolescents with chronic pain, at a developmental period when pediatric chronic pain often first develops [27] and has been shown to peak for girls [39]. Recently, we developed a novel pediatric model of PTSD symptoms and chronic pain, outlining individual, interpersonal, and neurobiological factors that underlie this co-occurrence [22]; however, research is needed to determine whether youth with chronic pain have PTSD symptom elevations and whether they are linked to worse health-related quality of life and greater pain-related impairment. Understanding of PTSD symptoms in youth with chronic pain might lead to targeted

assessment and treatment approaches, as has been the case for adults with comorbid pain and PTSD [3].

Parent factors play a key role in pediatric chronic pain [37] and in the development and persistence of children's PTSD symptoms [42; 55]. Research in other pediatric medical populations and in youth experiencing traumatic events (e.g., cancer, traumatic injury, abuse) has demonstrated that parents can experience their own clinically significant levels of PTSD symptoms related to their child's experiences [1; 19; 30], and that parental PTSD symptoms influence child outcomes over time [42]. Additionally, maternal PTSD symptoms are associated with increased exposure to traumatic events in children [10]. Nevertheless, PTSD symptoms have not been examined among parents of youth with chronic pain despite research indicating high levels of parent distress [35].

The aims of the current study were to compare PTSD symptoms and self-identified traumatic events among youth with chronic pain to a control group of youth without chronic pain, and to examine the association between PTSD symptoms, health-related quality of life, and pain characteristics within the chronic pain sample. Given the core role that parents play in shaping children's pain and trauma responses, we also examined PTSD symptoms and traumatic experiences in parents of the youth in this study, and their relationship to child outcomes. We hypothesized that 1.) youth with chronic pain and their parents would both demonstrate elevated PTSD symptoms and more stressful life events as compared to pain-free peers, and 2.) among youth with chronic pain, heightened PTSD symptoms would be predictive of worse health-related quality of life and would be associated with greater pain and pain-related impairment.

Method

This study was conducted at academic medical centers in the northwestern United States. All study procedures were approved by the Institutional Review Board and participants provided consent or assent prior to participating. Study participants were youth between the ages 10–17 years and one of their parents. Child participants either had ongoing chronic pain (n=95) or were a comparison sample of youth without chronic pain (n=100).

Children and adolescents with chronic pain were recruited from specialty pediatric pain clinics at two tertiary level children's hospitals. All patients in the chronic pain cohort had been evaluated in one of these specialty chronic pain clinics and had been diagnosed with a chronic pain condition by a physician. Potential participants were identified from chronic pain clinic schedules and were either approached in-person or mailed an informational letter about the study. Families were then contacted via telephone to undergo additional screening for inclusion/exclusion criteria. Inclusion criteria for youth with chronic pain were: pain present for three months or greater and presence of ongoing pain (i.e., pain intensity > 0/10 in the past month) at the time of screening. Children with life threatening conditions (e.g., cancer) were excluded given that there is a relatively large literature documenting the prevalence of PTSD symptoms in these youth as well as the potential that there could be differences between youth whose condition was and was not linked to mortality risk. None

of the participants who underwent screening for this study were excluded due to having a diagnosis of cancer or another life-threatening illness.

The comparison sample was recruited from community advertisements and a healthy participant research database, which included a list of youth who had been previously screened in our research laboratory and who indicated during assent/consent procedures that they would like to be contacted in the future about research projects. Interested families contacted study staff via telephone and completed screening for inclusion/exclusion criteria. Children in the comparison sample were eligible if they did not have an ongoing or past chronic pain problem (i.e., pain present for three months or greater), or a current or past chronic health condition (e.g., cancer, diabetes). To be included in the study, youth and parents in both groups were required to be able to speak and read English, independently complete study questionnaires, and have access to the internet. Youth could not have a cognitive impairment or a developmental disability. Parents were required to be the child's legal guardian.

Eligible families provided verbal consent/assent via telephone and written consent/assent via a secure online server. Youth completed assent forms; parents completed consent forms. Prior to completing these forms online (i.e., providing their electronic signatures), a researcher had a consent conference with participating parents and youth by telephone. This allowed the researcher to explain the study procedures in detail as well as to allow the participants to ask questions and seek clarification about the research. During the consent conference, researchers had a detailed conversation with parents and youth about the importance of independently completing the questionnaires. Parents and children completed study questionnaires via REDCap, a secure online data collection portal. Each child and parent participant was given an individual log in link with instructions to complete the survey independently. Similar to in person questionnaire completion, participants could choose not to answer items. If a large number of items were missing (e.g., an entire questionnaire), a researcher contacted the participant to inform them of this (as this could have been omitted in error). At this point, they were asked to complete missing items if they so desired. Participating parents and youth each received a gift card (valued at \$20.00 USD) for participating in the study.

Measures

Socio-demographics—Parents completed a questionnaire reporting on their and their child's socio-demographic characteristics including: age, sex, race, marital status, education, and family income.

Pain Characteristics—Child pain characteristics were assessed via self-report. Youth were asked to report on their pain frequency, intensity, unpleasantness, location, and duration over the past 7 days. If youth and parents (e.g., in the healthy cohort) did not experience any pain in the past 7 days, they did not complete the remaining items on the pain questionnaire. This questionnaire has demonstrated adequate validity in youth [36] and is composed of several well-validated single item pain measures [31; 51]. Pain frequency was rated using a 5-point Likert scale (anchors: 0 = 'not at all', 4 = 'daily'). Usual pain

intensity was assessed using an 11-point Numerical Rating Scale (NRS; anchors: 0 = ‘no pain’, 10 = ‘worst pain possible’) [51]. Pain unpleasantness was rated on a 5-point Likert scale by asking participants to rate how much aches or pain bothered or upset them (anchors: 1 = ‘not at all’, 5 = ‘very much’) [31]. Youth used a validated body map [41] to mark the location in which they experienced the most problems with pain. Youth with chronic pain were asked to report on the overall duration of their pain problem.

Pain Interference—Youth reported on the degree to which they experienced impairment as a result of their pain using the pain interference subscale of the PROMIS-25 Profile. The PROMIS-25 is one of the Pediatric Profile instruments developed by the National Institutes of Health (NIH) Patient Reported Outcomes Measurement Information System (PROMIS). The pain interference subscale consists of 4 items and is intended for use with youth aged 8–17 years. The measure was rigorously developed using item response theory and has recently been validated among youth with chronic pain, showing evidence of construct validity and responsiveness to change [26].

Post-Traumatic Stress Disorder Symptoms – Child—PTSD symptoms among youth were assessed using the 24-item Child PTSD Symptom Scale (CPSS-5) [15]. Children were instructed to first think of “scary or upsetting” events (e.g., car accident, getting beaten up, being robbed, being touched in a way you didn’t like, having a parent get hurt or killed, etc.) and then to report the event they had experienced that distressed them the most. A reporting time frame of the past month is used. The first section of this measure is composed of 17 items and children were asked to rate symptom frequency on a 4-point Likert scale (anchors: 0 = ‘not at all’, 3 = ‘3–5 times/week’). These 17 items map onto DSM-5 diagnostic criteria for PTSD. The second part of the questionnaire (7 items) assesses functional impairment in daily life (e.g., schoolwork, relationships with friends and family, etc.) that is associated with PTSD symptoms. Children responded to these items with dichotomous response options indicating if impairment was present or absent.

A total PTSD symptom score is obtained by summing children’s responses to the initial 17 items. Subscale scores for the 4 symptom clusters (re-experiencing, avoidance, negative cognitions and mood, hyperarousal) were also computed. The CPSS-5 is based on the CPSS-4, which has excellent psychometric properties [15; 33]. The CPSS-5 has excellent internal consistency for total symptom severity and good test-retest reliability. Emerging research demonstrates that the CPSS-5 shows evidence of convergent validity and discriminant validity with measures of child anxiety and depression. Clinical cut-off scores of 31 can be used for identifying probable PTSD diagnoses in youth (Capaldi, personal communication).

Post-Traumatic Stress Disorder Symptoms – Parent—Parents reported on their own symptoms of PTSD using the PTSD Checklist for DSM-5 [53]. The measure is designed to screen adults for PTSD and is appropriate for making a provisional PTSD diagnosis. Similar to the CPSS-5, on the PCL-5, parents were asked to self-identify their most distressing event and then rate each symptom based on how much they were bothered by that particular event in the past month. Response options are on a 5-point Likert scale (anchors: 0 = ‘not at all’, 4 = ‘extremely’). A total symptom severity score was obtained by

summing participants' responses to the 20 items. Subscale scores for the 4 PTSD symptom clusters (re-experiencing, avoidance, negative cognitions and mood, hyperarousal) were also computed. A score of 33 is the current clinical cut-off [50]. The PCL-5 has excellent psychometric properties (e.g., test-retest reliability, internal consistency, convergent and discriminant validity) [6].

Stressful Life Events – Child—The 30-item Life Events Scale for Children (LESC) was used to assess exposure to stressful life events among youth. The measure is based on the Coddington Life Events Questionnaire [11], and was subsequently modified to include additional negative life events [24; 54]. Events included on the LESC include normative, albeit stressful, life events (e.g., death of a pet, parental divorce) as well as events that could be potentially traumatic or life threatening (e.g., abuse, death of a parent). Similar to previous research [54], a total score reflecting the total number of stressful life events was computed given that it has been found to predict PTSD symptoms [12].

Stressful Life Events – Parent—Parents completed the Life Event Checklist for DSM-5 (LEC-5) to assess their previous exposure to potentially traumatic events. The measure lists 16 events and asks participants to rate their level of exposure over their lifetime with the following response options: 'happened to me', 'witnessed it', 'learned about it', 'part of my job', 'not sure' and 'doesn't apply'. The measure is used in conjunction with the PCL-5, which parents used to report on their symptoms of PTSD [16; 52].

Child Health-Related Quality of Life—The 15-item Pediatric Quality of Life Inventory (PedsQL) [9] assesses health-related physical, emotional, social, and school functioning using a 5-point Likert scale with response options ranging from 'never' (0) to 'almost always' (4). Higher scores indicate better health-related quality of life. The PedsQL is widely used in illness and healthy samples and has excellent psychometric properties [9]. For the purposes of the present study, the total PedsQL score was used.

Data Coding

Responses pertaining to the nature of the traumatic event that parents and youth self-identified when completing the PTSD symptom measures were coded into thematic categories by an independent coder. This resulted in a total of 24 themes. For reliability, 20% of the events were then randomly selected and subsequently coded by a second independent coder. Intraclass correlations were conducted to determine inter-rater reliability. A high degree of reliability was found between raters; average measure intraclass correlations were .87 for the child and .96 for the parent codes. When coders disagreed on allocation of events to thematic categories, a third individual (MN) made the final decision.

Data Analysis

Data collected via REDCap surveys were downloaded and analyzed using SPSS Version 22.0. T-tests and chi-square tests were used to examine differences between cohorts on socio-demographic variables to inform which covariates to enter in the analyses/models. Descriptive statistics were used to summarize frequencies of traumatic and stressful life

events as well as mean levels of PTSD symptoms, overall health-related quality of life, and pain characteristics.

Differences between cohorts (chronic pain vs. no chronic pain) on PTSD symptoms and impairment, total number of stressful life events, and overall health-related quality of life were examined using ANCOVAs, while controlling for socio-demographic variables (child age, child sex, parent education, household income). Within the chronic pain sample only, bivariate correlations were used to examine associations among PTSD symptoms and pain characteristics, pain-related interference, and health-related quality of life. Next, a hierarchical regression model (controlling for socio-demographic variables) was used to examine whether PTSD symptoms predicted overall health-related quality of life among youth with chronic pain.

Results

Descriptive Statistics

Socio-demographics of the sample are shown in Table 1. An independent samples t-test revealed that youth with and without chronic pain differed on child age and sex, with on average, the sample of youth with chronic pain being older ($t(196)=2.30, p < .05$) and composed of more girls ($X^2(1, N=198) = 5.98, p < .05$). In addition, parents of youth with chronic pain obtained lower levels of education ($X^2(3, N=198) = 21.30, p < .001$) and reported having a lower household annual income ($X^2(4, N=197) = 30.41, p < .001$) than parents of youth without chronic pain. Based on these socio-demographic differences, child age, child sex, household annual income, and parental education were controlled for in subsequent analyses comparing the two study groups. While controlling for these sociodemographic factors, as expected, health-related quality of life was found to be significantly lower for youth with chronic pain as compared to youth without chronic pain ($F(1,188) = 73.46, p < .001$).

Pain Characteristics

Youth with chronic pain—Among youth with chronic pain, primary pain locations were head (22%), leg (22%), and abdomen/stomach (16.5%). Over half (55.6%) of youth with chronic pain reported that their pain typically lasted all day. The average level of pain intensity was 5.8/10 ($SD = 1.7$). The majority (84.7%) of youth reported moderate to high degrees of pain unpleasantness.

Youth without chronic pain—As expected based on eligibility criteria, most youth in this cohort (70%) did not experience any pain (i.e., 0/10) in the past week. Among those who did experience pain, it was of low intensity. As consistent with screening for inclusion criteria, pain was short in duration in and did not persist for 3 months or more.

Cohort Differences in PTSD Symptoms and Stressful Life Events

Table 2 presents the mean differences between youth with and without chronic pain and their parents on PTSD symptoms and total number of stressful life events as well as the ANCOVA results. As hypothesized, youth with chronic pain had significantly higher levels of PTSD

symptoms and related impairment as compared to youth without chronic pain. Similarly, parents of youth with chronic pain reported significantly higher levels of PTSD total symptom severity as compared to parents of youth without chronic pain. Both youth with chronic pain and their parents also reported significantly higher scores on all of the individual PTSD symptom cluster scores (re-experiencing, avoidance, cognition and mood, hyperarousal). Because of the differences in socio-demographic factors between groups, child age and sex, parental education, and household annual income were controlled for in all between-groups analyses. Inclusion of these covariates did not change the pattern of results for the PTSD variables. Several covariates were significant; age was positively related to child PTSD impairment scores and income was positively related to parental PTSD symptom scores.

In terms of clinical cut-offs, significantly more youth with chronic pain reported PTSD scores at or above the clinical cut-off than youth without chronic pain ($n = 30$ versus $n = 8$; $\chi^2(1, N = 195) = 17.86, p < .001$). Nineteen parents, who were all parents of youth with chronic pain, reported PTSD symptoms at or above the clinical cut-off of 33, indicating clinically significant elevations in PTSD symptoms, while one parent of youth without chronic pain scored above the clinical cut-off. Youth with chronic pain reported significantly higher numbers of stressful life events ($M = 7.2, SD = 4.5$) than youth without chronic pain ($M = 5.8, SD = 3.2$); however, this relationship did not remain significant when socio-demographics were controlled. Age and income were significant covariates in this model.

Characteristics of Self-identified Traumatic Events

The self-identified events reported as most traumatic were largely similar between youth and parents in both cohorts. Youth in both groups identified death and physical illness/hospitalization as their most distressing events. Youth with chronic pain more commonly reported death as their traumatic event as compared to youth without chronic pain ($n = 27$ versus $n = 13$; $\chi^2(1, N = 195) = 7.105, p < .01$). Youth with chronic pain more commonly reported abuse (physical and sexual combined) than youth without chronic pain ($n = 11$ versus $n = 4$; $\chi^2(1, N = 195) = 3.94, p < .05$). Parents in both groups identified death, physical illness/hospitalization, and accidents as their most distressing events. Only a small percentage of youth (7.7%) and parents (9.0%) in the chronic pain group reported that their most distressing event was about their own/their child's chronic pain problem. Comparisons between cohorts on other types of traumatic events could not be conducted given the low frequency with which they were reported.

Within Group Analyses: Chronic Pain Cohort

Bivariate correlations between PTSD symptoms, exposure to stressful/traumatic events, pain characteristics (duration, intensity, unpleasantness), pain interference, and health-related quality of life within the sample of youth with chronic pain are shown in Table 3. As expected, correlations revealed that higher PTSD symptoms were related to higher pain intensity, pain unpleasantness, pain interference, and poorer overall health-related quality of life. Children who reported greater numbers of stressful life events had higher PTSD symptoms and related impairment and tended to report higher levels of pain unpleasantness and interference as well as longer pain duration. Among parents of youth with chronic pain,

PTSD symptoms were positively related to their child's pain intensity; however, contrary to hypotheses, parent and child PTSD symptoms were not significantly correlated with one another.

The results of the regression analyses using PTSD symptomatology to predict health-related quality of life within the chronic pain sample are presented in Table 4. After controlling for child age, sex, parental education, and household annual income, children's PTSD symptoms accounted for 33% of the variance in children's health-related quality of life. The total model accounted for 44% of the variance in children's health-related quality of life.

Discussion

This is the first study to compare PTSD symptoms in a clinical sample of youth with chronic pain and their parents to pain-free peers. Findings revealed that over and above socio-demographic factors, PTSD symptoms were significantly higher among youth with chronic pain, with 32% of these youth reporting clinically significant elevations in PTSD symptoms as compared to 8% of youth without chronic pain. Among the pediatric chronic pain sample, PTSD symptoms were predictive of poorer overall health-related quality of life, and were associated with greater pain intensity, unpleasantness, and interference. Moreover, parents of youth with chronic pain similarly reported elevated levels of PTSD symptoms as compared to parents of youth without chronic pain. Twenty percent of parents in the chronic pain cohort reported PTSD symptoms at or above the clinical cutoff for PTSD, compared to 1% of the parents of youth without chronic pain. Among parents in the chronic pain group, higher PTSD symptoms were associated with higher child-reported pain intensity. These findings suggest that at a symptom level, elevations in child and parent PTSD are common and related to reduced functioning among youth with chronic pain.

We also characterized traumatic events and examined associations among stressful life events and PTSD symptoms. The most distressing/traumatic events identified on the PTSD symptom measure were largely similar across youth and parents in each cohort, with death and physical illness/hospitalizations reported as the most frequently occurring events. Youth with chronic pain reported a significantly greater number of stressful life events than youth without chronic pain; however, this relationship did not remain significant when accounting for socio-demographic factors. Among youth with chronic pain, stressful/potentially traumatic events were positively related to PTSD symptoms. This may suggest that while the types of traumatic events that youth with and without chronic pain experience are similar, in the context of chronic pain, stressful life events may confer additional risk for development of PTSD symptoms. It is also possible that these youth are particularly vulnerable to the negative effects of stressful life events, which may contribute to the development of chronic pain and PTSD symptoms. Indeed, vulnerabilities such as difficulties regulating negative affect increase risk for the development of a number of negative psychological and physical health outcomes [18]. Moreover, early adverse childhood events have been previously linked to adult pain [13; 23; 25; 40; 43; 47]. Research is needed to determine whether there are sensitive periods in childhood during which adverse or traumatic events are most likely to leave a lasting mark on an individual's later pain responses. Additionally, research should

examine whether there are states in which early adverse life events are differentially linked to the development of chronic pain in the pediatric versus adult period.

Findings from this study also underscore the importance of examining PTSD symptoms in parents of youth with chronic pain, adding to the growing literature documenting high levels of distress experienced among parents of youth with chronic pain [35; 45; 46]. Contrary to existing research on pediatric PTSD [14], among the chronic pain cohort, parental PTSD symptoms were not related to child PTSD symptoms. Future research is needed to determine whether elevated parental PTSD symptoms influence parent behaviors toward their child's pain (e.g., protective or minimizing responses). Maladaptive pain promoting parental behaviors may be a mechanism through which parental trauma symptoms influence the child's pain experience. It is also possible that elevated parental PTSD symptoms increase children's risk for exposure to stressful or traumatic events, increased family stress, or parental dysregulation [28; 38], which might also serve to increase child risk for chronic pain. It is unknown whether observed elevations in parental PTSD symptoms preceded the development of child chronic pain. Future research should examine longitudinal/transactional trajectories of parent distress and PTSD symptoms, with consideration of critical periods of development, and how these might impact child pain and PTSD outcomes over time.

This research provides compelling evidence that, similar to adult samples, PTSD symptoms are elevated and linked to reduced functioning in youth with chronic pain; however, additional research is needed to examine the underlying mechanisms that might be driving this co-occurrence. Cognitive-affective factors such as anxiety sensitivity, avoidant coping, depression, and cognitive biases (e.g., attentional biases towards threat) have been proposed to underlie the co-occurrence of chronic pain and PTSD in adults [4; 44] and many of these factors are also present in youth with chronic pain [48]. While the current findings mirror adult research on co-occurring PTSD and chronic pain [4; 7; 29], research is needed to determine whether these models have applicability to pediatric populations. Our recent conceptual model of pediatric PTSD symptoms and chronic pain [22] provides a novel framework of intrapersonal (e.g., cognitive biases), interpersonal (e.g., parent responses) and neurobiological (e.g., activation of fear-based circuitry) contexts. A key research priority is to examine developmental differences in the expression and outcomes of co-occurring PTSD and chronic pain across childhood and adolescence [22]. Moreover, research on *modifiable* mechanisms (e.g., cognitive biases, sleep disturbance) may elucidate treatment targets that could enhance existing psychological interventions and maximize their efficacy for youth with co-occurring chronic pain and PTSD symptoms.

Given that the current study is cross-sectional, future research is needed to tease apart the temporal nature of the relationship between stressful life events, PTSD symptoms, and chronic pain in youth. Specifically, longitudinal research is needed to determine whether experiencing a traumatic event and subsequent PTSD symptoms heightens susceptibility for developing chronic pain and/or whether having a chronic pain problem increases vulnerability for responding to potentially traumatic events in a maladaptive way. Recent research suggests that mental health disorders may precede the onset of chronic pain [49]; however, directionality is yet to be determined and will be aided by longitudinal designs. It

is also likely that the relationships between PTSD symptoms and chronic pain are bidirectional and mutually maintaining [22]. Indeed, acute pain has been shown to predict PTSD symptoms in youth following injuries [21] and PTSD symptoms have also been shown to predict pain in youth with traumatic brain injuries [8]. Future research is needed to examine the co-occurrence of chronic pain and PTSD among clinical samples of youth seeking treatment for their trauma. Among adult samples, individuals with this comorbidity have been shown to present for treatment of either PTSD or chronic pain [4]. It is currently unknown whether the first point of entry into health-care settings among pediatric samples is typically for diagnosis and treatment of mental health (e.g., PTSD) or chronic pain issues. Prospective studies are needed to determine whether early treatment of PTSD can buffer children against subsequently developing chronic pain and/or whether early treatment of chronic pain protects youth from later developing PTSD.

This study had several limitations that should be considered in interpreting the findings. First, the focus in this study was on PTSD at the symptom, and not the diagnostic, level. As such, this research does not address whether PTSD *diagnoses* are prevalent and impairing in youth with chronic pain. Future research should use gold-standard clinician-administered diagnostic interviews to examine PTSD diagnoses in order to establish prevalence rates and better identify treatment needs of these youth. In addition, epidemiological research is needed to establish prevalence rates of PTSD among youth with versus without chronic pain to demonstrate the scope of this problem at a population level. Recent nationally representative data suggests that adolescents with chronic pain had higher lifetime rates of anxiety disorders (including diagnoses of PTSD) [34]; however, prevalence rates using the newer diagnostic system for PTSD that was introduced in 2013 [2] are needed. The present study was also cross-sectional; as such, it cannot address the temporal relationships between PTSD and chronic pain and whether PTSD makes youth vulnerable for the development of chronic pain and vice versa. Moreover, the study did not use socio-demographic matching procedures (e.g., on age and sex) for the comparison cohort and thus groups were unbalanced on important socio-demographic factors. This study relied exclusively on self-report questionnaires to assess symptoms and outcomes, and may have been subject to reporting biases. Future research could employ objective assessments of constructs implicated in this co-occurrence (e.g., behavioural coding of parent behaviours). In addition, the vast majority of the parent participants were mothers. In light of differences found between mothers and fathers in responses to children's pain [32] and PTSD symptoms [17; 20], examination of parent gender as a moderator of outcomes is warranted in future studies.

In conclusion, this is the first study to demonstrate that youth with chronic pain and their parents have greater elevations in PTSD symptoms as compared to youth without chronic pain and their parents. Moreover, PTSD symptoms were linked to worse health-related quality of life, greater pain complaints, and heightened impairment among youth with chronic pain. These findings emphasize the importance of examining PTSD symptoms in youth with chronic pain and their parents as they may confer additional risk for this already vulnerable group of youth. It also supports recent calls in the literature to screen for PTSD symptoms among pediatric chronic pain populations [48].

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Table 1

Sample socio-demographics.

	Chronic pain (<i>N</i> = 95)	No chronic pain (<i>N</i> = 100)	<i>p</i> <
Child's age (<i>M</i> years, SE)	15.0 (2.1)	14.3 (2.1)	<.05
Child's sex (% female)	72.2	55.4	<.05
Parent's sex (% female)	90.7	93.1	
Relationship to the child (%)			
Biological mother	87.6	90.1	
Biological father	8.2	5.9	
Adoptive mother	1.0	3.0	
Adoptive father	1.0	–	
Other	2.1	1.0	
Parent Education			<.001
High school or less	8.2	3.0	
Vocational school/some college	32.0	9.9	
College	38.1	44.6	
Graduate/professional school	21.6	42.6	
Child's race (%)			
White	88.2	75.0	
Other	6.5	11.0	
Black or African-American	2.2	7.0	
Asian	2.2	4.0	
Native Hawaiian or Other Pacific Islander	–	3.0	
American Indian or Alaska Native	1.1	–	
Household income (%)			<.001
\$10,000 – \$29,999	12.5	2.0	
\$30,000 – \$49,999	15.6	3.0	
\$50,000 – \$69,999	13.5	5.9	
\$70,000 – \$100,000	24.0	20.8	
More than \$100,000	34.4	68.3	

Table 2

ANCOVA results and mean differences between youth with and without chronic pain and their parents on PTSD symptoms, stressful life events, and quality of life.

Variable	Chronic pain group (N = 95) Mean (SD)	No chronic pain group (N = 100) Mean (SD)	ANCOVA results (covariates: child age, child sex, parental education, income)
Child PTSD symptoms total scores [‡]	23.79 (19.12)	10.02 (11.72)	$F(1,188) = 25.13, p < .001$
Child PTSD impairment subscale scores [‡]	2.60 (2.34)	0.75 (1.49)	$F(1,188) = 32.15, p < .001$
Parent PTSD symptoms total scores [‡]	18.04 (16.97)	6.91 (8.01)	$F(1,191) = 12.83, p < .001$
Child total number of stressful life events [*]	7.20 (4.54)	5.80 (3.20)	$F(1,191) = 0.15, p > .05$
Parent total number of stressful life events	8.10 (4.26)	6.92 (4.20)	$F(1,191) = 1.75, p > .05$
Child quality of life [‡]	57.43 (20.96)	82.59 (11.88)	$F(1,188) = 73.46, p < .001$

Note. The following measures were used: CPSS-5 (child PTSD symptoms); PCL-5 (parent PTSD symptoms); LESC (child stressful life events); LEC-5 (parent stressful life events); PedsQL (overall health-related quality of life). The covariate, child age, was significantly related to child PTSD impairment, quality of life, and stressful life events scores. Income was related to parent PTSD symptom and child stressful life events scores.

^{*} $P < 0.05$

[‡] $P < 0.001$

Correlations among PTSD symptoms, pain characteristics, stressful life events, and quality of life among youth with chronic pain and their parents.

Table 3

<i>N</i> = 95	1. Child PTSD symptoms	2. Child PTSD-related impairment	3. Parent PTSD symptoms	4. Pain intensity	5. Pain unpleasantness	6. Pain interference	7. Pain duration	8. Child total number of stressful life events	9. Parent total number of stressful life events	10. Quality of life
1. Child PTSD symptoms	1.00	0.76**	0.12	0.26*	0.39**	0.52**	0.17	0.41**	−0.04	−0.64**
2.		1.00	0.12	0.12	0.30**	0.47**	0.09	0.46**	0.05	−0.64**
3.			1.00	0.23*	0.19	0.18	−0.003	0.23*	0.52**	−0.13
4.				1.00	0.56**	0.38**	0.07	0.19	0.10	−0.35**
5.					1.00	0.49**	−0.07	0.21*	−0.04	−0.48**
6.						1.00	0.20	0.35**	0.04	−0.72**
7.							1.00	0.23*	0.03	−0.22*
8.								1.00	0.25*	−0.33**
9.									1.00	−0.05
10.										1.00

Note. The following measures were used: CPSS-5 (child PTSD symptoms); PCL-5 (parent PTSD symptoms); PedsQL (overall health-related quality of life); Pediatric PROMIS-25 (pain interference).

* *P* < 0.05

** *P* < 0.01

Hierarchical regression analysis explaining the contribution of child PTSD symptoms to overall health-related quality of life.

Table 4

Criterion variable	Step	Predictor	Beta	R ²	Cumulative R ²
Total quality of life	1	Child Sex	−0.077	0.106 [*]	0.106
		Child Age	−0.280 [†]		
		Parental Education	−0.084		
		Household Income	0.102		
	2	Child PTSD Symptoms	−0.611 [‡]	0.330 [‡]	.436

Note. The following measures were used: CPSS-5 (child PTSD symptoms); PedsQL (overall health-related quality of life). Standardized Beta weights are from the first step at which variables were first entered.

^{*} $P < 0.05$

[†] $P < 0.01$

[‡] $P < 0.001$