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Child and Family Antecedents of Pain During the Transition to Adolescence: A Longitudinal Population-Based Study

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Abstract: Pediatric persistent pain is associated with poorer physical and psychosocial functioning in children, as well as immediate and long-term societal costs. Onset typically occurs in early adolescence, suggesting that late childhood is a key window for identifying potential intervention targets before pain symptoms become entrenched. This study used population-based data from the Longitudinal Study of Australian Children (n = 3,812) and adopted a biopsychosocial and ecological systems approach to investigate child, family, and sociodemographic factors associated with pain problems in children transitioning to adolescence. The prevalence of at least weekly parent-reported pain in the study sample was approximately 5% at 10 to 11 years of age, and pain continued at 12 to 13 years of age for 40% of these children. Key factors at 10 to 11 years that uniquely predicted parent-reported pain problems at 12 to 13 years were frequency of previous pain (1–3 times weekly: odds ratio [OR] = 7.49; 95% confidence interval [CI], 4.3–13.0; 4–7 times weekly: OR = 17.8; 95% CI, 8.7–36.5) and sleep difficulties (OR = 1.86; 95% CI, 1.16–2.97). This study highlights the importance of early intervention for persistent pain in childhood, because pain complaints in late childhood tend to persist into early adolescence.

***Perspective:** This article used a biopsychosocial and ecological systems approach to understanding predictors of pain problems during the transition to adolescence within a nationally representative community-based cohort. Sleep difficulties at 10 to 11 years uniquely predicted pain at ages 12 to 13 years, suggesting that early intervention using sleep interventions may be a promising direction for future research.*

***Key words:** Child, adolescent, pain, longitudinal studies, family.*

Persistent or recurrent pain affects approximately 25% of young people,[38] and community-based studies have shown a rise in the prevalence of pain in school-aged children and adolescents over recent decades.[2,3,14,28] The most common pain symptoms in children include headaches, abdominal pain, and general musculoskeletal pain.[38] For some children, pain symptoms become chronic (ie, persist for more than 3 months) and are associated with a range of difficulties with mood, sleep, school attendance, and social functioning,[56] as well as poorer outcomes in adulthood.[7,13,33,39,48,67,68] The economic burden of persistent pain in childhood is shouldered by families, institutions, and society at large.[11,59]

Effective prevention and early intervention is crucial before pediatric pain problems become entrenched.[25] The peak onset of persistent pain occurs during adolescence,[64] thus making late childhood or the transition to adolescence a critical developmental window in which to intervene. However, formulating effective clinical

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responses first requires an understanding of the risk factors for onset and maintenance of pain problems during this period.

Pain is a complex phenomenon that is precipitated and maintained by an interplay of biological, psychological, and social factors.[24] Population-based studies have identified a number of biological factors that predict experience of any persistent pain including female sex[38,46] and pubertal status[63]; psychological and behavioral child factors such as peer victimization,[21,23,26,49] poor sleep,[1,58] and emotional problems[40,63]; and social factors such as familial hardship,[35,46] high levels of parental distress,[12,17,29,55] adverse events such as death of a family member,[6] and poorer family functioning.[42,50]

However, this evidence is restricted on several important counts. Investigations have largely used cross-sectional designs,[6,12,26,41,47,50,58] limiting inferences about causation and the capacity to differentiate whether these correlates represent risk factors for, or consequences of, persistent pain. Further, the aggregation of wide age ranges in studies[6,12,34] makes it difficult to understand developmental effects. Finally, few population studies simultaneously investigate a broad range of child and family factors,[29,63] which is imperative in determining those with unique effects that hold the most promise as targets for prevention or early intervention efforts.

In this study we capitalize on data from the Longitudinal Study of Australian Children (LSAC), a large, nationally representative, community sample of Australian children followed for over a decade, to investigate late childhood predictors of pain problems across the transition to adolescence. We aimed to: 1) describe the location, frequency and severity of pain in late childhood (10–11 years) and early adolescence (12–13 years), and 2) determine predictors in late childhood of pain problems in early adolescence (12–13 years). Potential predictors were selected on the basis of an ecological model of child development[10] to include individual (eg, gender, pubertal development), family (eg, maternal mental health, hostile parenting), and sociodemographic factors (eg, maternal education, financial hardship) previously shown to be associated with persistent and recurrent pain.

Methods

Study Design and Sample

The LSAC is a nationally representative clustered cross-sequential sample of 2 cohorts of Australian children—the birth cohort of 5,107 infants and the kindergarten cohort of 4,983 four-year-old children—that commenced in May 2004.[57] The study was approved by the Australian Institute of Family Studies Ethics Committee, and the study design and sample information are detailed elsewhere.[62] Briefly, a 2-stage cluster sample design was used in which approximately 10% of all Australian postcodes (stratified according to state of residence and urban vs rural) were selected, followed by the random selection of children proportional to population size from each postcode using Australia's universal health insurance (Medicare) database. Informed consent was obtained from each family when they were recruited into the LSAC study in 2004. This is the first study to examine pain data in this sample.

Retention rates remain high, with >80% of families continuing to participate in the study after 8 years.[16,62] Families were visited at the main waves of data collection every 2 years by an interviewer who conducted a parent interview, completed direct-child assessments and observational measures, and provided a self-report questionnaire to return via post. Teacher-report was collected during each of the main waves via a mail-out survey.

The current analysis draws on data from the kindergarten cohort (n = 4,983; 50.9% male) using parent and child report data from wave 4 (when children were aged 10–11 years; mean = 10.3 years, SD = .01), and wave 5 (when children were aged 12–13 years; mean = 12.4 years, SD = .01). These time points were the first waves at which data on 3 pain sites were available, and the 2 data waves were selected to capture the transition from late childhood to early adolescence.

Measures

Pain Problems

At 10 to 11 and 12 to 13 years, parents were asked to indicate whether their child had any of 3 ongoing conditions: recurrent abdominal pain, frequent headaches, or recurrent pains in other parts of the body. "Ongoing conditions" were defined as "conditions that exist for some period of time (weeks, months, or years) or reoccur regularly, and do not have to be diagnosed by a doctor." Parents indicated the frequency of occurrence for each condition from 5 response options: rarely, a few times a month, some days (1–3 times a week), most days (4–6 times a week), or daily, and rated severity as mild, moderate, or severe. The validity of these parent-reported items was supported by robust associations with the child's own response to a similar item (ie, "get a lot of headaches, stomachaches, or sickness") in the Strengths and Difficulties Questionnaire (SDQ).[27] For example, of the children reported by their parents to have recurrent headaches, 80% self-reported somatic complaints on the SDQ.

In defining pain problems, we focused on pain frequency rather than severity because this may be a more objective and reliable parent-report measure.[63] Children were categorized as experiencing pain problems if abdominal pain, headaches, and/or pains in other parts of the body were occurring at least weekly. We used this weekly cutoff to capture pain that was likely to be having an effect on child and family function. This approach was supported by significant associations between at least weekly pain symptoms and greater health service use (odds ratio [OR] = 4.16; 95% confidence interval [CI], 2.97–5.81) and school absenteeism (OR = 2.74; 95% CI, 2.00–3.74), which were consistent irrespective of pain location. Pain locations were combined in light

of research supporting the substantial overlap between somatic syndromes[69] and consistencies in baseline characteristics of children across different pain sites.[18]

Child Factors

Pubertal development. Parents rated their child's pubertal development with the Pubertal Development Scale (PDS).[54] Reponses were indicated on a 4-point Likert-type scale ranging from 1 (has not started) to 4 (seems complete) for growth in height, body hair, and skin changes. Additional sex-specific questions were asked about voice deepening, facial hair development, breast development, and the onset of menstruation. Puberty Category Scores were computed using Crockett's criteria (Crockett LJ: Pubertal Development Scale: Pubertal categories. 1988; unpublished) to classify children into the pre- (PDS = 3), early- (PDS = 4 or 5 and no 3-point responses or menarche), or mid to late stages of puberty (PDS ≥6 for boys and PDS ≥4 with or without menarche for girls).

Mental health. Mental health difficulties were assessed according to the total score on the child self-report SDQ. The item about somatic complaints was not included in the total score because of the conceptual overlap with the pain outcome measure. For this reason, a cutoff of ≥15, rather than 16,[27] was used to indicate elevated symptoms of internalizing and/or externalizing behavior problems compared with their same-age peers.

Sleep. Sleep deficiency was assessed using a single item in the audio computer-assisted self-interview instrument of the study ("During the past month, do you think you usually got enough sleep?"). The external validity of child self-reported sleep functioning in this age range is well supported in the literature.[5] Children who self-reported that they had 'not quite' or 'not nearly enough sleep' (vs 'plenty' or 'just enough') in the past month were classified as experiencing sleep deficiency.

Bullying. Children indicated yes or no to 4 questions in the audio computer-assisted self-interview instrument asking whether or not, in the previous 12 months, another child (or children) had picked on them by: 1) shoving, pushing, or hitting them; 2) calling them names or insulting them; 3) writing messages or notes; or 4) leaving them out of games or chats. Severe bullying was considered if children endorsed 3 or more types of bullying in light of data showing significantly poorer peer relations and emotional functioning in children endorsing ≥3 types of bullying compared with 1 or 2.[45]

Family Factors

Maternal mental health. Mother's mental health was assessed by self-report on the Kessler Scale, a widely used screening tool for the risk of serious mental illness.[37] The mother indicated on a Likert scale ranging from 0 'none of the time' to 5 'all of the time,' the frequency with which she experienced 6 symptoms of psychological distress in the past 4 weeks (eg, felt "so sad that nothing would cheer you up?"). Responses were summed to create a total score with a range from 0 to 24, with higher scores indicating greater maternal distress. In accordance with previously described cutoffs, maternal psychological distress was considered to be present if scores were in the moderate or high range (≥8).[20,31]

Mother's chronic pain. Presence of maternal chronic pain was assessed with a single yes or no question asking whether they experienced "chronic or recurring pain or discomfort causing restriction."

Hostile parenting style. Parenting hostility was assessed with 6 items. Questions were sourced from existing measures[52,65] and assessed as reliable indicators of these constructs.[70] Mothers indicated the frequency on a Likert scale that hostile (eg, losing temper, raising voice, or shouting) parenting behaviors were directed toward the study child. The summed items formed a total score ranging from 0 (low hostility) to 24 (high hostility), and the top quintile was categorized as hostile parenting.

Adverse life events. Mothers indicated exposure to adverse life events in the past 12 months from a list of 12 items (eg, moved house, marital breakdown). These were summed and dichotomized, such that high-stress family environments were considered to be those in which mothers indicated that they had experienced 2 or more stressful life events.[44]

Sociodemographic Factors

Mothers indicated whether they had completed year 12 of education or equivalent at wave 4. Single-parent households (lone mother households) were defined according to whether the child's mother was living alone or with a partner. Financial stress and hardship due to a shortage of money over the past 12 months was measured using 7 parent interview items (eg, "went without meals").[9] Parents who respond yes to at least 1 item (17.7% of the sample) were considered to have experienced financial hardship in the past year.

Statistical Analysis

Children were categorized into 2 groups on the basis of their pain symptom data at each time point: 1) no or infrequent pain, where pain symptoms were absent or occurred up to a few times a month, or 2) pain problems when 1 or more pain symptoms were occurring at least weekly.

Descriptive statistics were used to examine the prevalence and frequency of pain symptoms at both time points. Logistic regression using Stata version 13.0 (StataCorp LP, College Station, TX) was used to estimate the odds of pain problems in early adolescence (at 12–13 years) associated with each child, family, and sociodemographic factor in late childhood (at 10–11 years). Results are interpreted as the odds of pain problems associated with each predictor, compared with experiencing no or infrequent pain. Two models were estimated: model 1 shows the unadjusted association between each predictor at 10 to 11 years and pain problems at 12 to 13 years, and model 2 shows each association adjusted for all other predictors examined.

In each regression, complete case analysis was used to handle the very low rate of missing data on the predictor

variables (ranging from 0 to 3.2%), and survey methods weighting accounted for the probability of selecting each child in the study and nonresponse at 12 to 13 years.[16]

Results

Description of Study Sample

Data on pain symptoms were available for 4,161 children at 10 to 11 years (83.5% of 4,983 study children) and 91.8% of these children also had pain data at 12 to 13 years. Only children with pain data at both time points were included in the analyzed sample for this study (n = 3,821). The overall prevalence of children with any parent-reported pain symptoms in the study sample was 11.2% at 10 to 11 years and 11.9% at 12 to 13 years. Headaches were the most common type of pain complaint at 10 to 11 (6.1%) and 12 to 13 (6.6%) years of age (Table 1). When recurrent pains in the body were reported, the symptoms occurred more often than symptoms of headache or abdominal pain, at both time points. For example, at 12 to 13 years, 59.8% of parent-reported recurrent body pains were occurring at least weekly, compared with 39.7% of headaches and 39.1% of abdominal pains. The highest rates of severe pain were reported for headache sufferers at both time points. For example, at 12 to 13 years of age, 13.1% of those with headaches had severe symptoms compared with 8.3% of children with abdominal pain and 7.9% of children with other body pain. A small proportion of children (1.8%) reportedly had more than 1 type of pain, and these pain symptoms were more likely to be occurring frequently and rated 'severe' than pain symptoms of children with 1 pain type.

Pain symptoms occurred at least weekly for 5.2% (n = 199) of the total sample of children at 12 to 13 years (Table 2) and the incidence was similar at age 10 to 11 years (5.1%). Of the children with pain problems at 12 to 13 years, there were 80 (40.2%) who had a history of pain reported at 10 to 11 years (ie, recurring pain problems) although most did not report any pain symptoms in late childhood.

Predictors of Pain Problems in Early Adolescence

In unadjusted analyses (Table 2), several child- and family- but no sociodemographic-level factors examined at 10 to 11 years were significantly associated with an increased odds of pain problems at 12 to 13 years. The strongest predictor of pain problems in early adolescence was a history of pain symptoms experienced 1 to 3 or 4 to 7 times per week, which increased the odds of later pain by 8.6 (95% CI, 5.2–14.2) and 26.9 (95% CI, 14.5–49.8), respectively, compared with children with no pain at 10 to 11 years. Other significant child- and family-level predictors at 10 to 11 years included maternal chronic pain and 2 or more adverse life events in the past 12 months and child-reported mental health symptoms and sleep difficulties.

In the adjusted analyses accounting for all other predictors (Table 2), frequent pain at 10 to 11 years continued to be the strongest predictor and was associated with more than 17 times the odds of pain problems if pain occurred 4 to 7 times per week, compared with children with no pain (OR = 17.8; 95% CI, 8.68–36.5). In addition, sleep deficiency (OR = 1.86; 95% CI, 1.16–2.97) had a unique association with pain problems in early adolescence increasing odds of pain at 12 to 13 years almost twofold.

Discussion

This study used a biopsychosocial and ecological systems approach to understanding predictors of pain problems during the transition to adolescence within a nationally representative community-based cohort. Our data suggest that pain symptoms are fairly prevalent in late childhood and early adolescence, with approximately 11% of children reported by their parents to experience any pain, and headaches being the most common complaint. Direct comparison with other epidemiological research is difficult, because estimates vary widely and depend on how pain is assessed, the time period of reporting (ie, monthly, weekly, or daily), and age of the sample; however, the prevalence for pain in the current

Table 1. Pain Characteristics of the Study Sample at 10 to 11 and 12 to 13 Years

	Pain at 10 to 11 y				Pain at 12 to 13 y			
	Headache, n (%)	Abdominal, n (%)	Other Body, n (%)	Multiple Pains, n (%)	Headache, n (%)	Abdominal, n (%)	Other Body, n (%)	Multiple Pains, n (%)
Total (n = 3,821)	232 (6.1)	153 (4.0)	123 (3.2)	69 (1.8)	252 (6.6)	156 (4.1)	127 (3.3)	73 (1.9)
Frequency								
Rarely	18 (7.8)	28 (18.3)	23 (18.7)	2 (2.9)	32 (12.7)	30 (19.2)	16 (12.6)	1 (1.4)
A few times per mo	111 (47.8)	58 (37.9)	45 (36.6)	16 (23.2)	120 (47.6)	65 (41.7)	35 (27.6)	21 (28.8)
1 to 3 times per wk	79 (34.1)	55 (36.0)	36 (29.3)	36 (52.2)	84 (33.3)	43 (27.6)	46 (36.2)	35 (48.0)
4 to 6 times per wk	19 (8.2)	5 (3.3)	9 (7.3)	8 (11.6)	12 (4.8)	10 (6.4)	14 (11.0)	6 (8.2)
Daily	5 (2.2)	7 (4.6)	10 (8.1)	7 (10.1)	4 (1.6)	8 (5.1)	16 (12.6)	10 (13.7)
Severity								
Mild	113 (48.7)	107 (69.9)	76 (61.8)	29 (42.0)	127 (50.4)	88 (56.4)	76 (59.8)	22 (30.1)
Moderate	81 (34.9)	38 (24.8)	41 (33.3)	29 (42.0)	92 (36.5)	55 (35.3)	41 (32.3)	34 (46.6)
Severe	38 (16.4)	8 (5.2)	6 (4.9)	11 (15.9)	33 (13.1)	13 (8.3)	10 (7.9)	17 (23.3)

Table 2. Child, Family, and Sociodemographic Characteristics at 10 to 11 Years and Associations With Pain Problems at 12 to 13 Years

	Pain (at Least Weekly), 12 to 13 y		OR (95% CI)	
	No, n (%)	Yes, n (%)	Unadjusted	Adjusted
Total	3,622 (94.8)	199 (5.2)	-	-
Child				
Pain frequency 10 to 11 y				
No pain	3,273 (90.4)	119 (59.8)	Reference	Reference
Rare	56 (1.6)	3 (1.5)	1.03 (.29–3.70)	1.15 (.32–4.16)
Few times per mo	161 (4.4)	16 (8.0)	1.91 (.98–3.70)	1.68 (.79–3.55)
1 to 3 times per wk	106 (2.9)	39 (19.6)	8.59 (5.20–14.2)*	7.49 (4.32–13.0)*
4 to 7 times per wk	26 (.72)	22 (11.1)	26.9 (14.5–49.8)*	17.8 (8.68–36.5)*
Female	1,760 (48.6)	109 (54.8)	1.19 (.87–1.62)	1.52 (.99–2.33)
Pubertal stage				
Prepubertal	1,468 (42.9)	75 (40.5)	Reference	Reference
Early pubertal	827 (24.2)	46 (24.9)	1.02 (.62–1.68)	.87 (.51–1.48)
Mid- or postpubertal	1,130 (33.0)	64 (34.6)	.99 (.66–1.49)	.67 (.41–1.10)
At-risk child mental health	681 (19.2)	60 (31.3)	1.78 (1.21–2.61)*	1.35 (.78–2.33)
Sleep difficulties	637 (17.9)	66 (34.0)	2.09 (1.49–2.94)*	1.86 (1.16–2.97)*
Severe bullying (3 or more forms)	733 (20.6)	49 (25.3)	1.23 (.791.90)	.83 (.50–1.40)
Family				
Poor mental health of mother	395 (11.3)	32 (16.5)	1.39 (.88–2.22)	1.00 (.55–1.84)
Mother has chronic pain	133 (3.7)	21 (10.9)	2.65 (1.51–4.66)*	2.12 (.98–4.59)
Angry parenting	686 (19.5)	54 (27.8)	1.39 (.95–2.02)	1.01 (.63–1.61)
2 or more adverse life events	2,189 (61.0)	137 (69.2)	1.51 (1.04–2.18)†	1.11 (.72–1.69)
Sociodemographic				
Mother did not finish year 12 of school	1,308 (36.6)	81 (41.5)	1.18 (.83–1.66)	.96 (.65–1.40)
Financial hardship	578 (16.2)	51 (26.0)	1.48 (.98–2.23)	1.17 (.69–2.00)
Single-parent household	535 (14.8)	36 (18.1)	1.31 (.82–2.08)	.79 (.46–1.36)

*$P < .01$.
†$P < .05$.

sample conservatively falls within the lower end of the expected range on the basis of past studies of persistent and recurrent pain symptoms in childhood and early adolescence.[38]

Pain symptoms occurred at least weekly for 5.2% of children at 12 to 13 years, and for the purposes of this study, these children were regarded as having pain problems. The rate of pain symptoms being reported at both time points was similar to that reported in a population-based cohort of children 0 to 18 years of age followed for 2 years, whereby chronic benign pain persisted in 30% to 45% of the study population.[53] The strongest predictor of pain problems at 12 to 13 years was the experience of at least weekly pain in late childhood. In our fully adjusted model, children who had pain occurring 1 to 3 times or 4 to 7 times per week had an odds of pain in early adolescence that was 8 or 26 times greater, respectively, than children with no pain at 10 to 11 years. In contrast, pain symptoms that were occurring a few times a month or less often were not associated with later pain problems, suggesting that they represented more benign pains. These findings suggest that pain occurring at least weekly may be a useful marker in late childhood to identify children at greatest risk of recurring pain problems and thus who would benefit most from intervention. Findings also reinforce the importance of early identification and intervention efforts to prevent the persistence of pain problems into adolescence.

Sleep deficiency, assessed in this study as limitations in the quantity of sleep, also emerged as a significant predictor of pain symptoms. Sleep deficiency at 10 to 11 years was associated with a 2 times greater odds of pain problems in early adolescence, even when accounting for other covariates. Sleep disturbance is common in children and adolescents with persistent or recurrent pain.[51] Early models described a bidirectional relationship between pain and sleep,[43] where uncontrolled pain can cause sleep disruptions, and in turn, disturbed sleep can enhance pain sensitivity.[60] Recent research has shown that more studies now support the direction of sleep affecting pain rather than vice versa. That is, sleep disruption has now been shown to lead to subsequent increased pain in multiple samples across childhood and adulthood.[22] In line with this research, the current findings also suggest that sleep deficiency may precede pain problems, and thus could be used to identify children at greater risk for developing persistent or recurrent pain problems during the transition to adolescence. Other prospective population-based research suggests that irregular sleep in infancy predates early childhood abdominal pain[55] and that insufficient sleep in mid adolescence is an independent risk factor for neck and back pain 2 years later.[1]

Although data clearly indicate an association between sleep deficiency and pain, the specific mechanisms accounting for this relationship are as yet unknown and likely multifactorial. Insufficient sleep quantity may increase the risk for later pain through behavioral and cognitive factors (eg, ability to implement adaptive coping responses, anxiety symptoms) and neurobiological systems (eg, pain sensitivity).[22] Studies are emerging to evaluate the effects of cognitive-behavioral treatment for insomnia in adults with chronic pain reporting benefit for improving insomnia symptoms,[8] pain, and functional outcomes.[15,19,36,61,66] Future research is also needed to evaluate treatments for sleep deficiency in pediatric pain populations.

A number of additional factors were significantly associated with pain symptoms in the unadjusted models, but were no longer significant when covariates were accounted for. In unadjusted analyses, children of mothers who had chronic pain had a twofold increase in odds of experiencing pain problems in early adolescence compared with children without a maternal history of chronic pain, consistent with previous findings.[29,32,63] Similarly, the presence of adverse life events was associated with pain symptoms, which is consistent with past research in pediatric abdominal pain.[6,63] However, when included in the model with the child's own pain history and sleep difficulties, neither maternal chronic pain nor adverse life events made unique contributions to the prediction of later pain problems. This highlights the complex interrelationships among the study variables, and likely mediating and moderating effects that need to be explored in future research. It could be, for example, that in early childhood, mothers with chronic pain model and reinforce pain behaviors within the parent-child dyad,[4] such that by late childhood the effect of maternal pain is mediated through the child's own pain history and behaviors. Future longitudinal studies are needed to unravel the pathways by which sociodemographic and family variables may interact with child variables to influence pain.

The strength of our study lies in the large sample size, good retention rates, multi-informant approach, multivariate models, and longitudinal study design. Our assessment of a broad range of child, family, and sociodemographic factors allowed for testing multiple risk factors associated with pain problems in an effort to identify potential targets for intervention to prevent pain becoming chronic and debilitating in adolescence. We minimized possible reporting bias associated with mother's psychological distress by using child-report for bullying, emotional functioning, and sleep difficulties. The population-based sample and inclusion of multiple pain conditions enables the outcomes to be more readily generalized to the wider population than studies of children in clinical settings with severe pain-related functional disability. Combining pain symptoms provides a clearer representation of the true population burden of pediatric pain than focusing on individual pain types.

Nevertheless, there are some limitations that should be considered when interpreting our findings. The measures of psychosocial factors were necessarily brief because they were embedded within the LSAC questionnaire that covers many domains of child development. Similar to other epidemiological studies,[38] we did not use clinical examination to assess pain and exclude organic disease. However, we adopted a stringent threshold for defining pain problems that would likely capture more functional and impairing pains that may predispose children to later chronic pain conditions, while excluding the more common types of pain (eg, menstruation pain) and injury-specific pains (eg, a sprained ankle) experienced in childhood. If designing pain items de novo, we would have included child self-reported pain and assessed the functional effect of the pain symptoms, which will be important to consider in future research. Although the clinical relevance of the parent-reported pain symptoms in the current study may be questioned, the validity of the LSAC pain items received support from strong associations with a somatic symptom item on the child self-report SDQ and robust associations with greater school absenteeism and health service. Furthermore, parental report of child somatic symptoms is used in other nonclinical samples.[30]

Findings from this study highlight the need for early intervention to reduce a child's experience of pain before the symptoms become more frequent and a recurring problem across childhood. By late childhood, headaches, abdominal pain, and/or other body pains that are occurring weekly are a potent risk factor for pain problems during the transition to adolescence. Therefore, screening children for pain and offering intervention to target pain symptoms emerging earlier in childhood may be needed to reduce the frequency and effect of pain symptoms in later childhood and adolescence.

This study suggests that assessing and treating sleep problems in late childhood may reduce the risk of pain problems in the transition to adolescence. Health care providers could consider conducting routine sleep screenings, particularly for children who present with other risk factors for persistent pain such as a maternal history of chronic pain or recent exposure to adverse life events. Late childhood is an opportune time for educating parents and children about adequate sleep hygiene in preparation for adolescence when social pressures, after-school activities, increased internet and mobile phone use have the potential to reduce the quality and quantity of sleep and increase the risk for persistent and recurrent pain.

Future research would benefit from examining additional assessment points over time, to tease out the complex interrelationships and possible shared pathophysiologic or behavioral factors underlying the predictor variables. Extending informants to include fathers could also strengthen the study in light of previous research showing prospective relationships between father's mental health in the first year of a child's life and pain onset at age 6 years.[55] The relation between pain and other sociodemographic factors, such as ethnicity or parental country of birth,[38] warrants further examination. Intervention studies are needed to test causal relationships, for example, to determine whether improving

sleep can prevent the emergence of pain problems in the transition to adolescence.

Conclusions

To our knowledge, this is one of the first studies to focus on the associations between a broad range of child, family, and sociodemographic factors and pain problems in the transition from late childhood to adolescence. The results are consistent with the prevailing understanding of pediatric persistent pain from a biopsychosocial perspective. Late childhood may represent a critical developmental window for prevention of emergent pain symptoms by improving sleep before the steep rise in chronic pain in adolescence.[64] Our findings highlight the need for early intervention for persistent pain, because pain symptoms in late childhood tend to persist into early adolescence.

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