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# Chronic Pain and High Impact Chronic Pain in Children and Adolescents: A Cross-Sectional Study

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**Abstract:** **The aims of this study were to: 1) estimate the prevalence of chronic pain (CP) and high impact chronic pain (HICP) in a community sample of children and adolescents; and 2) compare groups (those without CP, those with CP but no HICP, and those with HICP) with respect to demographic variables, pain variables, and physical, psychological, and school-related function. One thousand one hundred and fifteen children and adolescents participated (56% girls; age: $\bar{x}$ = 11.67; SD = 2.47; range = 8–18 years). The prevalence of CP and HICP was 46% and 5%, respectively, and was higher in girls and increased with age. Participants with HICP reported greater pain intensity and higher pain frequency than those with CP but no HICP. In addition, participants with HICP reported lower mobility, greater fatigue, worst sleep quality, more anxiety and depression symptoms, worst cognitive function, missing more school days, and worse perceived school performance. HICP is a prevalent condition in children and adolescents and is associated with many negative consequences. Stakeholders must be aware of this and ensure that treatment programs are available to reduce the individual and societal impact of HICP in young individuals.**

***Perspective:*** ***This article provides information on CP and HICP prevalence and impact in children and adolescents. By better understanding the nature and score of these conditions, we will be able to develop more effective early interventions to help this population and thereby reduce their long-term negative impact.***



***Key words:*** *High impact chronic pain, adolescents, epidemiology, sex, prevalence.*

Chronic pain (ie, pain lasting 3 or more months[39,48]; is a common problem among children and adolescents,[19] with negative consequences to the individual,[15,23,24] the family,[49] and society.[13] Recent studies have noted the rise in the prevalence of chronic pain over the past few decades. For example, Roy and colleagues[41] reported an overall increase of 3% from 2001 to 2014 in the prevalence of chronic back pain among adolescents, using data from the Health Behavior in School-Aged Children study.[4]

Epidemiology research is key to understanding chronic pain.[3] Understanding its prevalence in different age groups helps to better appreciate developmental trajectories,[18] and epidemiological research identifying the determinants of chronic pain can inform the development of more effective interventions and improve management.[25] A number of studies have identified factors that are associated with chronic pain in children,

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including demographic (eg, female sex[17];), physical (eg, pain extension[12];), psychosocial (eg, anxiety[20,21];), and school-related factors (eg, school performance[20]).

Most epidemiology studies, however, report findings as if the population of children with chronic pain was homogenous. However, this is a heterogeneous group, and individual differences may explain the extent and impact of chronic pain.[12,28] For example, treatment outcomes have been shown to be associated to individual differences.[53] In addition, prior studies have mostly defined chronic pain by its duration only (eg, as being present for more than 3 months; cf.[15]) or used a combination of duration and frequency (eg,[12]). However, chronic pain does not affect individuals equally, and these definitions of "chronic pain" do not take into consideration its impact.[37]

The concept of high impact chronic pain (HICP) has been proposed to better identify individuals with significant levels of life interference due to chronic pain.[8] Moreover, individuals with HICP account for the largest share of the economic costs of chronic pain.[55] There has been a call to study HICP in specific populations, including children.[55] However, to the best of our knowledge, no study has yet examined the prevalence and correlates of HICP in children and adolescents. Determining the prevalence of chronic pain in general and HICP in particular in children and adolescents can help define the special needs of these populations, and therefore inform decisions regarding resource allocation. In addition, most epidemiology studies with youth are conducted with adolescents. Research that includes younger children is also needed to apply a lifespan developmental perspective to the study and treatment of young individuals with chronic pain.[57]

Given these considerations, the objectives of the current research were to: 1) estimate the prevalence of chronic pain and HICP in a community sample of both younger children and adolescents; and 2) compare the subsamples within the study – specifically participants who do not have chronic pain, those who have chronic pain that is not high impact (No HICP), and who have HICP – with respect to demographic, pain, and physical, psychological, and school-related function variables. Based on the prior studies conducted with adult samples,[37] we hypothesized that: 1) participants with No HICP would report worse functioning in all domains compared to participants who do not have CP, and 2) participants with HICP would report worse function in all domains compared to participants who have chronic pain that is not high impact.

# Methods

## Procedure

This is a cross-sectional analysis of data from the EPIDOL Project (which is a longitudinal epidemiological study of pain in children and adolescents conducted in the South East of Catalonia, Spain). Data for this study were collected before the lockdown due to COVID-19. The ethics committee of the Universitat Rovira i Virgili approved the study (*Institut d'Investigació Sanitària Pere Virgili; ref.: 136/2018)*. Current analysis, reported in this article, used baseline data from the EPIDOL project only.

Eleven schools were approached to participate; one did not accept the invitation, reporting that the staff did not have the time to participate. Schools were randomly selected from all (nonspecial) schools in the region. Study data were collected from children and adolescents attending 4 primary schools, 3 secondary schools, and 3 schools which both education levels in Reus, Catalonia (Spain).

Following the acceptance of study participation by the school boards, all parents of children aged from 8 to 18 attending these schools (N = 3,167) were mailed a letter describing the project and asking them to provide consent for their children to participate. Thirty-six percent of these parents agreed (N = 1,142), and 35 percent of the children (N = 1115) provided data and were included in the analyses for this study. The children of these parents were then asked to respond to a paper-and-pencil survey during the school day, following instructions provided by research staff. Of the total school children included in the study, 12% (N = 136) did not finish the questionnaire or skipped questions.

In order to participate, both the students and their parents had to provide their assent and consent, respectively. Participating students received a gym sack and a calendar for their participation (approximate value = €3 each). In an effort to enroll as many interested participants as possible, we scheduled additional assessment sessions for those that were absent at the first time of data collection.

## Measures

### Demographic Information

The children who participated were asked to provide information regarding their sex, age, and school grade.

## Pain Characteristics: Pain Location, Pain Extent, Frequency, and Intensity

The participants were asked to provide information about the characteristics of any significant pain problem(s) they had experienced in the last 3 months, including the pain(s)' location(s), frequency, and intensity. We used a pain site checklist to assess *pain location*. It included 11 specific locations (ie, head, neck, chest, shoulders, back, arms, hands, bottom/hips, belly/pelvis, legs, and feet) and an "other" category. This pain site checklist has been used in previous studies.[6,26,27] *Pain extent* was computed by summing all of the locations with pain (possible range, 0–12). *Pain frequency* for each pain problem was assessed using a 5-point Likert scale (1 = "Every day," 2 = "More than once a week," 3 = "Once a week," 4 = "Once or twice times per month," 5 = "Once in the last 3 months"). Finally, children reported the usual (average) *pain intensity* in the

last 7 days for each pain location, using a 0 to 10 Numerical Rating Scale (NRS-11) where 0 = "No pain" and 10 = "Very much pain." The NRS-11 has been shown to provide reliable and valid scores when used with children as young as 6 years old.[1]

On the basis of current definitions[39] and previous epidemiology studies,[17,20,42,56,60] we defined chronic pain as a pain that has lasted for at least 3 months and that was present at least once a week during this 3-month period. Using this definition in the current study allowed us to be able to compare the results with other highly cited studies (eg,[20]). For descriptive purposes, one primary pain location was chosen for each participant with chronic pain for purposes of describing pain frequency and intensity. For those participants with pain in only one site, their chronic pain location was defined as the pain problem at this site. For those reporting chronic pain at more than one site, the primary pain location was defined as that location associated with the highest reported average pain intensity. Following Wager and colleagues' procedures,[56] when participants reported the same pain intensity at more than one site (n = 46 in the current study), or participants neglected to rate pain intensity at all of the pain sites indicated (n = 68 in the current study), the participant's primary pain location was defined as that location they indicated which had the highest prevalence in the sample as a whole (ie, based on the following order list of pain locations: headache, back pain, leg pain, feet pain, belly/pelvis pain, neck pain, shoulder pain, arm pain, "other" pain, chest pain, hand pain and abdominal pain and bottom/hips, respectively; for example, if a participant rated leg pain and chest pain as having the same pain intensity, that participant's primary pain was defined as being leg pain, because leg pain is more common than chest pain in the sample as a whole).

## Pain-Related Interference

We used the Spanish version of the 8-item Pediatric Patient-Reported Outcomes Measurement Information System (PROMIS) Pain Interference scale v2.0 (PROMIS-PI[51];) to assess pain interference. With the PROMIS-PI, respondents are asked to rate how often pain has interfered with 4 activities during the last 7 days using a 5-point Likert scale (1= "Never," 2="Almost never," 3="Sometimes," 4="Often," and 5="Almost always"). Sample items include "It was hard for me to walk one block I had pain" and "It was hard for me to pay attention when I had pain." In order to obtain pain interference scores, the participants' ratings for each item were summed and this total sum was transformed to a T-score. Higher scores reflect higher pain interference. The pediatric form of the PROMIS-PI has been shown to provide valid and reliable data of pain interference in children and adolescents.[50] In this sample, the Cronbach's alpha was good ($\alpha$ = .86).

Based on the participants' reports of having chronic pain or not, as well as their level of pain interference for those who did have chronic pain, we classified the sample into 3 groups: 1) those without chronic pain (No CP); 2) those with chronic pain but not with HICP (No HICP); and (3) those with HICP. The definition of HICP that was used in this study is based on the one published by von Korff and colleagues, which defines HICP as pain limiting life or work activities most or every day in the previous 3 months.[54] The labels given to PROMIS Pain Interference Scale score ranges are as follows: 0 to 49.9 = "pain interference within normal limits"; 50 to 54.9 = "mild pain interference"; 55 to 64.9 = "moderate pain interference"; and 65 to 100 = "severe pain interference".[32] In this study, participants were classified as having HICP if they had both CP and a PROMIS Pain Interference Scale T-score $\geq$ 65 (ie, $\geq$1.5 SD units). Those with CP with PROMIS-PI scales <65 were classified as being into the No HICP group. Those without CP were put into the No CP group.

## Physical Function

Participants were asked to respond to measures assessing mobility, fatigue, and sleep quality. We used the Spanish version of the 4-item physical function-mobility from the Pediatric-25 Profile Form v.2 (PROMIS-PF-M[50,9];) to assess mobility. With this scale, respondents are asked to indicate how able they were to perform 4 activities during the last 7 days using a 5-point Likert scale (1 = "Not able to do," 2 = "With a lot of trouble," 3 = "With some trouble," 4 = "With a little trouble," and 5 = "With no trouble"). Sample items include "I could do sports and exercise that other kids my age could do" and "I could walk up stairs without holding on to anything." Responses were summed and transformed to T-scores. Higher scores reflect being better able to be mobile. Evidence supports the reliability and validity of the pediatric form of the PROMIS-PF-M in children and adolescents.[50] In the current sample, the Cronbach's alpha was acceptable ($\alpha$ = .79).

We used the Spanish version of the 4-item fatigue short form from the PROMIS Pediatric-25 Profile Form v.2 (PROMIS-F[50];) to assess fatigue. With the PROMIS-F, respondents are asked to rate how often they experience each fatigue response in the last 7 days using a 5-point Likert scale (1 = "Never," 2 = "Almost never," 3 = "Sometimes," 4 = "Often," and 5 = "Almost always"). Sample items include "Being tired made it hard for me to keep up with my schoolwork" and "I was too tired to enjoy the things I like to do." In order to obtain fatigue scores, responses were summed and transformed to T-scores. Higher scores in the PROMIS-F reflect greater fatigue. Previous research supports the reliability and validity of the PROMIS-F items provide for assessing fatigue in children and adolescents.[38] In this sample, the Cronbach's alpha was borderline acceptable ($\alpha$ = .68).

We used the Spanish version of 5 sleep disturbance items of the item Bank v1.0 of the PROMIS[38]) to assess sleep quality. The PROMIS Sleep Disturbance scale (PROMIS-SD) contains items that assess a variety of sleep quality indicators, and scores from this scale have been shown to provide valid and reliable information about sleep quality when used with young individuals.[11,14]

With this scale, respondents are asked to indicate the frequency with which they experienced each sleep problem indicator during the last 7 days using a 5-point Likert scale (1 = "Never," 2 = "Almost never," 3 = "Sometimes," 4 = "Often," and 5 = "Almost always"). Sample items include "My sleep was refreshing" and "I had a problem with my sleep." In order to obtain sleep disturbance scores, responses were summed and transformed to T-scores. Higher scores in the PROMIS-SD reflect greater sleep disturbance. The internal consistency of the measure in the current sample was good ($\alpha$ = .80).

### Psychological Function

Participants were asked to respond to measures of cognitive function, anxiety, and depressive symptoms. We used the Spanish version of the 7-item PROMIS pediatric cognitive function short form v1.0 (PROMIS-CF[9,50];) to assess cognitive function. With this scale, respondents are asked to indicate how often they had experienced problems with 7 different cognitive function domains during the last 4 weeks using a 5-point Likert scale (1 = "All the time," 2 = "Most of the time," 3 = "Some of the time," 4 = "A little of the time," and 5 = "None of the time"). Sample items include "I have to read things several times to understand them" and "I have trouble keeping track of what I am doing if I get interrupted." In order to obtain cognitive function scores, the participants' responses were summed and transformed to T-scores. Higher scores reflect better cognitive function. Research supports the reliability and validity of the scores of the pediatric form of the PROMIS-CF.[50] In this sample, the Cronbach's alpha was good ($\alpha$ = .83).

Anxiety was assessed using the Spanish version of the anxiety subscale of the PROMIS Pediatric-25 Profile Form v2.0.[50] With the PROMIS-A, respondents are asked to rate the frequency with which they experienced 4 anxiety symptoms in the last 7 days using a 5-point Likert scale (1 = "Never," 2 = "Almost never," 3 = "Sometimes," 4 = "Often," and 5 = "Almost always"). Sample items include "I felt something awful might happen" and "I felt nervous." Responses to the PROMIS-A items were summed and transformed to T-scores. Higher scores reflect more frequent anxiety symptoms. The Pediatric-25 Profile Form scales have been shown to be able to report reliable and valid scores of anxiety symptoms.[38] In this sample, the Cronbach's alpha indicated good internal consistency ($\alpha$ = .85).

Depressive symptom severity was assessed using the Spanish version of the Depressive Symptoms subscale of the PROMIS Pediatric-25 Profile Form v2.0 (PROMIS-DS[50];). With this measure, respondents are asked to rate the frequency with which they experienced 4 depressive symptoms in the last 7 days using a 5-point Likert scale (1 = "Never," 2 = "Almost never," 3 = "Sometimes," 4 = "Often," and 5 = "Almost always"). Sample items include "I felt everything in my life went wrong" and "It was hard for me to have fun." In order to obtain PROMIS-DS scores, the participants' responses were summed and transformed to T-scores. Higher scores reflect greater depressive symptoms. The Pediatric-25 Profile Form scales have been shown to be able to report reliable and valid scores depressive symptoms.[38] In this sample, the Cronbach's alpha for the PROMIS-DS was good ($\alpha$ = .83).

### School Function

Participants were asked to respond to 2 different and independent questions related to 1) the number of missed days due to pain in the previous 3 months, and 2) perceived school performance relative to other classmates. In response to the question about the number of missed days due to pain, participants were asked to report: 1) the total number of full/complete days missed, and 2) total number of partial/non-complete days missed in the past 3 months. The sum of both scores was the score used in the analysis. In relation to *perceived school performance*, participants were asked to respond to the following question "Compared to the majority of your classmates, what is your academic performance like?" using a 5-point Likert scale (1 = "Much worse," 2 = "Worse," 3 = "Equal," 4 = "Better," and 5 = "Much better"). The responses to each question were examined separately in the data analyses.

## *Data Analyses*

We first computed percentages, means, and standard deviations of the sociodemographic and study variables to describe the sample. Chi-Square tests and t-tests were conducted to compare sex and age differences on pain locations respectively for the whole sample. Next, we computed the number and rates of individuals in each of the 3 study groups (No CP, No HICP, and HICP) in the sample. We then compared the three study groups (ie, No CP, No HICP, and HICP) with respect to demographic and physical-, psychological-, social-, and school-related characteristics. For continuous variables (ie, age, physical function-mobility, fatigue, sleep disturbance, cognitive function, anxiety, depression, and pain-related school absence), we used Univariate Analyses of Variance (ANOVA); for nominal variables (ie, sex), we used Chi-Square tests; and for ordinal variables (ie, perceived school performance), we used Kruskal-Wallis tests. Bonferroni-adjusted post hoc tests were conducted to identify differences between the study groups. We then compared the CP and the HICP groups with respect to pain-related characteristics. For continuous variables (ie, pain intensity and pain extension), we used univariate t-tests; for nominal variables (ie, pain location), we used Chi-Square tests; and for ordinal variables (ie, pain frequency), we used Kruskal-Wallis tests. Pairwise deletion was used to handle missing values.

Effect sizes were reported using the *Cramér's V* (interpretation depending on degrees of freedom according to Cohen)[2] for the Chi-Square tests; the partial $\eta^2$ (Cohen, 1988) for ANOVAs (small effect: $\eta^2_p$ = 0.01, medium effect: $\eta^2_p$ = 0.06; large effect: $\eta^2_p$ = 0.14); the $\varepsilon^2$ (small effect: $\varepsilon^2$ = 0.01, medium effect: $\varepsilon^2$ = 0.06; large effect: $\varepsilon^2$ = 0.14) [47] for the Kruskal-Wallis tests; and the

Cohen's *d* (small effect: *d* = 0.2; medium effect: *d* = 0.6; large effect: *d* = 0.8)[2] for univariate t-tests. A 2-tailed significance level of $P < .05$ was defined as statistically significant. Data analyses were conducted using SPSS version 28.01 (IBM, Armonk, NY, USA), and STATA 14 (Stata Corp., Texas, USA).

# Results

## *Sample Characteristics*

Table 1 provides a summary of the characteristics of the participants. The sample included a higher number of girls (n = 630; 56%) than boys (n = 485; 44%). The mean age of the participants was 11.67 years (SD = 2.47; range = 8–18). This sample was a healthy sample for the most part (only 27% reported having an illness in the previous 3 months).

Most of the participants (89%; see Table 2) reported having experienced pain in the past three months of responding to the survey, and 57% of these reported that they missed school due to pain problems (mean number of full days missed = 3.54, SD = 3.57; mean number of partial days missed = 2.52, SD = 2.56). Also, a substantial subset of participants reported having

**Table 1. Descriptive Statistics for Demographic, Physical, Psychosocial, and School-Related Characteristics of Participating Children and Adolescents (n = 1,115)**

| *Variable (Range* | *N* | *%* | *Mean* | *SD* |
|---|---|---|---|---|
| Sex | | | | |
| Female | 630 | 56 | | |
| Male | 485 | 44 | | |
| Age* (8–18) | 1,114 | | 11.67 | 2.47 |
| Physical function | | | | |
| Mobility† (20–80) | 1,076 | | 48.49 | 9.04 |
| Fatigue‡ (20–80) | 1,071 | | 49.88 | 10.93 |
| Sleep quality§ (20–80) | 1,065 | | 49.64 | 9.45 |
| Psychological function | | | | |
| Cognitive function# (20–80) | 1,057 | | 48.75 | 7.59 |
| Anxiety‡ (20–80) | 1,071 | | 52.49 | 11.46 |
| Depression‖ (20–80) | 1,075 | | 51.02 | 10.79 |
| Perceived School performance‡‡ | | | | |
| Much worse | 29 | 3 | | |
| Worse | 102 | 9 | | |
| Equal | 471 | 42 | | |
| Better | 326 | 29 | | |
| Much better | 122 | 11 | | |

Note: Range for age is actual range in the sample, whereas Ranges for the measures represent possible ranges for each variable. Pain intensity reports average pain intensity. The numbers in "n" vary among variables due to the number of missing information in each case
*n = 1,114 (missing = 1).
†n = 1,076 (missing = 39).
‡n = 1,071 (missing = 44).
§n = 1,065 (missing = 50).
#n = 1,057 (missing = 58).
‖n = 1,075 (missing = 40).
¶n = 853 (missing = 136).
**n = 882 (missing = 107).
††n = 881 (missing = 108).
‡‡n = 1,050 (missing = 65).

**Table 2. Descriptive Statistics for Pain-Related Characteristics of Participating Children and Adolescents (n = 1,115)**

| *Variable (Range)* | *N* | *%* | *Mean* | *SD* |
|---|---|---|---|---|
| Pain prevalence | | | | |
| Pain in the past 3 months* | 989 | 89 | | |
| Pain location | | | | |
| Head | 593 | 53 | | |
| Neck | 288 | 26 | | |
| Chest | 141 | 13 | | |
| Shoulders | 186 | 17 | | |
| Back | 358 | 32 | | |
| Arms | 169 | 15 | | |
| Hands | 151 | 14 | | |
| Bottom/Hips | 87 | 8 | | |
| Belly/Pelvis | 402 | 36 | | |
| Legs | 358 | 32 | | |
| Feet | 295 | 26 | | |
| Other | 102 | 9 | | |
| Pain extent (0–12) | | | 2.80 | 2.24 |
| 0 | 126 | 11 | | |
| 1 | 225 | 20 | | |
| 2 | 257 | 23 | | |
| 3 | 167 | 15 | | |
| ≥4 | 340 | 30 | | |
| Chronic pain (≥weekly pain for ≥3 months) | 510 | 46 | | |
| Chronic pain location | | | | |
| Head‡ | 201 | 18 | | |
| Neck§ | 102 | 9 | | |
| Chest# | 43 | 4 | | |
| Shoulders‖ | 83 | 7 | | |
| Back¶ | 180 | 16 | | |
| Arms# | 48 | 4 | | |
| Hands** | 42 | 4 | | |
| Bottom/hips# | 23 | 2 | | |
| Belly/Pelvis†† | 106 | 10 | | |
| Legs‡‡ | 122 | 11 | | |
| Feet§§ | 113 | 10 | | |
| Other## | 46 | 4 | | |
| Chronic pain extent (0-12) | | | 1.03 | 1.49 |
| 0† | 605 | 54 | | |
| 1 | 221 | 20 | | |
| 2 | 129 | 12 | | |
| 3 | 82 | 7 | | |
| ≥4 | 78 | 7 | | |
| Pain-related school absence‖‖ (n = 989) | | | | |
| No absence | 288 | 29 | | |
| Absence | 565 | 57 | | |
| Full days¶¶ | 464 | 47 | 3.54 | 3.57 |
| Partial days*** | 426 | 43 | 2.51 | 2.56 |
| Chronic pain characteristics (n = 510) | | | | |
| Most intense chronic pain location | | | | |
| Head | 132 | 26 | | |
| Neck | 22 | 4 | | |
| Chest | 14 | 3 | | |
| Shoulders | 23 | 5 | | |
| Back | 90 | 18 | | |
| Arms | 14 | 3 | | |
| Hands | 7 | 1 | | |
| Bottom/hips | 3 | 1 | | |
| Belly/Pelvis | 59 | 12 | | |
| Legs | 65 | 13 | | |

(*continued on next page*)

**Table 2. Continued**

| *Variable (Range)* | *N* | *%* | *Mean* | *SD* |
|---|---|---|---|---|
| Feet | 56 | 11 | | |
| Other | 25 | 5 | | |
| Pain frequency | | | | |
| Once a week | 130 | 25 | | |
| More than once a week | 233 | 46 | | |
| Every day | 147 | 29 | | |
| Pain intensity-Average in the past 7 days††† (0-10) | 442 | | 6.06 | 2.37 |
| Pain interference‡‡‡ (20-80) | 483 | | 53.58 | 9.04 |

*Forty-seven participants reported pain but did not report the frequency and/or duration, thus could not be determined if the pain was or not chronic.
†Includes the 47 participants that reported pain in the previous 3 months but did not provide additional information to classify the pain as chronic. The numbers in "n" vary among variables due to the number of missing information in each case.
‡n = 1,094 (missing = 21).
§n = 1,100 (missing = 15).
#n = 1,109 (missing = 6).
‖n = 1,108 (missing = 7).
¶n = 1,098 (missing = 17).
**n = 1,003 (missing = 12).
††n = 1,095 (missing = 20).
‡‡n = 1,099 (missing = 16).
§§n = 1,096 (missing = 19).
##n = 1,110 (missing = 5).
‖‖n = 853 (missing = 136).
¶¶n = 882 (missing = 107).
***n = 881 (missing = 108).
†††n = 442 (missing = 68).
‡‡‡n = 483 (missing = 27).

experienced pain (any type of pain, including chronic pain) in the past 3 months at more than one site (n = 764; 68%). The most frequent locations were the head (53%), the belly/pelvis (36%), the back and legs with the same percentage (32%); less common pain locations were the chest (13%) and the bottom/hips (8%). Girls reported pain in the head, neck, chest, back, bottom/hips, and belly/pelvis more frequently than boys. Boys reported pain in the legs more frequently than girls (see Supplementary Table 1).

The analyses indicated that there were age differences with respect to pain locations, such that participants who reported pain in the head, neck, chest, shoulders, back, arms, hands, bottom/hips, belly/pelvis, legs, and feet were significantly older than those that did not report pain in those locations (see Supplementary Table 2). The sample had fewer children (n = 247; 22%) than adolescents (n = 868; 78%; the World Health Organization defines adolescence as the phase of life that goes from 10 to 19 years old, see https://www.who.int/health-topics/adolescent-health#tab=tab_1). Sixty-four percent of children (n = 159) did not report chronic pain, 19% (n = 48) reported no HICP, and 3% (n = 7) reported HICP. With respect to the adolescent subsample, 46% (n = 399) did not report chronic pain, 44% (n = 383) reported no HICP, and 5% (n = 45) reported HICP. Given the very small sample size of children with HICP (n = 7) compared to the sample size of adolescents with HICP (n = 45), we compared the prevalence of chronic pain status (ie, No CP, No HICP, and HICP) in the sample as a whole, collapsed across age group.

## *Prevalence of Chronic Pain*

Regardless of the impact, the prevalence of chronic pain (ie, pain that lasted for at least three months and was present at least once a week) in any location was

**Table 3. Pain-related Characteristics of Participants in the High Impact Chronic Pain (HICP) Group Compared With Participants in the Chronic Pain that is not High Impact (No HICP)Group**

| | *No HICP (N = 431)* | | | *HICP (N = 52)* | | | | |
|---|---|---|---|---|---|---|---|---|
| *CP Characteristics* | *N* | *% Within Subsample* | *M (SD)* | *N* | *% Within Subsample* | *M (SD)* | *CP vs HICP* | *P (Effect Size)* |
| Most intense chronic pain location | 431 | | | 52 | | | $X^2_{(11)} = 9.93$ | .536 (0.14) |
| Head | | 26 | | | 31 | | | |
| Neck | | 4 | | | 4 | | | |
| Chest | | 2 | | | 8 | | | |
| Shoulders | | 4 | | | 6 | | | |
| Back | | 18 | | | 15 | | | |
| Arms | | 3 | | | 0 | | | |
| Hands | | 2 | | | 0 | | | |
| Bottom/hips | | 1 | | | 0 | | | |
| Belly/Pelvis | | 11 | | | 12 | | | |
| Legs | | 13 | | | 10 | | | |
| Feet | | 11 | | | 13 | | | |
| Other | | 5 | | | 2 | | | |
| Pain extent | 431 | | 2.12 (1.44) | 52 | | 2.52 (1.70) | $t_{(481)} = -1.82$ | .069 (-0.26) |
| Pain Frequency | 431 | | | 52 | | | $X^2_{(1)} = 10.59$ | .001 (0.02) |
| Once a week | | 27 | | | 10 | | | |
| More than once a week | | 46 | | | 46 | | | |
| Every day | | 27 | | | 44 | | | |
| Pain Intensity | 366* | | 5.82 (2.35) | 49† | | 7.39 (2.08) | $t_{(413)} = -4.43$ | <.001 (-0.67) |

Note: The numbers in "n" vary among variables due to the number of missing information in each case
*n = 366 (missing = 65).
†n = 46 (missing = 6).

high (n = 510; 46%). The head was the most common location, experienced by 18% of the sample, followed by the back (16%) and the legs (11%), whereas the arms (4%), chest (4%), hands (4%), and bottom/hips (2%) were the less frequently locations reported.

### High Impact Chronic Pain

With the definition of HICP used in this study, the prevalence of HICP in the sample was 5%. The prevalence of HICP was higher for girls than for boys (8% vs 2%, $X^2_{(1)} = 19.76$, $P < .001$) and participants with HICP were significantly older than those without HICP (mean = 12.46, SD = 2.75 vs mean = 11.70, SD = 2.45, $t_{(1,038)} = 2.16$, $P = .031$).

The locations of reported HICP were diverse. However, the most frequent locations were the head (31%), back (15%), and lower extremities (legs: 15%; feet: 14%). There were no significant differences in locations between girls and boys but there were differences related to age. In this sample, participants reporting pain in the head were older (mean = 13.56 years, SD = 2.73 vs mean = 11.59 years, SD = 2.49, $T_{(50)} = 2.73$, $P = .009$) and participants reporting pain in the feet were younger (mean = 10.87 years, SD = 1.86 vs mean = 13.16 years, SD = 2.81, $t_{(50)} = -2.97$, $P = .004$). Pain extent (ie, the number of locations with chronic pain) was 2.52 (SD = 1.70) and most participants (n = 32; 62%) reported multi-site chronic pain. However, there were no differences in pain extent between participants in the HICP and No HICP group (see Table 3).

Participants in the HICP group reported greater pain intensity (mean = 7.39; SD = 2.08) and a higher pain frequency (eg, almost half of them reported experiencing pain every day), than those in the No HICP group (see Table 3). In addition, participants in the HICP group reported worse physical function (ie, lower mobility, greater fatigue, and worst sleep quality), and psychological function (ie, more anxiety and depression symptoms, and worst cognitive function) than those in the No CP group (see Table 4). The data also showed significant differences in relation to school-related characteristics; that is, those with HICP reported missing more school days and worse perceived school performance than those in the No CP and the No HICP groups. Participants in the HICP group also reported worse perceived school performance than those in the No CP group, although no differences were found between the HICP and No HICP groups (see Table 4).

## Discussion

The aims of this study were to estimate the prevalence of CP and HICP in a community sample of children and adolescents, and compare individuals in the 3 groups (ie, No CP, No HICP, and HICP) with respect to their demographic, pain, and physical, psychological, and school-related function. Four key findings emerged. First, the prevalence of CP in this community sample of children and adolescents was high (46%), in line with findings reported in other studies of children like this sample.[12,52] However, in this study the prevalence of CP was higher than the one found in a study that we conducted 15 years ago in the same region with a similar sample of participants (37%[17];). There are a number of potential explanations for these differences, which are not mutually exclusive. First, although the samples were for the most part similar, there is a slight age-related difference between the samples (ie, the current sample had a larger age range: 8–18 years old, whereas in the previous study the age range was 8 to 16 years old, and research has shown that chronic pain prevalence increases with age.[44] In addition, the two samples might be different in other ways that we could not evaluate here. Second, we used different procedures for data collection for the two studies. In our previous study (ie,[17]) the information was collected using individual interviews. In the current study, we used a written survey. A recent meta-analysis[43] showed that collecting data with an interview method is associated to lower CP prevalence rates than data collected via questionnaires. It is also possible that the differences in prevalence rates found between the 2 studies might be associated with an actual increase in the rates of CP over time. Such a possibility would be consistent with recent findings[41] showing an increase in the prevalence of chronic back pain among adolescents in a study with samples from 33 countries and/or regions. Studies using children and adolescents from additional populations are needed to confirm whether the prevalence of CP in children is increasing in Spain and other locations. Moreover, research to study the factors responsible for such increases, if they are present, is also warranted.[40] Particularly, research should seek to identify the modifiable factors that may be responsible for the increase in CP prevalence, as such findings could inform the development of strategies that could reduce the prevalence of CP. Research has shown that as pain becomes chronic, it becomes increasingly difficult to treat, and CP has long-term effects on children and adolescents. For example, in a study with a cohort of pediatric patients with functional abdominal pain that was followed for 15 years, the data showed that 35% of the patients continued to experience abdominal pain into adulthood, and showed an increased risk for depression and anxiety.[58] Thus, it is important to implement effective treatment as soon as possible to help improve life course trajectories for these individuals.

A second key finding is that the prevalence of HICP was also found to be high, relative to the prevalence found in other studies. The 5% rate we found here is higher, for example, than the 1% to 2% prevalence reported in estimations of children in the highest level of chronic pain-related disability reported in previous studies, including a study conducted with a sample with similar characteristics and from the same region,[17,20] but similar to other studies with samples of children (see[44]). The same potential explanations for the differences found between studies apply. Nevertheless, the findings suggest that not only might CP be increasing in frequency, but the most severe cases may also be growing. If this were a

**Table 4. Demographic, Physical, Psychological, and School-Related Characteristics of Participants in the High Impact Chronic Pain (HICP) Group Compared with Participants in the Chronic Pain (CP) and the Chronic Pain that is not High Impact (No HICP) Groups (n = 1,041)**

| | *No CP (N = 558; 54%)* | | | *No HICP (N = 431; 41%)* | | | *HICP (N = 52; 5%)* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Characteristics* | *N* | *% Within Subsample* | *M (SD)* | *N* | *% Within Subsample* | *M (SD)* | *N* | *% Within Subsample* | *M (SD)* | *Chi Square Test* | P *(Effect Size)* | *Post Hoc Comparisons** |
| Demographics | | | | | | | | | | | | |
| Sex | | | | | | | | | | $X^2_{(2)} = 29.46$ | <.001 (0.17) | |
| Female | 284 | 49 | | 262 | 61 | | 45 | 87 | | | | No CP < No HICP < HICP |
| Male | 274 | 51 | | 169 | 39 | | 7 | 13 | | | | No CP > No HICP > HICP |
| | | | | | | | | | | One-way ANOVA | *P* (effect size) | Post Hoc Comparisons |
| Age in years | 557† | | 11.03 (2.27) | 431 | | 12.57 (2.41) | 52 | | 12.46 (2.75) | $F_{(2,1037)} = 54.92$ | <.001 (0.09) | No CP < No HICP, HICP |
| Physical function | | | | | | | | | | | | |
| Mobility | 537‡ | | 49.06 (9.08) | 423§ | | 48.63 (8.44) | 51# | | 41.90 (10.60) | $F_{(2,1008)} = 15.13$ | <.001 (0.03) | No CP, No HICP > HICP |
| Fatigue | 531‖ | | 47.26 (10.73) | 425¶ | | 51.37 (9.97) | 52 | | 63.27 (9.63) | $F_{(2,1002)} = 64.72$ | <.001 (0.11) | No CP < No HICP < HICP |
| Sleep quality | 529** | | 47.78 (9.15) | 423§ | | 50.93 (8.99) | 52 | | 58.57 (10.26) | $F_{(2,1001)} = 39.92$ | <.001 (0.07) | No CP < No HICP < HICP |
| Psychological function | | | | | | | | | | | | |
| Cognitive function | 524†† | | 50.17 (7.20) | 422‡‡ | | 47.90 (7.34) | 52 | | 42.56 (7.76) | $F_{(2,995)} = 31.54$ | <.001 (0.06) | No CP > No HICP > HICP |
| Anxiety | 532§§ | | 49.61 (10.42) | 424## | | 54.53 (11.03) | 51# | | 65.56 (12.27) | $F_{(2,1004)} = 64.05$ | <.001 (0.11) | No CP < No HICP < HICP |
| Depressive symptom severity | 532§§ | | 47.78 (9.28) | 427‖‖ | | 53.54 (10.71) | 52 | | 63.61 (11.56) | $F_{(2,1008)} = 82.15$ | <.001 (0.14) | No CP < No HICP < HICP |
| School function | | | | | | | | | | | | |
| Number of days of pain-related school absence | 369¶¶ | | 2.33 (3.65) | 383*** | | 3.08 (3.95) | 46 | | 6.09 (7.53) | $F_{(2,944)} = 20.63$ | <.001 (0.04) | No CP < No HICP < HICP |
| | | | | | | | | | | Kruskal Wallis test | *P* (effect size) | Post Hoc Comparisons* |
| Perceived school performance | 517‡‡‡ | | | 418§§§ | | | 50### | | | $X^2_{(2)} = 10.42$ | .005 (0.01) | |
| Much worse | | 1 | | | 4 | | | 10 | | | | No CP < No HICP, HICP |
| Worse | | 6 | | | 11 | | | 17 | | | | No CP < No HICP, HICP |
| Equal | | 44 | | | 40 | | | 40 | | | | n.s. |
| Better | | 30 | | | 30 | | | 19 | | | | n.s. |
| Much better | | 11 | | | 11 | | | 10 | | | | n.s. |

*shows the order of groups in each comparison; The numbers in "n" vary among variables due to the number of missing information in each case.
†n = 557 (missing = 1).
‡n = 537 (missing = 21).
§n = 423 (missing = 8).
#n = 51 (missing = 1).
‖n = 531 (missing = 7).
¶n = 425 (missing = 6).
**n = 529 (missing = 29).
††n = 524 (missing = 34).
‡‡n = 422 (missing = 9).
§§n = 532 (missing = 26).
##n = 424 (missing = 7).
‖‖n = 427 (missing = 4).
¶¶n = 369 (missing = 63).
***n = 383 (missing = 48).
†††n = 46 (missing = 6).
‡‡‡n = 517 (missing = 41).
§§§n = 418 (missing = 13).
###n = 50 (missing = 2).

reliable finding, it would mean, a call to action to address and reduce the individual and societal impact of No HICP and HICP in children and adolescents should be issued. A regional or national chronic pain strategy would require the participation of all stakeholders and the inclusion of different actions, including but not limited to increasing the number of specialized treatment programs,[31] improving the training of primary healthcare professionals,[30] and taking advantage of the digital tools (eg, mobile applications) which have already shown that can facilitate access to health care (eg,[7,22]).

A third key finding from this study is that there were differences in HICP related to sex and age, in that HICP prevalence was higher in girls than boys, and that the age of those with HICP was significantly higher than in those with CP. Furthermore, in this study, 60% of the participants with HICP reported chronic pain in at least 2 sites, and 25% reporting 4 or more sites. This finding is consistent with research showing that multisite pain is more prevalent than single site pain in individuals with CP regardless of the impact.[16,35,36,46]

Epidemiology studies have also shown that being female is a risk factor for a large variety of CP conditions.[44] Research should study the factors that are associated with the higher prevalence of CP among girls. It has not yet been determined if there are CP treatments that may be better suited for girls and women than for boys and men. However, there is an evidence of different practices and treatments used with women and men. For example, a study with adults, found that female patients were more likely to receive a larger variety of pain treatments than male patients, including both contraindicated and recommended polypharmacy.[34]

The fourth key study finding – perhaps not surprising – is that participants with HICP were severely impacted in all studied domains. Specifically, participants with HICP reported higher levels of physical (ie, fatigue and sleep disturbance), psychological (ie, greater symptoms of anxiety and depression, and worst cognitive function), and school (ie, were less able to attend school due to pain) dysfunction than those with no CP and No HICP. There is mounting evidence showing the deteriorating effects of CP on young individuals' general health and well–being,[45] which may negatively influence their physical, psychological, and social development. This finding has also practical implications. Importantly, that treatments for children and adolescents with CP should be multidisciplinary,[59] and address the whole person rather than to the CP problem alone. Different treatments have been shown to help improve young individuals with CP.[10,29,33] However, one of the limitations in relation to treatment for this population has been the tendency to treat all individuals with CP with essentially the same treatment program. As noted previously, research has shown that individuals with CP are not equal. Therefore, those individuals should be treated differently, based on their characteristics and needs.

The study has a number of limitations that should be considered when interpreting the findings. First, this was a cross-sectional study. Therefore, it precludes any conclusions regarding causative factors, including those that may impact the development of HICP. Longitudinal studies to determine what factors might be associated with both the development and resolution of CP in this population is warranted. Second, the data for this study were collected from a convenience sample of children and adolescents and only 36% of parents approached consented to have their children participate. Also, although we put a great deal of effort to locate students whose parents agreed they could participate in the study, but who were not present the day of the data collection at school, we were not able to locate them all. That said, if this did bias the sample, it would seem likely that the prevalence of HICP could be even higher than estimated here, as individuals with HICP are the ones that are more severely affected in their function and tend to miss school more days. Similarly, characteristics of the parents (eg, education, general health) that have been found to be associated to CP, are an additional source of potential bias, which could have affected (self-)selection into the study. Measures of these potential biasing factors should be included in future studies. In addition, although the definition of CP used for this study has been successfully used in previous studies (eg,[17]), it is not the only classification system that could be used. Some studies in adults, for example, use a more conservative threshold for CP (eg, CP defined as pain that is present most day or every day; eg,[5]). Researchers should carefully consider which definition to use, and base their decision on the aims of the study, recognizing that the definition will ultimately impact the rates of CP found in any one sample. Moreover, although we used validated measures they covered different time spans. We cannot be certain if and how these differences have impacted the findings. This potential problem is very common in the pain research literature (see[20]). Therefore, it would be recommendable that researchers seek to use measures that cover the same time periods whenever possible. Finally, we were not able to compare children and adolescents groups with respect to HICP because of the small number of individuals who met criteria for HICP in the children group (n = 7). Future studies with larger sample sizes are needed.

Despite these limitations, this study provides new valuable information that improves our understanding of the prevalence of chronic pain and HICP in children and adolescents, as well as of the associations between chronic pain and children's physical, psychological, and school-related function. These findings can now be used by stakeholders interested in improving the quality of life of this population, as it provides important information about the overall need of this population of children who bear a great burden of pain. By understanding the factors that are associated with these conditions, researchers and clinicians will be able to develop more effective early interventions to help better this population.

## Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jpain.2022.12.007.

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