Systematic Review and Meta-Analysis

PAIN 165 (2024) 2215–2234

PAIN®

OPEN

The prevalence of chronic pain in children and adolescents: a systematic review update and meta-analysis

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Abstract

Chronic pain, defined as persistent or recurring pain or pain lasting longer than 3 months, is a common childhood problem. The objective of this study was to conduct an updated systematic review and meta-analysis on the prevalence of chronic pain (ie, overall, headache, abdominal pain, back pain, musculoskeletal pain, multisite/general pain, and other) in children and adolescents. EMBASE, PubMed, CINAHL, and PsycINFO were searched for publications between January 1, 2009, and June 30, 2023. Studies reporting population-based estimates of chronic nondisease related pain prevalence in children or adolescents (age ≤ 19 years) were included. Two independent reviewers screened articles based on a priori protocol. One hundred nineteen studies with a total of 1,043,878 children (52.0% female, mean age 13.4 years [SD 2.4]) were included. Seventy different countries were represented, with the highest number of data points of prevalence estimates coming from Finland and Germany (n = 19 each, 4.3%). The overall prevalence of chronic pain in children and adolescents was 20.8%, with the highest prevalence for headache and musculoskeletal pain (25.7%). Overall, and for all types of pain except for back pain and musculoskeletal pain, there were significant differences in the prevalence between boys and girls, with girls having a higher prevalence of pain. There was high heterogeneity (I^2 99.9%). Overall risk of bias was low to moderate. In summary, approximately 1 in 5 children and adolescents experience chronic pain and prevalence varies by pain type; for most types, there is higher pain prevalence among girls than among boys. Findings echo and expand upon the systematic review conducted in 2011.

Keywords: Epidemiology, Paediatrics, Pain, Chronic pain, Prevalence, Headache, Back pain, Musculoskeletal pain

1. Introduction

Chronic pain, defined as persistent or recurring pain or pain lasting longer than 3 months,[143] is a common problem in childhood and adolescence. Chronic pain in childhood is associated with significant functional impairment that often carries through to adulthood; children who experience chronic pain are at an increased risk for developing depression and anxiety,[128,133] experiencing social isolation,[95] have more school absences,[90] and are more likely to have a poorer quality of life.[53] Children with chronic pain often become adults with chronic pain, leading to significant stress on the person, family, and healthcare system.[60,86,153] In 2019, an estimated $40B was spent on chronic pain in Canada alone.[26] Given the significant individual, social, and economic burden of pediatric chronic pain from childhood through adulthood, it is important to understand the epidemiology of chronic pain in children and adolescents.

In recent years, there has been a substantial effort towards improving the diagnosis and management of pediatric pain. In a 2020 *Lancet* Commission on children's pain, which involved individuals with lived experiences, 4 transformative goals were proposed: make pain matter, make pain understood, make pain visible, and make pain better.[43] According to the *Lancet* Commission, if achieved, the goals will transform the lives of children with pain and their families.[43] In 2020, the World Health Organization released a guideline on the physical, psychological, and pharmacological interventions for the management of primary and secondary chronic pain in children aged 0 to 19 years.[160] In addition, chronic primary pain was recognized as a primary pain type in the International Classification of Diseases (ICD-11) in 2019.[106] Chronic primary pain is defined as "pain in 1 or more anatomic regions that persists or recurs for longer than 3 months

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.painjournalonline.com).

http://dx.doi.org/10.1097/j.pain.0000000000003267

and is associated with significant emotional distress or significant functional disability (interference with activities of daily life and participation in social roles) and that cannot be better explained by another chronic pain condition."[143 (p.1004)] Chronic secondary pain is pain that is associated with another condition, such as chronic cancer pain, chronic postsurgical and posttraumatic pain, chronic neuropathic pain, chronic headache and orofacial pain, chronic visceral pain, and chronic musculoskeletal pain.[143] However, there remains a need for a pediatric emphasis as the current criteria are focused on adults, and thus might not be relevant for children and adolescents.[152] To reach the *Lancet* Commission goals, combined with the exponential growth in pediatric pain literature over the past few decades,[23] an updated systematic review and meta-analysis on the overall prevalence of chronic pain in children and adolescents worldwide is essential. This knowledge is essential to facilitate early diagnosis and improve treatment, ultimately reducing the impact that chronic pain has on the lives of children, adolescents, their families, and society.

The last comprehensive systematic review on the epidemiology of chronic pain in children and adolescents was published over a decade ago by King et al.[79] The review estimated that the median prevalence of chronic pain in children and adolescents ranged from 11% to 38% depending on the pain type.[79] However, the prevalence varied substantially across studies and no meta-analysis was conducted at the time. The review also found that the prevalence of chronic pain was higher in girls and the prevalence increased with age.[79] The review of King et al. built on the first narrative review on this topic by Goodman et al.,[54] who found that significant methodological limitations substantially affected the ability to establish a prevalence of chronic pain. Although a number of other reviews on pediatric pain have been published since the King et al. review, they focused on specific types of pain (eg, functional abdominal pain,[82] headache),[2,158] did not focus on chronic pain,[25] or focused only on adolescents.[103] Furthermore, at the time of the 2011 review, the quality of included studies was generally low to moderate and had methodological limitations, such as inconsistent definitions of pain between the studies.[79] As the field of systematic reviews and definitions of chronic pain have evolved and standardized over time,[106] it is important to explore whether prevalence estimates and study quality remained the same or if any changes in the prevalence and quality of studies have changed over time to advance knowledge in this area.

Therefore, the objectives of this review are to (1) provide updated estimates of the prevalence of chronic pain in children and adolescents overall and by pain type (ie, headache, abdominal pain, back pain, musculoskeletal pain, multisite/general pain, and other pain); (2) compare the prevalence of chronic pain in children and adolescents by sex; and (3) assess study quality and identify gaps in the literature and areas for future research.

2. Methods

This systematic review follows an a priori published protocol.[145] In keeping with best practices in patient-oriented research, this review was designed and conducted in collaboration with a patient partner and coauthor (J.M.).

2.1. Inclusion criteria

2.1.1. Population

This review considered studies that included population-based samples of children and/or adolescents aged ≤19 years. This cutoff follows the World Health Organization definition of adolescent, which is ages 10 to 19 years.[159] Studies that used a non-population-based sampling approach were excluded. Studies that reported on participants beyond 20 years of age were excluded, unless estimates for younger age groups were able to be calculated separately. No limitations were placed based on geography. Studies that reported on the prevalence of chronic pain in specific subpopulations, such as children and adolescents with chronic illnesses (eg, cancer, arthritis) or other health conditions (eg, cerebral palsy, muscular dystrophy), were excluded.

2.1.2. Condition

This review sought to summarize existing evidence on the prevalence of chronic pain in children and adolescents. In the protocol, chronic pain was defined as "pain with a minimum duration of at least 3 months or pain that is described as chronic, persistent, or recurrent."[145] For further clarity, the final definition of chronic pain used in this review was as follows: (1) pain with a minimum duration of at least 3 months; or (2) pain that is described as chronic, persistent, or recurrent *with no timeframe reported.* If a study included pain measured over a time frame of less than 3 months (eg, participants were asked about recurrent pain over the past 2 months), these were excluded as non-chronic pain. In addition, if a study did not separate chronic pain data from other diagnoses, it was excluded (eg, studies that reported on diagnosis of Functional Gastrointestinal Disorders using the ROME criteria[141] but did not separately report on the overall abdominal pain subtype were excluded).

2.1.3. Outcomes

The primary outcome of this review is the prevalence of chronic pain in children and adolescents. The original systematic review[79] used the following pain types: headache, abdominal pain, back pain, musculoskeletal pain, multiple pain, general pain (eg, any pain, not specified), and other pain (eg, fibromyalgia). For the current review, multiple site pain and general pain were collapsed based on similarity of reporting, and general and other were separated. Furthermore, for the current review, these broad types were defined to capture all relevant and reported outcomes according to the International Association of Study of Pain (IASP) classification of chronic primary pain for ICD-11.[106] Thus, although fibromyalgia and chronic widespread pain also reflect pain across multiple sites, they are separate primary pain conditions.[106] Therefore, these diagnoses were kept separate from multisite/general pain, which is a broader category. **Table 1** outlines the pain conditions reported on within each overarching pain type.

Additional outcomes collected included pain frequency (ie, daily or several times weekly, weekly or at least weekly, monthly or at least monthly, recurring or not otherwise defined, or met ROME diagnostic criteria for functional abdominal pain disorder) and sociodemographic information (ie, age, sex, and country of data collection). These data are reported at the study level and are available in **Table 2**.

Originally, an examination of sociodemographic (eg, age, sex, race) and psychosocial (eg, anxiety, depression, sleep) factors related to the prevalence of chronic pain in children and adolescents was to be undertaken. However, because of difference in reporting and lack of available aggregated data, subanalyses were not possible based on any sociodemographic

Table 1

Included pain types within each overarching chronic pain type.

Chronic pain type	Definition
Headache	1. Any (not specified) 2. Multisite (migraine, tension, etc) 3. Chronic migraine 4. Chronic tension 5. Not classifiable/other 6. Chronic temporomandibular pain
Abdominal	1. Any (not specified) 2. Abdominal migraine 3. Irritable bowel syndrome 4. Functional dyspepsia 5. Functional abdominal pain 6. Functional abdominal pain syndrome 7. Abdominal pain—Functional gastrointestinal disorder (AP-FGID)
Back	1. Any (not specified) 2. Multisite/general 3. Lower back pain (LBP) only 4. Spinal column only
Musculoskeletal	1. Any (not specified) 2. Multisite/general 3. Neck and shoulder (NSP) 4. Neck pain only 5. Lower limb (leg)
Multisite/general	1. Any/multisite/combined/general 2. Back and musculoskeletal pain
Other	1. Fibromyalgia 2. Chronic widespread pain (CWP) 3. CWP and chronic regional pain (CRP) combined

variables other than sex. In addition, no subanalyses were possible based on psychosocial factors as the measurement tools and reporting varied significantly and was not able to be meta-analyzed in a meaningful way.

2.1.4. Types of studies

This review considered observational or cohort studies that provided prevalence estimates for chronic pain in adolescents and children. Studies must have been published in peer-reviewed journals in English. Case studies, conference abstracts, dissertations, reviews, book chapters, and qualitative studies were excluded. All studies published after January 2009 were eligible because the prior systematic review[79] included studies published up until 2009.

2.2. Search strategy

The search strategy was created in consultation with a health research librarian, D.C. The following electronic databases were searched: EMBASE, PubMed, CINAHL, and PsycINFO. The searches were restricted to English language articles, human studies, and manuscripts published between January 2009 and June 2023. The original search was conducted on July 7, 2020, with updated searches occurring on June 24, 2021, and June 30, 2023. Forward and backward searches of citation lists of included studies were also conducted.

The search terms were composed of 3 conceptual blocks: (1) pain terms (eg, musculoskeletal pain, back pain, headache, abdominal pain, recurrent pain); (2) pediatric terms (eg, child, adolescent, boy, girl); and (3) epidemiological terms (eg, epidemiology, prevalence, frequency). The full search strategy is in eTable 1, http://links.lww.com/PAIN/C50 in the Supplement.

2.3. Study selection

Records were transferred to Covidence systematic review management software,[148] and duplicates were removed through the automation process. Studies manually identified as duplicates were marked as such in the Covidence software. Two reviewers independently screened all titles and abstracts and excluded records that did not meet inclusion criteria. The full-text articles were retrieved for the remaining records and 2 independent reviewers, blinded to each other's decisions, determined if the article met the inclusion criteria and recorded reasons for exclusion. Agreement between reviewers was required, and disagreements between reviewers at all stages were resolved through discussion with a third reviewer. All reasons for exclusion at full-text stage were recorded and are reported in the preferred reporting items for systematic reviews and meta-analyses (PRISMA) figure.[113]

2.4. Data extraction and synthesis

Data were extracted from studies by one reviewer and verified by another using a data extraction sheet developed by the authors, which was modified and revised through pilot testing before final data extraction. Any disagreements in the data extraction process were verified through discussion. No authors were contacted for missing or clarification of data, and only data available in the published studies were included. If studies used the same exact population as another study, only one study was used to provide data for this review with other studies being marked as duplicate. If studies used the same database, but at different times of data collection or different pain types, both studies were included. Studies that reported on data from multiple countries within one report were extracted at the country level, when possible.

For all studies, the number of participants (N) and prevalence (%) and/or number of participants with chronic pain (n) were extracted. When a study reported only the prevalence or the number of participants with chronic pain, the other variable was calculated manually. When studies reported duplicate data (ie, time-series design, longitudinal studies), the most recent time point of eligible participant data was extracted. Data were categorized into the broad pain type (headache, abdominal pain, back pain, musculoskeletal pain, multisite/general pain, and other pain).

When studies reported on the prevalence of more than one pain type within one report, data for each pain type were extracted (eg, headache and back pain). However, if a study reported on many subsites of pain within a pain type where the prevalence of the overall pain could not be calculated, then this study was excluded. For example, if a study reported on multiple sites of musculoskeletal pain with participants selecting more than one area, an overall musculoskeletal prevalence could not be calculated without overcounting prevalence, thus was excluded.

2.5. Quality assessment

Risk of bias was determined for each study using a validated 10-item tool developed by Hoy et al.[66] designed to assess external and internal validity of prevalence studies. Each item was coded

Table 2

Characteristics of included studies (n = 119).

Study	Study design	Pain type	Pain report	Pain frequency	Sample* N	Age in y Mean (range)	Sex % female	Country
Adegoke 2015[1]	Cross-sectional	Back	Child	Recurring	571	14.2 (10-19)	52.2	Nigeria
Albuquerque 2009[3]	Cross-sectional	Headache	Parent	Monthly, weekly, daily	5179	NR (6-18)	53.3	Brazil
Al-Hashel 2019[4]	Cross-sectional	Headache	Child	Recurring	3423	12.5 (6-17)	49.3	Kuwait
Al-Khotani 2016[5]	Cross-sectional	Headache	Child	Recurring	456	NR (10-18)	59.6	Saudi Arabia
Alp 2010[6]	Cross-sectional	Headache	Child	Recurring	1385	13.5 (11-18)	39.2	Turkey
Altamimi 2014[7]	Cross-sectional	Abdominal	Child	ROME III	451	12.7 (11-15)	49.2	Jordan
Al-Tulaihi 2009[8]	Cross-sectional	Headache	Child	Recurring	1447	NR (16-19)	47.0	Saudi Arabia
Arruda 2010[10]	Cross-sectional	Headache, abdominal, musculoskeletal	Parent	Recurring	1906	NR (5-12)	47.6	Brazil
Ayanniyi 2011[11]	Cross-sectional	Back	Child	Recurring	3185	NR (10-19)	54.3	Nigeria
Ayonrinde 2020[12]	Longitudinal	Abdominal	Child	Weekly	1281	17 (17)	52.8	Australia
Azevedo 2023[14]	Cross-sectional	Back	Child	Recurring	1463	NR (9-19)	49.1	Portugal
Barack 2015[15]	Cross-sectional	Other	Child, HCP	Recurring	437	NR (11-18)	47.8	Turkey
Bhatia 2016[16]	Cross-sectional	Abdominal	Child	ROME III	1115	NR (10-17)	NR	India
Bouzios 2017[21]	Cross-sectional	Abdominal	Parent, child	ROME III	1658	12.9 (6-17)	51.8	Greece
Buse 2012[22]	Cross-sectional	Headache	Child	Recurring	13,951	NR (12-17)	48.6	United States
Çagliyan Türk 2020[24]	Cross-sectional	Other	HCP	Recurring	476	13.8 (9-17)	48.5	Turkey
Castro 2013[27]	Cross-sectional	Headache	Child	Recurring	750	10.4 (7-14)	56.1	Brazil
Cavestro 2014[28]	Cross-sectional	Headache, abdominal	Parent	Monthly	649	NR (3-11)	49.2	Italy
Chiwaridzo 2014[31]	Cross-sectional	Abdominal	Child	Recurring	532	16 (13-19)	46.2	Zimbabwe
Chong 2010[32]	Cross-sectional	Headache	Child	Recurring	2873	NR (6-16)	55.2	Singapore
Cvetkovic 2014[34]	Cross-sectional	Headache	Child	Recurring	2057	17.2 (14-18)	50.2	Croatia
da Silva Jr 2019[132]	Cross-sectional	Headache	HCP	Weekly	284	NR (10-19)	NR	Brazil
Dantas 2021[35]	Cross-sectional	Back	Child	Monthly, weekly	520	NR (10-16)	57.5	Brazil
de Melo Junior 2019[98]	Cross-sectional	Headache	HCP	Recurring	1342	NR (10-17)	68.7	Brazil
Devanarayana 2011[36]	Cross-sectional	Abdominal	Child	ROME III	427	14.4 (12-16)	49.9	Sri Lanka
Devanarayana 2011[37]	Cross-sectional	Abdominal	Child	ROME III	2163	13.4 (10-16)	45	Sri Lanka

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Table 2 (*continued*)

Study	Study design	Pain type	Pain report	Pain frequency	Sample* N	Age in y Mean (range)	Sex % female	Country
Dhroove 2017[38]	Cross-sectional	Abdominal	Child	ROME III	362	11.6 (8-18)	53.5	Mexico
Dissing 2017[39]	Longitudinal	Back	Parent	Weekly	1077	NR (10-16)	52	Denmark
Drozda 2011[40]	Cross-sectional	Multisite/general	Child	Monthly, weekly	426	NR (13-17)	50	Poland
Du 2011[41]	Cross-sectional	Multisite/general	Child, parent	Recurring	14,836	NR (3-17)	49	Germany
Durmaz 2013[42]	Cross-sectional	Other	Child	Recurring	1109	14.8 (12-18)	50.5	Turkey
Erdoğan 2021[44]	Cross-sectional	Headache	Child	Monthly	4151	16.6 (15-19)	48.5	Turkey
Fabricant 2020[45]	Cross-sectional	Back	Child	Recurring	3669	14.0 (10-18)	50.6	New Zealand
Farrant 2023[46]	Cross-sectional	Multisite/general	Child	Recurring	7721	NR (12-19)	NR	United States
Franco-Micheloni 2015[47]	Cross-sectional	Headache	Child	Recurring	1307	12.7 (12-14)	56.8	Brazil
Franz 2014[48]	Longitudinal	Back	Parent	Weekly	1171	NR (6-11)	53.0	Denmark
Fuglkjaer 2017[49]	Longitudinal	Musculoskeletal	Parent	Weekly	1033	12.5 (10-16)	52.0	Denmark
Genizi 2013[50]	Cross-sectional	Headache	Child	Recurring	2019	NR (15-16)	56.7	Israel
Gobina 2015[52]	Cross-sectional	Headache, abdominal, back	Child	Weekly	36,762	15 (15)	50.3	Multiple countries
Gobina 2019[51]	Cross-sectional	Headache, abdominal, back, multisite/general	Child	Weekly	214,283	13.6 (11-15)	50.7	Multiple countries
Gulewitsch 2013[55]	Cross-sectional	Abdominal	Parent	ROME II	1537	8.8 (5-12)	51.1	Germany
Gupta 2009[56]	Cross-sectional	Headache	Child	Recurring	2563	NR (12-19)	38.3	India
Gustafsson 2018[57]	Longitudinal	Back, musculoskeletal	Child	Weekly, monthly, daily	568	15 (15)	52.8	Finland
Haraldstad 2011[58]	Cross-sectional	Multisite/general	Child	Recurring	1238	NR (12-18)	53.0	Norway
Harrison 2016[59]	Cross-sectional	Other, musculoskeletal	Child	Recurring	3568	NR (17)	58.2	United Kingdom
Heinrich 2009[61]	Cross-sectional	Headache	Child	Monthly, weekly	3833	11.4 (14-19)	50.1	Germany
Hoftun 2011[63]	Cross-sectional	Multisite/general	Child	Weekly	7373	15.8 (13-19)	50.8	Norway
Holstein 2020[65]	Time-trend	Abdominal	Child	Recurring	2981	NR (11-15)	51.6	Denmark
Holstein 2022[64]	Time-trend	Back	Child	Daily	2953	NR (11-15)	51.6	Denmark
Ivanova 2022[69]	Cross-sectional	Multisite/general	Child	Recurring	5910	16.2 (14-18)	64.0	Russia
Játiva 2016[70]	Cross-sectional	Abdominal	Child	ROME III	417	12.0 (8-15)	49.2	Ecuador
Kadim 2021[72]	Cross-sectional	Abdominal	Child	ROME III	396	12.7 (NR)	59.8	Indonesia
Kaltseis 2022[73]	Cross-sectional	Headache	HCP	Monthly, weekly, daily	1923	17.0 (14-19)	57.3	Austria & Italy
Katsuki 2023[74]	Cross-sectional	Headache	Child	Monthly, daily	2489	NR (6-17)	48.0	Japan

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Table 2 (*continued*)

Study	Study design	Pain type	Pain report	Pain frequency	Sample* N	Age in y Mean (range)	Sex % female	Country
Kedra 2013[75]	Cross-sectional	Back	Child	Monthly	1089	NR (10-19)	50.2	Poland
Kedra 2019[76]	Cross-sectional	Back	Child	Recurring	11,424	NR (10-19)	53.8	Poland
Kemta Lekpa 2021[77]	Cross-sectional	Back	Child	Recurring	1075	11 (8-14)	49.5	Cameroon
Khayat 2021[78]	Cross-sectional	Abdominal	Parent	ROME IV	317	NR (3-18)	50.8	Saudi Arabia
Knezevic-Pogancev 2010[80]	Cross-sectional	Headache	Child, parent, HCP	Monthly	30,636	9.2 (3-17)	49.6	Serbia
Kolb 2022[81]	Cross-sectional	Headache, back	Child	Recurring	1516	14.4 (11-17)	50.8	Germany
Krogh 2015[83]	Cross-sectional	Headache	Child	Recurring	488	NR (12-18)	56.6	Norway
Kroner-Herwig 2011[84]	Cross-sectional	Multisite/general	Child	Recurring	2219	13.3 (7-14)	50.3	Germany
Kumar 2017[85]	Cross-sectional	Musculoskeletal	Child	Recurring	1018	11.0 (5-16)	44.8	India
Lipton 2011[89]	Cross-sectional	Headache	Child	Daily	24,712	NR (12-19)	49.5	United States
Lu 2016[91]	Cross-sectional	Abdominal	Child	ROME III	321	10.0 (8-14)	61.1	Panama
Lucas 2021[92]	Longitudinal	Multisite/general	Parent	Recurring	4036	10.0 (10)	49.1	Portugal
Lukaszewska 2013[93]	Cross-sectional	Back	Child	Monthly, weekly	2676	16.3 (13-19)	54.1	Poland
Luntamo 2012[94]	Cross-sectional	Headache, abdominal	Child	Monthly	2215	14.4 (13-18)	50.0	Finland
Malik 2012[96]	Cross-sectional	Headache	Child	Recurring	5000	NR (8-18)	54.5	India
Masiero 2010[97]	Cross-sectional	Musculoskeletal	Child	Recurring	7542	15.0 (12-16)	49.9	Italy
Meziat Filho 2015[99]	Cross-sectional	Back	Child	Recurring	989	16.8 (14-17)	53.3	Brazil
Meziat Filho 2017[100]	Cross-sectional	Musculoskeletal	Child	Recurring	989	NR (14-17)	NR	Brazil
Mingels 2022[101]	Cross-sectional	Headache	Child	Weekly, daily	424	NR (5-18)	NR	Belgium
Miro 2023[102]	Cross-sectional	Multisite/general	Child	Weekly	1115	11.7 (8-18)	56.0	Spain
Myrtveit 2014[104]	Cross-sectional	Musculoskeletal	Child	Weekly	8990	17.8 (17-19)	53.7	Norway
Nieswand 2019[107]	Cross-sectional	Headache	Child	Monthly	2706	NR (6-19)	50.3	Germany
Noll 2016[108]	Cross-sectional	Back	Child	Monthly, weekly	1374	NR (11-16)	46.8	Brazil
Nyame 2010[109]	Cross-sectional	Headache	Child	Weekly	237	11.8 (8-15)	55.3	United States
Østeras 2015[110]	Cross-sectional	Musculoskeletal	Child	Recurring	422	NR (16-17)	51.5	Norway
O'Sullivan 2012[111]	Cross-sectional	Back	Child	Recurring	1288	17.0 (17)	52.6	Australia

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Table 2 (*continued*)

Study	Study design	Pain type	Pain report	Pain frequency	Sample* N	Age in y Mean (range)	Sex % female	Country
Oswari 2019[112]	Cross-sectional	Abdominal	Child	ROME III	1813	13.5 (10-17)	59.2	Indonesia
Perera 2016[115]	Cross-sectional	Headache	Child	Recurring	606	13.0 (11-16)	50.7	Sri Lanka
Poyrazoğlu 2015[117]	Cross-sectional	Headache	Child	Recurring	10,584	NR (7-17)	55.7	Turkey
Rau 2021[118]	Longitudinal	Multisite/general	Child	Weekly	777	12.9 (9-17)	53.3	Germany
Rho 2012[119]	Cross-sectional	Headache	Child	Recurring	5039	NR (6-18)	52.3	South Korea
Saha 2017[120]	Cross-sectional	Headache	Child	Recurring	1499	13.1 (11-15)	33.0	Bangladesh
Santinello 2009[121]	Cross-sectional	Headache	Child	Weekly	4386	NR (11-15)	51.6	Italy
Saps 2009[124]	Cross-sectional	Abdominal	Child	Weekly	237	11.8 (8-15)	57.0	United States
Saps 2014[123]	Cross-sectional	Abdominal	Child	ROME III	373	10.0 (NR)	50.7	Colombia
Saps 2017[122]	Cross-sectional	Abdominal	Child	ROME III	4394	11.9 (8-18)	48.1	Colombia
Saps 2018[125]	Cross-sectional	Abdominal	Child	ROME IV	3567	13.7 (8-18)	56.6	Colombia
Shan 2013[126]	Cross-sectional	Back, musculoskeletal	Child	Weekly	3016	NR (15-19)	44.5	China
Shaygan 2020[127]	Cross-sectional	Headache, abdominal, back, musculoskeletal, multisite/general	Child	Recurring	734	15.0 (12-19)	62.5	Iran
Shuaibi 2021[129]	Cross-sectional	Headache	Child	Recurring	1089	11.5 (7-16)	61.4	Kuwait
Siajunboriboon 2022[130]	Cross-sectional	Abdominal	Child	ROME IV	1700	16.1 (4-18)	55.5	Thailand
Sillanpaa 2018[131]	Cross-sectional	Headache	Child, parent, HCP	Recurring	1185	14 (14)	NR	Finland
Siu 2012[134]	Cross-sectional	Multisite/general	Child	Recurring	1518	NR (11-19)	42.9	Hong Kong
Sjölund 2021[135]	Longitudinal	Abdominal	Child	ROME III	2374	16.0 (16)	50.6	Sweden
Sollerhed 2013[136]	Cross-sectional	Multisite/general	Child	Recurring	206	NR (8-12)	44.7	Sweden
Somayajula 2022[137]	Cross-sectional	Other	HCP	Recurring	8507	NR (8-18)	48.9	United Kingdom
Sperotto 2014[138]	Cross-sectional	Musculoskeletal	Child	Recurring	289	10.6 (8-13)	75.7	Italy
Stahl 2014[139]	Time-trend	Back, musculoskeletal, multisite/general	Child	Weekly	4436	NR (12-18)	58.9	Finland
Swain 2014[140]	Cross-sectional	Headache, abdominal, back	Child	Monthly	404,206	13.6 (9-17)	51.2	Multiple countries
Torres-Ferrus 2019[142]	Cross-sectional	Headache	Child	Monthly, weekly, daily	1619	14.4 (12-18)	51.9	Spain
Tumin 2018[144]	Cross-sectional	Multisite/general	Parent	Recurring	43,712	NR (0-17)	NR	United States
Udoh 2016[146]	Cross-sectional	Abdominal	Child	ROME III	818	14.6 (10-18)	50.0	Nigeria
van den Heuvel 2020[62]	Cross-sectional	Multisite/general	Parent	Recurring	6200	6.0 (6)	49.7	Netherlands
Van Gessel 2011[147]	Longitudinal	Headache, abdominal, back	Child	Monthly, recurring	2025	NR (12-18)	50.3	Germany

(*continued on next page*)

Table 2 (*continued*)

Study	Study design	Pain type	Pain report	Pain frequency	Sample* N	Age in y Mean (range)	Sex % female	Country
Vierola 2012[149]	Cross-sectional	Multisite/general	Parent	Weekly	424	7.9 (6-8)	48.5	Finland
Vila 2012[150]	Cross-sectional	Abdominal	Child	Weekly	1173	13.0 (11-17)	51.0	United Kingdom
Wager 2020[151]	Cross-sectional	Multisite/general	Child	Weekly	2280	13.0 (10-18)	52.2	Germany
Walter 2014[155]	Cross-sectional	Headache	Child	Weekly	13,570	NR (11-17)	51.3	United States
Wijga 2021[156]	Longitudinal	Headache	Child	Recurring	2083	17 (17)	51.6	Netherlands
Wilkes 2021[157]	Cross-sectional	Headache	Parent	Recurring	7933	NR (10-11)	48.8	Australia
Wurm 2018[161]	Longitudinal	Multisite/general	Child	Monthly	1181	NR (14-16)	46.1	Sweden
Yao 2011[162]	Cross-sectional	Back	Child	Recurring	2083	14.4 (10-18)	53.1	China
Zablah 2015[163]	Cross-sectional	Abdominal	Child	ROME III	399	11.8 (8-15)	58.7	El Salvador
Zeevenhooven 2020[165]	Cross-sectional	Abdominal	Child	ROME IV	782	14.7 (11-18)	61.7	Curacao
Zhang 2015[166]	Cross-sectional	Headache, abdominal, back, musculoskeletal	Child	Weekly	2587	NR (16-18)	51.5	China

* Sample after exclusion, NR = not reported.

as "0" (low risk) or "1" (high risk) by a reviewer. A second independent reviewer coded each item for 20% of the articles to ensure interrater reliability in using the risk of bias tool. Scores across the 10 items were summed, and each study was categorized with an overall risk of bias as low (0-2), moderate (3-4), or high (5-10).

2.6. Statistical analysis

A meta-analysis was conducted on the overall prevalence of pediatric chronic pain, grouped by pain type: headache, abdominal pain, back pain, musculoskeletal pain, multisite/general pain, and other pain. A second meta-analysis comparing the prevalence of chronic pain between male/female sex was conducted using a subgroup analysis.

Meta-analysis was performed using the meta command in Stata SE 18.0 for single proportion (prevalence) outcomes. Random effects models with restricted maximum likelihood method were carried out. Proportions were calculated using the Freeman–Tukey double arcsine transformation, of which the inverse (ie, the proportion) was reported in the result. Heterogeneity of studies was estimated using I^2 to represent the amount of variability in study prevalence that is attributable to heterogeneity across studies rather than chance.

3. Results

3.1. Search results

The combined searches yielded 18,636 citations. After removal of duplicates, 16,063 titles and abstracts were screened for eligibility, of which 346 were screened in full-text review. An additional 20 records were identified through backward and forward citation searching. A total of 119 studies were included in the review. **Figure 1** shows the PRISMA diagram with the flow of studies in the review.

Table 3

Summary table of psychosocial outcomes by pain type.

Pain type	Depression	Anxiety	Stress	Sleep
Headache	5 [35,48,75,155,156]	5 [35,48,84,110,156]	3 [32,84,97]	7 [32,51,95,118,142,155,166]
Abdominal	3 [12,123,150]	4 [12,73,84,123]	5 [38,84,113,146,165]	2 [95,166]
Back	3 [58,105,127]	2 [58,84]	1 [84]	2 [58,166]
Musculoskeletal	4 [58,60,85,127]	2 [58,60]	1 [111]	4 [58,60,85,166]
Multisite/general	9 [47,63,70,103,119,134,144,152,161]	8 [63,70,84,103,119,144,152,161]	3 [84,134,161]	3 [63,134,152]
Other	4 [24,43,60,137]	4 [24,43,60,137]	1 [43]	4 [24,43,60,137]
Total	28	25	14	22

N.B. Totals do not add up to numbers reported in the table because of multiple studies reporting on different pain types and psychosocial outcomes.

Table 4

Summary table of pooled prevalence estimate by pain type.

Pain type	Prevalence estimate (95% CI)
Headache (n = 133)	25.7 (22.2, 29.3)
Abdominal (n = 120)	17.3 (14.3, 20.5)
Back (n = 115)	19.1 (16.6, 21.7)
Musculoskeletal (n = 13)	25.7 (17.3, 35.1)
Multisite/general (n = 60)	21.0 (18.5, 23.6)
Other (n = 5)	6.9 (4.4, 10.0)
Total (n = 446)	20.8 (19.2, 22.4)

3.2. Study characteristics

In total, 1,043,878 children (52.0% female) ranging from 0 to 19 years of age (mean age = 13.4 years, SD = 2.4 years) were included in the meta-analysis. There were 70 different countries represented, with the highest number of data points coming from Finland and Germany (n = 19 each, 4.3%). Four studies reported on multiple countries, with each country reported separately, except for Kaltseis et al.[73] who reported on Austria and Italy combined. Fourteen studies (11.8%) reported on more than one pain type with the remaining studies only reporting on one pain type, which, when separated out by country when applicable, resulted in a total of 446 data points of prevalence estimates included in the meta-analysis. The total number of data points on each of the following pain types were headache (n = 133, 29.8%), abdominal pain (n = 120, 26.9%), back pain (n = 115, 25.8%), musculoskeletal pain (n = 13, 2.9%), multisite/general pain (n = 60, 13.5%), and other pain (n = 5, 1.1%).

One hundred four (87.4%) of the 119 included studies were cross-sectional in design, 12 (10.1%) were longitudinal studies, and 3 (2.5%) were repeated, time-trend designs. Most studies collected chronic pain data through child report (n = 96, 80.7%) with the remaining assessed through parent (n = 13, 10.9%), healthcare provider proxy (n = 5, 4.2%), or multiple sources (n = 5, 4.2%). Several studies used data from the same project/cohort, including but not limited to the Health Behaviour in School-aged Children (HBSC),[51,52,64,65,121,140] Functional International Digestive Epidemiological Research Survey (FIND-ERS),[38,70,91,122,163] and Childhood Health, Activity and Motor Performance School Study Denmark (CHAMPS).[39,48,49]

Chronic pain prevalence was reported daily (n = 8, 5.9%), weekly (n = 31, 23.0%), monthly (n = 19, 14.1%), and recurring (unspecified) (n = 57, 42.2%). In addition, 20 studies (14.8%) reported on the prevalence of pain-related functional abdominal pain disorders as defined by the ROME criteria.

In terms of psychosocial outcomes, 25 studies (21.0%) reported on depression, 20 (16.8%) on anxiety, 16 (13.4%) on sleep, and 11 (9.2%) on stress. Seventeen studies coreported on both anxiety and depression (14.3%). **Table 3** provides a detailed breakdown of the psychosocial outcomes by chronic pain types. Because of variation in reporting, no meta-analysis was possible on these outcomes.

3.3. Prevalence of chronic pain

Overall, across all studies, the prevalence of chronic pain in children and adolescents was 20.8% (95% CI: 19.2-22.4), which equates to 1 in 5 children and adolescents experiencing chronic pain. There is a high proportion of total variability in this estimate due to between-study heterogeneity, with the overall $I^2 = 99.9\%$. As seen in **Table 4**, among the types, the prevalence of headache pain was 25.7% (95% CI: 22.2-29.3), back pain was 19.1% (95% CI: 16.6-21.7), abdominal pain was 17.3% (95% CI: 14.3-20.5), musculoskeletal pain was 25.7% (95% CI: 17.3-35.1), multisite/general pain was 21.0% (95% CI: 18.5-23.6), and other pain was 6.9% (95% CI: 4.4-10.0).

3.4. Sex differences in the prevalence of chronic pain

Girls have a higher prevalence of chronic pain (18.3%) compared with boys (12.7%). Among all types and overall, except for back pain and musculoskeletal pain, there were significant differences between boys and girls, with girls having a higher prevalence of pain (**Table 5**). The largest discrepancies in the prevalence of pain by sex was among musculoskeletal pain, with girls having a prevalence of 43.1% (95% CI: 26.0-61.2), whereas boys had a prevalence of 26.8% (95% CI: 11.8-45.3). However, this difference was not significant, most likely due to low statistical power because only 10 studies were able to be included in this meta-analysis. The largest significant difference was for multisite/general pain with girls having a prevalence of 24.5% (95% CI: 21.7-27.4), whereas boys had a prevalence of 15.1% (95% CI: 13.2-17.0).

3.5. Risk of bias assessment

Most included studies were categorized as having either low (n = 57, 47.9%) or moderate (n = 55, 46.2%) overall risk of bias, with only 7 studies (5.9%) categorized as high risk (**Table 6**). The most common areas of bias across studies were lack of national representation (n = 97, 81.5%) and nonresponse bias (n = 74, 62.2%), whereas the least common areas of bias were inconsistent data collection methods (n = 0, 0%), sampling frame (n = 2, 1.7%), appropriate numerators and denominators (n = 14, 11.8%), and inadequate length of prevalence period (n = 14, 11.8%).

Table 5

Summary of pooled prevalence estimates by pain type and sex.

	Pooled proportion (95% CI)		
	Males	Females	Overall
Headache (n = 170)	15.1 (12.7, 17.6)	23.5 (19.9, 21.4)	19.1 (1.69, 21.4)
Abdominal (n = 138)	7.1 (5.8, 8.4)	11.3 (9.0, 13.8)	9.1 (7.8, 10.5)
Back (n = 154)	13.9 (11.9, 16.0)	15.1 (12.5, 17.9)	14.5 (12.9, 16.2)
Musculoskeletal (n = 10)	26.8 (11.8, 45.3)	43.1 (26.0, 61.2)	34.8 (22.4, 48.3)
Multisite/general (n = 96)	15.1 (13.2, 17.0)	24.5 (21.7, 27.4)	19.6 (17.7, 21.5)
Other (n = 10)	5.1 (3.7, 6.7)	9.7 (8.6, 10.9)	7.0 (4.9, 9.4)
Total (n = 574)	12.7 (11.6, 13.8)	18.3 (16.6, 20.0)	15.4 (14.4, 16.4)

Table 6

Risk of bias summary scores (n = 119)*†

Study (first author, year)	Item 1‡ Target population	Item 2§ Sampling frame	Item 3‖ Random selection	Item 4¶ Nonresponse bias	Item 5# Data collection	Item 6** Case definition	Item 7†† Reliability and validity	Item 8‡‡ Mode data collection	Item 9§§ Prevalence period	Item 10‖‖ Parameter calculations	Summary score (/10)	Overall category
Adegoke, 2015[1]	1	0	0	0	0	0	0	0	0	0	1	Low
Albuquerque, 2009[3]	1	0	0	1	1	1	0	0	0	0	4	Moderate
Al-Hashel, 2019[4]	0	0	0	1	0	0	0	0	0	0	1	Low
Al-Khotani, 2016[5]	1	0	0	1	0	0	0	0	0	0	2	Low
Alp, 2010[6]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Altamimi, 2014[7]	1	0	0	0	0	0	0	0	0	0	1	Low
Al-Tulaihi, 2009[8]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Arruda, 2010[10]	1	0	0	0	1	0	1	0	0	0	3	Moderate
Ayanniyi, 2011[11]	1	0	0	1	0	0	0	0	0	0	2	Low
Ayonrinde, 2020[12]	1	0	1	1	1	0	0	0	0	0	4	Moderate
Azabagic, 2016[13]	1	0	0	1	0	1	1	0	0	0	4	Moderate
Barçak, 2015[15]	1	0	0	0	0	0	1	0	0	0	2	Low
Bhatia, 2016[16]	1	0	1	0	0	0	0	0	0	0	2	Low
Bouzios, 2017[21]	1	0	0	1	1	0	0	0	0	0	3	Moderate
Buse, 2012[22]	0	0	0	1	1	0	0	0	0	0	2	Low
Çagliyan Türk, 2020[24]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Castro, 2013[27]	1	0	1	1	0	0	1	0	0	0	4	Moderate
Cavestro, 2014[28]	1	0	0	1	1	0	1	0	0	0	4	Moderate
Chiwaridzo, 2014[31]	1	0	0	0	0	0	0	0	0	1	2	Low
Chong, 2010[32]	0	0	0	1	0	0	0	0	1	0	2	Low
Cvetkovic, 2014[34]	1	0	0	0	0	0	1	0	1	0	3	Moderate
da Silva Jr, 2010[132]	1	0	0	0	0	0	1	0	0	0	2	Low
Dantas, 2021[35]	1	0	1	1	0	1	0	0	0	0	4	Moderate
de Melo Junior, 2019[98]	1	0	0	1	0	0	0	0	0	0	2	Low
Devanarayana, 2011[36]	1	0	0	0	0	0	0	0	0	0	1	Low
Devanarayana, 2011[37]	1	0	0	0	0	0	0	0	0	0	1	Low
Dhroove, 2017[38]	1	0	0	0	0	0	0	0	0	1	1	Low

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Table 6 (*continued*)

Study (first author, year)	Item 1‡ Target population	Item 2§ Sampling frame	Item 3‖ Random selection	Item 4¶ Nonresponse bias	Item 5# Data collection	Item 6** Case definition	Item 7†† Reliability and validity	Item 8‡‡ Mode data collection	Item 9§§ Prevalence period	Item 10‖‖ Parameter calculations	Summary score (/10)	Overall category
Dissing, 2017[39]	0	0	1	1	1	0	0	0	0	0	3	Moderate
Drozda, 2011[40]	1	0	0	1	0	1	0	0	0	0	3	Moderate
Du, 2011[41]	0	0	0	1	1	1	1	0	0	0	4	Moderate
Durmaz, 2013[42]	1	0	0	0	0	0	1	0	0	0	2	Low
Erdoğan, 2021[44]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Fabricant, 2020[45]	0	0	0	1	0	1	1	0	0	0	3	Moderate
Farrant, 2023[46]	1	0	0	1	0	1	1	0	1	1	6	High
Franco-Micheloni, 2015[47]	1	0	0	1	0	0	0	0	0	0	2	Low
Franz, 2014[48]	0	0	1	1	1	0	0	0	0	0	3	Moderate
Fuglkjaer, 2017[49]	0	0	0	1	1	1	0	0	0	0	3	Moderate
Genizi, 2013[50]	1	0	0	0	0	1	1	0	0	0	3	Moderate
Gobina, 2015[52]	0	0	0	1	0	0	0	0	0	1	2	Low
Gobina, 2019[51]	0	0	0	1	0	0	0	0	0	1	2	Low
Gulewitsch, 2013[55]	1	0	1	1	1	0	0	0	1	0	5	High
Gupta, 2009[56]	1	0	1	0	0	0	0	0	0	0	2	Low
Gustafsson, 2018[57]	1	0	1	1	0	1	0	0	0	1	5	High
Haraldstad, 2011[58]	1	0	0	1	0	0	0	0	0	0	2	Low
Harrison, 2016[59]	1	0	0	1	0	0	0	0	0	0	2	Low
Heinrich, 2009[61]	1	0	0	1	0	0	0	0	0	0	2	Low
Hoftun, 2011[63]	1	0	0	0	0	0	0	0	0	0	1	Low
Holstein, 2020[65]	0	0	0	0	0	0	0	0	0	0	0	Low
Holstein, 2022[64]	0	0	0	1	0	0	0	0	0	1	2	Low
Ivanova, 2022[69]	1	1	1	1	0	0	1	0	1	0	6	High
Jativa, 2016[70]	1	0	1	0	0	0	0	0	0	0	2	Low
Kadim, 2021[72]	1	0	1	0	0	0	0	0	0	0	2	Low
Kaltseis, 2022[73]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Katsuki, 2023[74]	1	0	0	0	0	0	1	0	0	0	2	Low
Kedra, 2013[75]	1	0	0	0	0	0	0	0	0	0	1	Low
Kedra, 2019[76]	1	0	0	1	0	1	0	0	0	0	3	Moderate
Khayat, 2021[78]	1	0	0	1	1	0	1	0	1	0	5	High

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Table 6 (*continued*)

Study (first author, year)	Item 1‡ Target population	Item 2§ Sampling frame	Item 3‖ Random selection	Item 4¶ Nonresponse bias	Item 5# Data collection	Item 6** Case definition	Item 7†† Reliability and validity	Item 8‡‡ Mode data collection	Item 9§§ Prevalence period	Item 10‖‖ Parameter calculations	Summary score (/10)	Overall category
Knezevic-Pogancev, 2010[80]	1	0	0	1	1	0	0	0	1	0	4	Moderate
Kolb, 2022[81]	0	0	0	1	0	0	0	0	0	1	2	Low
Krogh, 2015[83]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Kroner-Herwig 2011[84]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Kumar, 2017[85]	1	0	0	0	0	0	0	0	0	0	1	Low
Lipton, 2011[89]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Kemta Lekpa, 2021[77]	1	0	0	0	0	0	0	0	0	0	1	Low
Lu, 2016[91]	1	0	1	1	0	0	0	0	0	0	3	Moderate
Lucas, 2021[92]	1	0	0	1	1	1	1	0	0	0	5	High
Lukaszewska, 2013[93]	1	0	0	0	0	1	1	0	0	0	3	Moderate
Luntamo, 2012[94]	1	0	0	0	0	1	1	0	0	1	4	Moderate
Malik, 2012[96]	1	0	0	1	1	0	0	0	1	0	4	Moderate
Masiero, 2010[97]	1	0	1	1	0	1	0	0	0	0	4	Moderate
Meziat Filho, 2015[99]	1	1	1	1	0	0	0	0	0	0	4	Moderate
Meziat Filho, 2017[100]	1	0	1	1	0	0	0	0	0	0	3	Moderate
Mingels, 2022[101]	1	0	1	1	0	0	1	0	0	0	4	Moderate
Miró, 2023[102]	1	0	0	1	0	0	0	0	0	0	2	Low
Myrtveit, 2014[104]	1	0	0	1	0	1	0	0	0	0	3	Moderate
Nieswand, 2019[107]	1	0	1	1	0	0	1	0	0	0	4	Moderate
Noll, 2016[108]	1	0	0	0	0	1	0	0	0	0	2	Low
Nyame, 2010[109]	1	0	1	1	0	1	0	0	0	0	4	Moderate
Østeras, 2015[110]	1	0	1	0	0	0	1	0	0	0	3	Moderate
O'Sullivan, 2012[111]	1	0	1	0	0	1	0	0	0	0	3	Moderate
Oswari, 2019[112]	1	0	0	1	0	0	0	0	0	0	2	Low
Perera, 2016[115]	1	0	0	0	0	0	1	0	0	0	2	Low
Poyrazoglu, 2015[117]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Rau, 2021[118]	1	0	1	1	0	0	0	0	0	0	3	Moderate
Rho, 2012[119]	0	0	0	0	0	0	1	0	0	0	1	Low

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Table 6 (*continued*)

Study (first author, year)	Item 1‡ Target population	Item 2§ Sampling frame	Item 3‖ Random selection	Item 4¶ Nonresponse bias	Item 5# Data collection	Item 6** Case definition	Item 7†† Reliability and validity	Item 8‡‡ Mode data collection	Item 9§§ Prevalence period	Item 10‖‖ Parameter calculations	Summary score (/10)	Overall category
Saha, 2017[120]	1	0	0	1	0	0	0	0	0	0	2	Low
Santinello, 2009[121]	0	0	0	0	0	1	0	0	0	0	1	Low
Saps, 2009[124]	1	0	1	1	0	1	0	0	0	0	4	Moderate
Saps, 2014[123]	1	0	1	0	0	0	0	0	0	1	3	Moderate
Saps, 2017[122]	0	0	1	0	0	0	0	0	0	0	1	Low
Saps, 2018[125]	1	0	0	0	0	0	0	0	0	0	1	Low
Shan, 2013[126]	1	0	0	0	0	0	0	0	0	0	1	Low
Shaygan, 2020[127]	1	0	0	0	0	0	0	0	0	0	1	Low
Shuaibi, 2021[129]	1	0	0	1	0	0	0	0	0	0	2	Low
Sillanpaa, 2018[131]	1	0	0	1	0	0	1	0	0	1	4	Moderate
Siu, 2012[134]	1	0	0	0	0	0	0	0	0	0	1	Low
Sjölund, 2021[135]	1	0	0	0	0	0	0	0	0	0	1	Low
Sollerhed, 2013[136]	1	0	0	0	0	1	0	0	1	1	4	Moderate
Somayajula, 2022[137]	1	0	0	0	1	0	0	0	1	0	3	Moderate
Sperotto, 2014[138]	1	0	1	1	0	0	1	0	0	0	4	Moderate
Stahl, 2014[139]	0	0	0	1	0	1	0	0	0	1	3	Moderate
Swain, 2014[140]	0	0	0	1	0	0	0	0	0	1	2	Low
Torres-Ferrus, 2019[142]	1	0	1	0	0	0	1	0	1	0	4	Moderate
Tumin, 2018[144]	0	0	0	1	1	0	0	0	0	0	2	Low
Udoh, 2016[146]	1	0	0	0	0	0	0	0	0	0	1	Low
van den Heuvel, 2020[62]	1	0	0	1	1	0	0	0	0	0	3	Moderate
Van Gessel, 2011[147]	1	0	0	1	0	0	1	0	0	0	3	Moderate
Vierola, 2012[149]	1	0	1	1	1	1	1	0	0	0	6	High
Vila, 2012[150]	1	0	0	0	0	0	0	0	0	0	1	Low
Wager, 2020[151]	1	0	0	1	0	0	0	0	0	0	2	Low
Walter, 2014[155]	0	0	0	1	0	1	1	0	0	0	3	Moderate
Wijga, 2021[156]	0	0	0	1	0	0	1	0	0	0	2	Low
Wilkes, 2021[157]	0	0	0	1	1	0	0	0	1	1	4	Moderate
Wurm, 2018[161]	1	0	0	0	0	0	1	0	0	0	2	Low

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Table 6 (*continued*)

Study (first author, year)	Item 1‡ Target population	Item 2§ Sampling frame	Item 3‖ Random selection	Item 4¶ Nonresponse bias	Item 5# Data collection	Item 6** Case definition	Item 7†† Reliability and validity	Item 8‡‡ Mode data collection	Item 9§§ Prevalence period	Item 10‖‖ Parameter calculations	Summary score (/10)	Overall category
Yao, 2011[162]	1	0	1	0	0	0	0	0	0	0	2	Low
Zablah, 2015[163]	1	0	1	0	0	0	0	0	0	0	2	Low
Zeevenhooven, 2020[165]	1	0	0	1	0	0	0	0	1	0	3	Moderate
Zhang, 2015[166]	1	0	0	0	0	0	0	0	0	0	1	Low

* "0" = low risk, "1" = high risk.
† 0 to 2 = low risk (further research is very unlikely to change our confidence in the estimate); 3 to 4 = moderate risk (further research is likely to have an important impact on our confidence in the estimate and may change the estimate); 5 to 10 = high risk (further research is very likely to have an important impact on our confidence in the estimate and is likely to change the estimate).
‡ Item 1: Was the study's target population a close representation of the national population in relation to relevant variables, eg, age, sex, occupation?
§ Item 2: Was the sampling frame a true or close representation of the target population?
‖ Item 3: Was some form of random selection used to select the sample, OR, was a census undertaken?
¶ Item 4: Was the likelihood of nonresponse bias minimal?
# Item 5: Were data collected directly from the subjects (as opposed to a proxy)?
** Item 6: Was an acceptable case definition used in the study?
†† Item 7: Was the study instrument that measured the parameter of interest (eg, prevalence of low back pain) shown to have reliability and validity (if necessary)?
‡‡ Item 8: Was the same mode of data collection used for all subjects?
§§ Item 9: Was the length of the shortest prevalence period for the parameter of interest appropriate?
‖‖ Item 10: Were the numerator(s) and denominator(s) for the parameter of interest appropriate?

4. Discussion

This systematic review provides updated estimates of the prevalence of chronic pain in children and adolescents based on the literature published since 2009. Based on 119 studies and 446 data points across 70 countries, the prevalence of chronic pain in children and adolescents was estimated at 20.8%, which is equivalent to 1 in 5 children worldwide experiencing chronic pain. Given the high degree of heterogeneity, which demonstrates the variability among the results of individual studies, the pooled prevalence should be interpreted with caution. However, the risk of bias for the included studies was predominantly low or moderate, suggesting that the evidence at the study level is reliable. Girls have a higher prevalence of chronic pain than boys, among all types and overall, except for back pain and musculoskeletal pain.

The prevalence estimates yielded in this study are in line with those reported in the last comprehensive systematic review on the epidemiology of chronic pain in children and adolescents over a decade ago.[79] The previous review published in 2011 was not a meta-analysis but instead reported that the median prevalence of chronic pain in children and adolescents ranged from 11% to 38% depending on pain type.[79] They similarly found that the prevalence of chronic pain was higher in girls than in boys but were not able to provide meta-analysis prevalence estimates. Thus, as an updated systematic review and meta-analysis on the prevalence of chronic pain in children and adolescents, the current review was able to provide reliable evidence on the prevalence of chronic pain that has been published since 2009.

Our findings suggest that chronic pain in children and adolescents continues to be a common health issue and despite advances in pain prevention and management[33,160] and calls for transformative action in the field,[43] there are still significant numbers of children and adolescents experiencing chronic pain. Furthermore, a few recent studies of chronic pain in children and adolescents during the COVID-19 pandemic found a decrease in the prevalence compared with a prepandemic cohort.[9,118] Other studies suggest that the COVID-19 pandemic has had a negative impact on children and adolescents with chronic pain,[105] which could potentially set back any progress made. The current review was not able to compare any differences in relation to the COVID-19 pandemic due to limited number of studies collecting data during this period. However, this potential issue should continue to be explored to determine whether any changes in prevalence occurred due to the COVID-19 pandemic and the mechanism by which this may or may not be occurring.

Although there are other systematic reviews on the prevalence of chronic pain in children and adolescents, the current review is the most comprehensive, examining chronic pain in children from 0 to 19 years from all countries. Other reviews are limited by pain type,[20,30] age ranges,[20] and geographical locations.[30,88] These differences may help explain variation in the prevalence of chronic pain reported. For instance, in the current review, the prevalence of abdominal pain was found to be 17.3%, yet in other systematic reviews, the prevalence has ranged from 8.4%[30] to 13.5%.[82] These differences are likely related to different definitions of chronic pain or differences in populations studied, including geographical location. Thus, the current review offers a broad picture of the evidence on the prevalence of chronic pain as defined by the ICD-11, in children and adolescents aged 0 through 19 years worldwide.

Girls had a higher prevalence of chronic headaches, multisite/general pain, and overall pain than boys. This is a similar finding to Liao et al.[88] who found that headache, abdominal, and multisite/

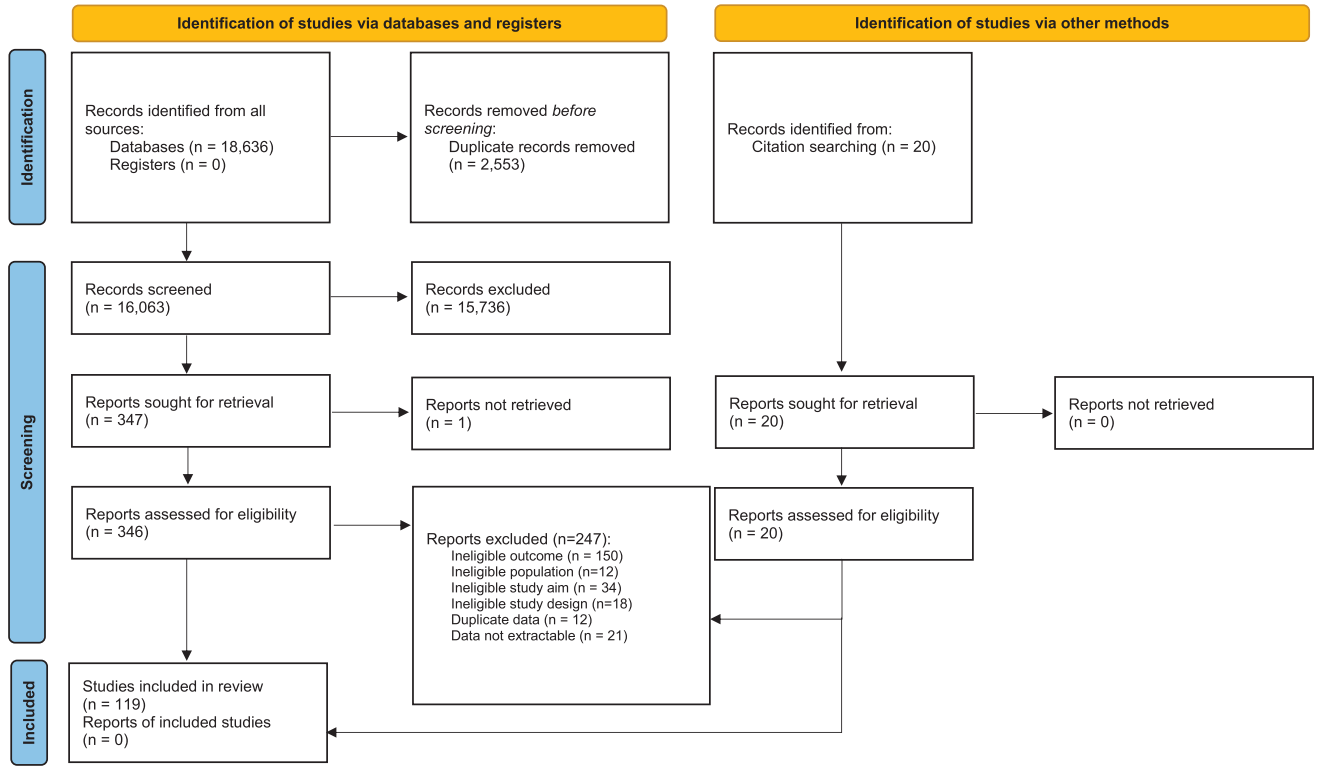

Figure 1. PRISMA 2020 flow diagram.

general pain were also more prevalent in girls than in boys in their meta-analysis on pediatric chronic pain in low-income and middle-income countries. The higher pain prevalence in girls in comparison to boys may be related to pubertal development, as it has been established that sex differences in pain often emerge during adolescence[87] and differences in pain experienced during experimental pain tasks start to differ around 12 years of age.[17] The lack of sex differences in back and musculoskeletal pain are of note and worthy of future research. Furthermore, there is an important distinction between sex (biological) and gender (social constructed roles and expression), yet gender is rarely studied directly.[18] As research continues to expand in this area, specific research into sex and gender differences among children and adolescents with chronic pain is recommended to understand the biopsychosocial factors that influence this difference. Furthermore, it is important to consider potential differences between sex and gender and its impact on pediatric chronic pain, as gender is increasingly recognized as a more fluid entity and there is a paucity of evidence in transgender and gender-diverse adolescents.[19] Although there is evidence on the increased risk of pain experiences in gender-diverse youth,[19] there is a lack of evidence on the prevalence in this population, suggesting an important area for future exploration.

The continued high prevalence of chronic pain in children and adolescents underscores the need for continued research and knowledge mobilization to prevent and manage pain in children and improve early diagnosis. In a recent review, the current knowledge around pediatric chronic pain was unsatisfactory among healthcare providers, especially for assessment and management.[116] Given the substantial evidence around pediatric pain, there is an increased need for knowledge mobilization of this evidence to not only healthcare providers but also parents, who act as advocates for their children.[29] For example, Solutions for Kids in Pain (SKIP) is a Canadian knowledge mobilization network that seeks to bridge the gap between evidence-based solutions and current treatment practices.[68] To move the needle on chronic pain in children and adolescents, new and innovative ways to disseminate knowledge are needed.

Despite an attempt to explore differences in the prevalence of chronic pain in children and adolescents because of sociodemographic (eg, age, race) and psychosocial (eg, anxiety, depression, sleep) factors, only differences due to sex were able to be analyzed. Analysis based on age was not possible due to substantial variation in the range of ages that were included in studies and variation in how age comparison was reported within each study. In addition, analysis based on race was not possible as no studies reported differences in chronic pain prevalence by race. The lack of consistent or available data is a significant limitation in the field, as this limits the ability to understand the impact of chronic pain based on equity, diversity, and inclusivity (EDI) variables. The experience of chronic pain has been shown to be interconnected with social inequities and structural violence[154] with certain populations, such as indigenous populations[71] and people of color[164] experiencing higher pain symptoms than the general population. Therefore, more work is needed to understand the prevalence of chronic pain in children and adolescents from Black, Indigenous, and People of Color (BIPOC) populations.

Furthermore, because of differences in measurement tools used and timing of when data was collected, no meta-analysis on psychosocial variables was possible. Further research should consider using similar standardized measures of psychosocial factors,[114] which would facilitate a greater ability to consider how psychosocial variables are related to chronic pain in children and adolescents.

4.1. Strengths and limitations

This systematic review has several identified strengths. First, a comprehensive literature search was used to identify eligible studies, and a meta-analysis was conducted to determine the prevalence of chronic pain in children and adolescents. This is an improvement over the last systematic review, which did not include a meta-analysis. The current review ensured that included studies were similar in definition and methodological approaches, which allowed for meta-analyses to be performed, thus strengthening the estimates on the prevalence of chronic pain in children and adolescents. Second, all the studies included in this review underwent critical appraisal and were predominantly considered low-to-moderate risk of bias, suggesting that the quality of data included is much improved since previous iterations of this review.[54,79] Third, a clear definition of chronic pain that is consistent with the literature[106] was used to determine which studies were eligible for inclusion in the meta-analysis. This resulted in some studies being deemed ineligible because of the use of definitions that were unclear or that did not meet the IASP[106] definition of chronic pain, such as asking participants about their pain over the past month, rather than over 3 months.

Despite these strengths, this review does have some limitations. First, there was significant between-study heterogeneity in the meta-analysis with the I^2 at 99.9%, and thus, the prevalence estimates should be interpreted with caution. This can be related to the fact that a variety of chronic pain types were included, as well as different time points of measurement (eg, weekly, monthly, recurring), different ages (ie, 0-19 years), and different definitions of chronic pain types (eg, using the ROME criteria to determine the presence of abdominal pain). Despite this limitation, the significant number of studies included in the meta-analysis lends strength to the general findings.

In addition, because of reporting in the original articles, the number of cases in a study was often calculated from reported prevalence and vice versa. Although this did not have a major impact on the overall prevalence calculation for the current study, it did result in some discrepancies between the overall and sex-based analyses, where the number of cases in the sex analysis did not always match the overall prevalence cases. This resulted in different prevalence estimates for the pain types overall in studies included in the sex analysis and those included in the full analysis. Furthermore, as not all studies provided a comparison by sex, not all studies were able to be included in the sex meta-analysis, leading to different overall prevalence estimates for each pain type. Nevertheless, the difference in cases and prevalence was not substantial and is unlikely to have significantly affected the findings. Furthermore, because of the lack of consistent reporting or splitting of age groups in analysis, no analysis was possible related to age, despite evidence suggesting that chronic pain can vary based on age.

Another limitation is that as an updated systematic review, the search was limited to articles published between 2009 and 2023. Although results are likely an indication of prevalence estimates during that time, this review did not explore the relation between time of data collection and prevalence.

A final limitation is the original articles used self-reported and parent-reported data, which can be influenced by recall bias. However, using a chronic pain definition that includes a time frame of having chronic pain for at least the past 3 months is likely to minimize this limitation as the time point is a recent recall period.

4.2. Future directions and recommendations

This review highlights several areas of recommendations related to the future of research on the prevalence of chronic pain in children and adolescents. First, it is important to ensure that the definition of chronic pain used in future prevalence studies is consistent with the IASP and ICD-11's definition of chronic primary pain[67,106] and any future definitions specific to children and adolescents. Second, improved reporting on the prevalence of chronic pain based on age, race, and psychosocial outcomes is recommended, including provision of prevalence at the granular level (eg, by each age, by race) when possible. Third, consideration of how the COVID-19 pandemic has affected the prevalence of chronic pain is recommended for future exploration, including a consideration of the impacts of long COVID and the unknown impact on children. Fourth, it is important to expand beyond the boy–girl dichotomy with enhanced nuance needed in the field to allow for a broader sex-based and gender-based analysis to better understand how chronic pain may vary in these populations.

5. Conclusions

Although the prevalence of chronic pain varies by pain type, approximately 1 in 5 children and adolescents experience chronic pain, with girls often experiencing a higher prevalence than boys overall and in headache, back pain, and other pain. The findings of this review enhance our understanding of the current burden of pediatric chronic pain, which may help inform the treatment and allocation of clinical resources for this population.

Conflict of interest statement

The authors have no conflicts of interest to declare.

Acknowledgements

The authors thank Dr. G. Allen Finley (Department of Anesthesia, Pain Management & Perioperative Medicine, Dalhousie University & Centre for Pediatric Pain Research, IWK Health) for his clinical perspective at the early stages of this project. They also thank Dr. Samuel Stewart (Department of Community Health and Epidemiology, Dalhousie University) who provided data analytical support at the early stages of this project and Jessica Savoie (Research Assistant, IWK Health) and Alicia Reil (Research Assistant, IWK Health) for assisting with data verification.

Sources of funding and support: This work was supported by an operating grant from the Canadian Institutes of Health Research (CIHR; FRN167902) awarded to C.T.C. C.T.C. is the senior author and is supported by a Tier 1 Canada Research Chair with infrastructure support from the Canada Foundation for Innovation. C.L. was supported by an IWK Health Summer Studentship [1025420]. P.R.T. was supported by a Scholars Award from Research Nova Scotia, a Nova Scotia Graduate Scholarship, and an IWK Graduate Studentship Award. J.D. was supported by a CIHR Fellowship (FRN181869).

Data transparency and sharing: As this is a review, no new data have been generated.

Authorship: C.T.C. had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. C.T.C. conceived the study idea. C.L., P.R.T., and J.A.P. designed the study protocol. N.P. and J.D. led the data extraction. C.L. and B.C. led the quality

appraisal. A.G. led the meta-analysis. J.D., J.A.P., P.R.T., C.T.C., and B.C. wrote the first draft of the manuscript. All authors provided critical insights at all stages. All authors approved and contributed to the final manuscript. Authorship decisions were guided by the ICMJE guidelines.

PROSPERO registration number: CRD42020198690.

Supplemental digital content

Supplemental digital content associated with this article can be found online at http://links.lww.com/PAIN/C50.

Article history:
Received 19 December 2023
Received in revised form 28 February 2024
Accepted 18 March 2024
Available online 15 May 2024

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