



A scoping review of chronic pain in emerging adults

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Abstract

Much of the adult chronic pain literature addresses pain in typical pain cohorts of middle-aged to older individuals. To date, little research has focused on chronic pain in younger adults, who likely have a completely different pain experience. This scoping review aimed to address this gap by describing the emerging adult (18–29 years) chronic pain experience regarding prevalence, associated factors, outcomes, and pain management. Searches of primary electronic databases including PubMed, Embase, PsycINFO, and CINAHL were performed on February 26, 2020, restricting the publication date from database inception to December 31, 2019. The search strategy, conducted in English, covered search term combinations of “chronic pain” and “young adults.” A total of 6,612 records were considered—3,141 after removing duplicates. These records were screened by title and abstract; 871 through full-text screening. Of these, 78 articles covered the topic of emerging adults with chronic pain. Collectively, results indicated that between 5% and 30% of emerging adults experience chronic pain, depending on the sample and exact chronic pain definition. The most consistent associated factors were female sex, familial chronic pain, and previous experiences of chronic pain in childhood. Anxiety, depression, and sleep issues appeared associated both before and after the onset of chronic pain. Outcomes of pain included interruptions to study and work, poorer physical functioning, and pain-related interference to socializing. We observed that few pain treatments have been tested specifically in this cohort. A greater ongoing focus on chronic pain in emerging adults is required to improve long-lasting outcomes.

Keywords: Emerging adulthood, Young adults, Youth, Chronic pain, Headache, Musculoskeletal pain, Abdominal pain, Review

1. Introduction

Chronic pain is a highly prevalent issue internationally, estimated to occur in 30% to 50% of the adult population.^{26,48,85} Across epidemiological studies, the oldest adult age groups consistently report the highest chronic pain prevalence, with prevalence increasing across the lifespan with age.^{11,17,26,48,51,85}

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

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Unsurprisingly, much of the adult chronic pain literature addresses pain in typical pain cohorts of middle-aged to older individuals.³⁹ To date, little research has focused on chronic pain in younger adults, who likely have an entirely different chronic pain experience.

Emerging adulthood is a term to describe young adults aged 18 to 29 years⁵ and a developmental stage that is particularly observable in modern industrial societies.⁶ Critical neurological developments occur during this stage, particularly in frontal brain regions which control higher order cognitive functions such as decision-making, response inhibition, and interference suppression.^{16,79,88} This occurs in conjunction with psychosocial characteristics of exploring identity, identifying long-term aspirations and vocational goals, seeking social connectivity, and increasing independence from parents.⁶

Unique vulnerabilities associated with chronic pain in emerging adults may directly impact on these developmental characteristics, causing conflict between developmental goals and expectations vs physical, cognitive, and psychological limitations associated with pain. For example, 2 qualitative studies of emerging adults diagnosed with chronic pain identified common themes of fewer employment and educational opportunities, feeling isolated from peers, a lack of validity in their illness because of their young age, and increased dependence on parents and services.^{83,87} Accessing appropriate treatment can also be particularly difficult in this developmental stage.⁸³ For example, emerging adults have reported they were unable to relate to others in adult therapeutic group settings, as the therapy targeted the needs and experiences of older adults who made up a majority of the group.⁸³ Furthermore, because of the lack of subgroup analyses on this

cohort, it is not clear whether currently available adult treatments are successful in meeting their treatment goals.⁷⁷

Although some reviews on specific pain types in this cohort exist,^{20,47,82} to date, there has been only one review covering chronic pain; a narrative review focusing on pain-related outcomes in emerging adults.⁷⁷ As a summary of the pain-related experiences of emerging adults does not yet exist, and the characteristics of the body of the academic literature covering this topic remain unknown, the aim of our review was to provide a broad summary of the available research covering prevalence, associated factors, outcomes, and management of chronic pain in emerging adults. The authors chose scoping review methodology to address these aims of mapping the potentially large and diverse body of the available literature,^{4,70,74} rather than systematic review methodology, which would better synthesize the best available research on a specific question.⁷⁰

2. Method

2.1. Search strategy

Before commencing, Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines⁶⁹ and the extension for scoping reviews⁸⁴ were consulted. To obtain research covering the interprofessional health care field, searches of primary electronic databases including PubMed, Embase, PsycINFO, and CINAHL were performed on February 26, 2020, restricting the publication date from database inception to December 31, 2019. The search strategy, conducted in English, covered search term combinations of “chronic pain” and “young adults.” Search terms were combined using Boolean logic. The search terms were developed and tested by the research team and amended after peer feedback by researchers experienced with this methodology. Broad search terms were deliberately chosen to capture the scope of literature, and thus, we chose to restrict the search strategy to the title alone. The search strategy is available in **Table 1**. Reference lists of relevant review articles and selected articles were also perused for additional relevant literature. Database search results were transferred into EndNote to assist with identifying duplicates and then transferred into a Microsoft Excel spreadsheet.

2.2. Study selection

2.2.1. Inclusion criteria

Studies were eligible for inclusion if they met the following criteria: (1) published in English, (2) primary research study published in an academic journal (eg, qualitative and quantitative studies, clinical trials), (3) focused on participants aged between 18 and 29 year old, and (4) described chronic pain. Additional details about age and pain definitions were as follows.

2.2.1.1. Age

Most of the sample included participants aged 18 to 29 years. Where emerging adults were only a proportion of the cohort, studies were included if the mean age minus one standard deviation (SD) for younger cohorts or plus one SD for older cohorts, fell within the target age range. In addition, studies were included if subanalysis of the target group was reported separately.

2.2.1.2. Chronic pain

The study included participants who had functionally restricting, or nonspecific recurrent pain or chronic pain. This was

Table 1

Search strategy for electronic databases.

Search subject	Search terms
Chronic pain	Chronic pain OR recurrent pain OR persistent pain OR functional pain OR headache* OR abdominal pain OR musculoskeletal pain OR back pain
Emerging adults	Young adult* OR adolescen* OR emerging adult* OR student* OR youth* OR teen*

identified as repeated pain experienced in the same location at least monthly over at least a 3-month period or clinically diagnosed chronic pain. In addition, because headache is often described according to the International Headache Society (IHS) definitions,^{43–45} episodic and chronic tension-type headache (TTH) (minimum of 10 episodes over 12 months) and migraine (minimum of 5 migraine attacks) were included. Specific diseases causing pain were not sought out.

2.2.2. Exclusion criteria

Studies were excluded if they (1) described a majority of participants younger than 18 years or older than 29 years or did not report separately on emerging adults, (2) described acute pain or did not provide enough information to determine whether the pain described was chronic, (3) described a sample without chronic pain, such as university students learning about chronic pain, and (4) were case studies.

2.3. Study screening

After removing duplicates, studies were initially screened by title and abstract for inclusion and exclusion criteria by 6 staff members at the German Paediatric Pain Centre, and reviewed by the first author (D.B.) and second author (S.S.). Articles in which the criteria were met, as well as those that were undecided or unclear, were retained for full-text screening. Full-text articles were screened by the first (D.B.) and second (S.S.) author. During screening, disagreement emerged for 26 articles. Discussion of these inconclusive full texts occurred within the team until consensus was reached.

2.4. Data extraction

Data were extracted from each article into a Microsoft Excel spreadsheet. Data extraction of study characteristics included descriptive characteristics (authors, year, title, journal, volume, issue, pages, country of corresponding author, abstract, study design, study setting, and study findings), pain characteristics (definition of pain, pain duration, measures of pain, and pain type/location), and participant characteristics (sample size, proportion female/male, mean age, age range, and number of participants with chronic pain). In addition, content was extracted on the topics of interest for this review, including prevalence, associated factors, outcomes, and management of chronic pain. Here, associated factors refer to factors that precede or co-occur with chronic pain. A clear causal relationship cannot necessarily be assumed. Outcomes refer to changes that emerge or a new phenomenon that seems to occur after the onset of chronic pain, or effects of the pain condition that are reported by young adults.

3. Results

Information obtained from the data extraction process was stratified into 4 general topics covering chronic pain in emerging adults based on the study aims: (1) prevalence, (2) associated factors, (3) outcomes, and (4) chronic pain management. Because of the breadth of the literature, the associated factors section was stratified into biological, psychological, social, and lifestyle subsection themes, based on the biopsychosocial model of chronic pain.²⁹ Content for all topics was further grouped into meaningful subtopics driven by study content.

3.1. Study selection

A total of 6,551 records were identified through electronic database searches, and a further 61 records were considered during hand-searching of relevant review articles and key papers. After removing duplicate records, 3,141 records were screened by title and abstract. A further 2,270 were removed, resulting in 871 full-text articles being reviewed. A total of 793 did not meet the inclusion criteria, resulting in 78 articles covering the topic of emerging adults with chronic pain. See **Figure 1** for full Preferred Reporting Items for Systematic Reviews and Meta-Analysis study selection process.

3.2. Study characteristics

Characteristics of the included studies can be seen in **Table 2**. Included research was conducted in 26 countries, with a median of 2 articles published per country. The United States was an outlier with 19 publications. All studies were published between January 1988 and October 2019, with 94.9% published since 2000 and 61.5% published since 2010. Regarding chronic pain topics covered in this review, the topics of prevalence and associated factors of chronic pain in emerging adults have been consistently researched across this time span, whereas outcomes of chronic pain and management of chronic pain have received more attention in recent years—see **Figure 2**. Supplementary Table 1 provides details of all included studies (available at <http://links.lww.com/PR9/A100>).

Of studies reporting discrete sample sizes ($n = 75$) and excluding duplicate study samples ($n = 5$), 148,811 emerging adults were represented in the included research. Just over half (56.1%) were women, and the mean weighted age was 22.3 years. In total, 78,364 emerging adults with chronic pain were included.

3.3. Prevalence of chronic pain in emerging adults

Prevalence rates for chronic pain were difficult to establish, given the diversity in chronic pain definitions, and variations in participant demographics and study characteristics. Broadly, between 5% and 20.5%^{11,12,17,48,51,62} of emerging adults reported chronic pain in epidemiological surveys. Slightly higher prevalence rates were reported in an intercontinental population-based study of 17 countries,⁸⁵ in which 30.4% (developed countries) to 35.2% (developing countries) of young women and 20.9% (developed countries) to 22.0% (developing countries) of young men met the study's criteria for chronic pain.

Reoccurring headaches were more universally defined, with most studies using the IHS guidelines for TTH and migraine^{43–45} to report prevalence. However, despite the consistent definition of headache, sample selection issues were prevalent in the research on this topic, contributing to wide ranges and potentially

unreliable findings. In population-based studies, migraine rates varied from 7.4% to 24.5% in emerging adults^{14,67,78,91,94} and TTH prevalence rates varied from 11.1% to 15.8%,^{67,91,94} although one population-based twin study reported considerably higher rates.⁷⁸ Differences in study methodology, ie, whether cases of combined TTH and migraine were separated,^{91,94} and sample selection based on health scores,⁶⁷ presence of insurance¹⁴ or being a twin,⁷⁸ likely affect these rates. A large number of studies were also conducted with participant samples selected from community-based settings; in all but 1 study, these were with university students, particularly medical students in which higher than average rates of headaches were hypothesized.^{1,8–10,18,24,33,42,49,50,52,55,58,59,72,73,90,102} Rates of both headache types ranged widely, again likely because of methodological differences and uncontrolled biases, such as selective sampling. Migraine rates varied from 6.4% to 28.5%^{1,8–10,18,24,42,49,52,55,58,59,72,73,90,102} and TTH rates varied from 12.8% to 66.8%.^{8–10,18,24,33,49,50,52,55,58,59,72}

Other specific locations of chronic pain were not meaningfully covered in the included literature. Few studies reported on chronic musculoskeletal pain, meaning prevalence rates are not adequately represented. Only one population-based study was conducted, which assessed prevalence through 2 large cross-sectional surveys 11 years apart (1995–1997; 2006–2008) in Norway.³⁶ During this survey, prevalence rates increased from 25.6% to 29.3%.³⁶ Other studies of chronic musculoskeletal pain were conducted with university student samples,^{23,66,68,89} in many cases selectively chosen because of concerns about training-related elevated risk of musculoskeletal pain. Prevalence of chronic abdominal pain was covered by only 1 study that assessed the prevalence of irritable bowel syndrome (IBS) in a sample of German university students.³⁴ Similarly, chronic widespread pain was investigated in 1 South Korean study of university students.⁵³ Supplementary Table 2 includes specific pain definitions and prevalence rates for each study (available at <http://links.lww.com/PR9/A100>).

3.4. Associated factors of chronic pain

Factors associated with chronic pain in emerging adults were covered widely, mostly in cross-sectional studies. Difficulty exists in determining temporality of factors reported here regarding their onset and the onset of chronic pain. A summary of topics identified in the literature can be seen in **Table 3**.

3.4.1. Biological factors

3.4.1.1. Sex

Being female, rather than male, has been associated with an increased risk of chronic pain in emerging adulthood and has been observed in mostly cross-sectional research covering primary headache,^{30,42,54,60,78} chronic musculoskeletal pain^{54,66}, abdominal complaints,³⁴ and chronic pain generally.^{31,85} In addition, in a review of tertiary pain clinic patients' medical charts, women reported more pain locations than men.³

3.4.1.2. Age

Only a small number of cross-sectional studies have considered age across emerging adulthood as a risk factor for chronic pain. In a study of IBS, age was not associated with the presence of the condition.³⁴ However, in 2 university-based cross-sectional studies of chronic back pain, older age increased the likelihood

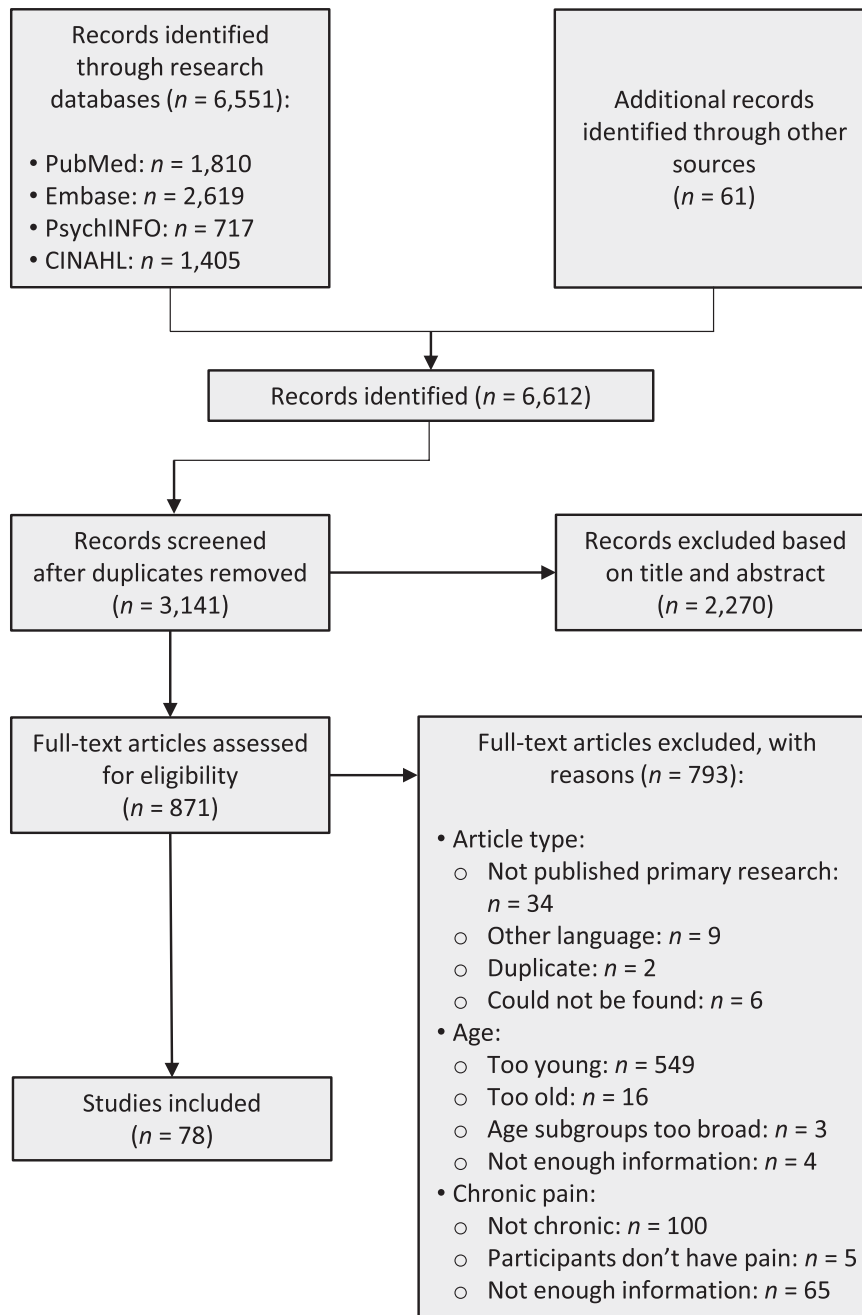


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (2009) flow chart of articles identified for inclusion and exclusion of chronic pain in emerging adults scoping review.

of chronic back pain,⁶⁸ and university students in more advanced years of study had higher prevalence of pain.⁶⁶ A similar trend was reported in 2 studies of chronic headache, but only in women. In a cross-sectional study of migraine in senior high-school students,¹ and in a large Scandinavian population-based study of twins,⁷⁸ older subgroups had significantly higher migraine prevalence than younger subgroups. This was not found for TTH.⁷⁸

3.4.1.3. Earlier experiences of chronic pain

Cross-sectional^{34,42} and longitudinal^{37,38,54,95,98,99} studies of chronic pain in emerging adults have consistently found previous chronic pain to be a precursor to experiencing chronic pain in

emerging adulthood. Furthermore, this has been found when pain is assessed in the same region,^{34,37,38,42,54,98,99} as well as in other bodily regions.^{34,37,95} Results from a prospective study in close to 9,600 Danish twins identified a dose response, in which more days with lower back pain in adolescence increased the risk of persistent back pain in emerging adulthood.³⁸

3.4.1.4. Family history of chronic pain

A family history of chronic pain is often observed among emerging adults with chronic pain. A retrospective study found familial chronic pain was associated with 2.5 to 3 times the risk of chronic pain in emerging adults⁶⁴ and was later supported by a prospective study of clinical pain patients, in which worse pain

Table 2**Summary of characteristics of the included studies.**

Study characteristic	Number (n = 78)	Proportion (%)
Year published		
<1990	1	1.3
1990–1994	3	3.8
1995–1999	0	0.0
2000–2004	10	12.8
2005–2009	16	20.5
2010–2014	21	26.9
2015–2019	27	34.6
World region*		
North America	23	29.5
Middle East	11	14.1
Oceania	8	10.3
Northern Europe	7	9.0
United Kingdom	5	6.4
Western Europe	5	6.4
Chinese Asia	4	5.1
South America	4	5.1
Southern Europe	3	3.8
Eastern Europe	3	3.8
Central and West Africa	2	2.6
South Eastern Europe	1	1.3
Japan and Korea	1	1.3
Southern and East Africa	1	1.3
Sample size†		
>100	10	13.3
100–499	26	34.7
500–999	12	16.0
1000–4999	21	28.0
5000+	6	8.0
Type of chronic pain‡		
Headache	36	45.0
Musculoskeletal	16	20.0
Abdominal	5	6.3
General chronic (or multisite)	23	28.8
Study design		
Cross-sectional observational	51	65.4
Prospective cohort	18	23.1
Retrospective case-control	2	2.6
Randomized controlled trial	2	2.6
Cross-sectional experimental	1	1.3
Noncontrolled trial	1	1.3
Mixed design	1	1.3
Cross-sectional qualitative interview	2	2.6

* World regions as per ABS.⁷

† n = 75, because of 3 studies not reporting the emerging adult subgroup sample size.

‡ n = 80, because of 2 studies reporting on both headaches and musculoskeletal pain.

outcomes were found in those reporting parental chronic pain regardless of parent or child sex.⁸¹ Having 2 parents with chronic pain worsened health outcomes further.⁸¹ This association has also been reported in chronic headache. In 2 longitudinal studies assessing childhood predictors of chronic headache, frequent parental headaches were a significant predictor of chronic pain in emerging adulthood,^{54,91} and many cross-sectional studies assessing chronic headaches in emerging adults have confirmed observations that parents^{18,60,90} and/or family members^{42,60} often have a family history of problematic headaches.

3.4.1.5. Preterm delivery and low birth weight

A longitudinal study of individuals delivered preterm and with low birth weight (≤ 1500 g) found that they had 2.6 times the risk of chronic pain in emerging adulthood, and individuals who were term but small for gestational age had 3.6 times the risk of chronic pain, compared with a control group.⁴⁶ Similarly, researchers in another study found low birth weight and neonatal intensive care

unit admission increased the likelihood of having musculoskeletal chronic pain in adulthood by 2.2 and 1.6 times, respectively.⁶³ However, null findings between perinatal complications and headaches presence in young adulthood have also been reported.⁹¹

3.4.1.6. Neurobiology

Neurobiological differences have been identified between those with and without chronic pain, although temporality was not examined. In an experimental case control study, 20 young adults with and without chronic lower back pain were compared in their motor neuronal network activity.⁸⁶ Individuals with lower back pain had reduced map volume of lower back muscles when the motor cortex was stimulated by transcranial magnetic stimulation, indicating that they had reduced and more generalized cortical organization of inputs to back muscles. In a second experimental study, 349 emerging adults grouped into persisting chronic abdominal pain, remittent abdominal pain, and healthy controls were presented with 2 stress-provoking situations. Heart rate variability was found to be reduced only in women with an ongoing chronic pain condition, suggesting reduced parasympathetic “braking” of sympathetic activity, both at rest and in stress. Consequently, poorer parasympathetic regulation may increase the risk of chronic abdominal pain.⁹⁷

3.4.1.7. Illness, injury, and posture

Few studies have assessed the link between illness, injury, and posture and chronic pain in emerging adults. Emerging adults with a primary headache condition have reported lower ratings of their health than controls.⁹⁴ Illness in childhood has also been associated with chronic pain, with admittance to the hospital during childhood and having more illness than peers in secondary school increasing the likelihood of chronic pain in emerging adulthood by 1.7 times and 4 times, respectively.⁶⁴ Similarly, a history of head trauma,⁶⁰ arterial hypertension,⁶⁰ and childhood neck or back injury⁹¹ have been associated with primary headaches in emerging adults in some studies. Others have reported null findings for mild traumatic head injury⁹¹ and cervical disc degeneration.⁵⁶ Limited, primarily cross-sectional evidence exists regarding a role of posture in chronic musculoskeletal pain. Compared with university students without chronic pain, those with chronic lower back pain had a more extended posture during load transfer tasks,⁶⁸ and those with chronic neck-shoulder pain had more spinal rotation during smart phone use.¹⁰¹ Another study found no link between thoracic curvature and chronic back pain.⁴⁰

3.4.2. Psychological factors

3.4.2.1. Anxiety and depression

Anxiety and depression have been considered both before and after the onset of chronic pain (also see Section 3.5.3). In a longitudinal birth cohort, after adjusting for sex, childhood, and maternal history of headache, high ratings of anxiety symptoms in childhood, high anxiety in adolescence, or an anxiety diagnosis in emerging adulthood all increased the likelihood of migraines, but not TTH, at age 26.⁹¹ In cross-sectional community-based research, temporality was not assessed, although a pattern of comorbid presentation was frequently observed. Generally, depression was more common among migraineurs than other headache types or no headaches in a cohort of women.¹⁸ In other

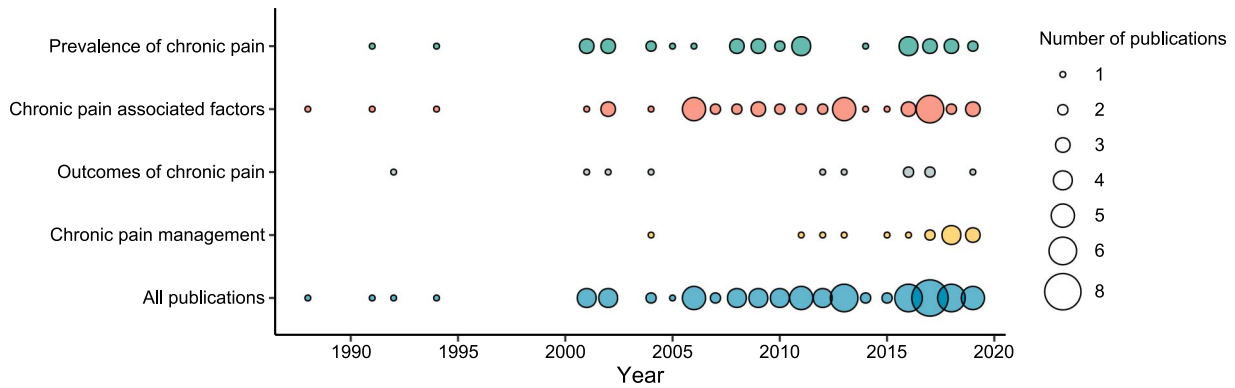


Figure 2. Number of research articles included in the review by the year of publication and topic. Publications that addressed multiple topics were included in each category.

studies, depressive symptoms were associated with increased likelihood of comorbid migraines by between 2.1 times and 4.4 times.^{14,42,59} In one of these studies, depressed mood was twice as likely in women with TTH.⁵⁹ Having anxiety similarly increased the likelihood of participants reporting migraines by 2.3 times¹⁴ to 4.5 times.⁴² In a study on chronic musculoskeletal pain in university students, depression and anxiety were both associated with a higher likelihood of also having chronic lower back pain.⁶⁶ The comorbid presence of internalizing disorders and chronic pain has also been observed in tertiary pain clinic sample, in which medical chart review before treatment revealed 45% of the sample had depression and 41% had anxiety, with the presence of either of these conditions associated with worse pain interference.³ Female patients were more likely to have anxiety than male patients, although no sex differences were present for depression.

3.4.2.2. Stress

Stress may have short-term and long-term consequences on chronic pain, although this has not been explored in much detail in emerging adults. In one longitudinal study, Waldie⁹² determined that high-intensity stress during adolescence predicted migraine in emerging adulthood. Other research identified cross-sectional associations between stress and chronic pain. In small⁶⁸ and large⁶⁶ cross-sectional analyses, recent stress was associated with also having chronic musculoskeletal pain. In the latter study, sources of stress included being dissatisfied with their university major, being dissatisfied with the university, high expectations from parents, difficulty adapting to campus life, feelings of inadequacy, and being worried about not meeting their goals. Similarly, other researchers found that dissatisfaction with tertiary study in men doubled the likelihood of also reporting TTH,

Table 3
Factors associated with chronic pain in emerging adults.

Associated factor	Number and type of studies		
	Cross-sectional	Longitudinal	Total
Biological			
Sex	8	2	10
Age	5	0	5
Earlier experiences of chronic pain	2	6	8
Family history of chronic pain	4	4	8
Preterm delivery and low birth weight	0	3	3
Neurobiology	2	0	2
Illness, injury, and posture	5	3	8
Psychological			
Anxiety and depression	6	1	7
Stress	3	1	4
Pain catastrophizing	3	1	4
Personality	2	1	3
Cognitive function	1	1	2
Social and environmental			
Socioeconomic status	2	1	3
Parent mental health and family functioning	1	1	2
Childhood abuse	1	1	2
Sexual orientation	1	0	1
Lifestyle			
Sleep	5	1	6
Recreational drugs (alcohol, tobacco, and cannabis)	8	0	8
Body mass	4	0	4
Physical activity	2	0	2

Cross-sectional designs included cross-sectional observational, cross-sectional experimental, and cross-sectional qualitative interview. Studies with a time component, whether prospective or retrospective, were included in the longitudinal design category. Longitudinal study designs included prospective cohort, randomized controlled trial, longitudinal data-linkage cohort, retrospective case-control, and noncontrolled trial.

and self-reported overwork doubled the likelihood of migraine in both sexes.⁵⁹

3.4.2.3. Pain catastrophizing

Limited evidence has assessed whether pain catastrophizing is associated with the presence of chronic pain, although a link with poorer outcomes may exist. In 2 studies of university students, catastrophizing was not associated with whether or not individuals had chronic pain.^{15,68} However, within a subsample of emerging adults with chronic pain, higher levels of catastrophizing were associated with greater headache pain and more pain-related interference.¹⁵ In a larger US-based data linkage study of 1,028 individuals, age moderated the relationship between catastrophizing and pain interference, with the association between the 2 decreasing as age increased.²⁷

Pain catastrophizing in adolescence may be associated with the presence of chronic pain in emerging adulthood. In a 9-year longitudinal study of 843 adolescents with clinically relevant chronic abdominal pain, the authors identified 3 phenotypes of pain adaptation, which combined catastrophizing with other psychological pain constructs and disability. In their follow-up, the authors assessed whether a chronic pain condition was present in young adulthood.⁹⁶ They found that the “high pain dysfunctional” group (characterized by extremely high catastrophizing, a threatening view of their pain, little belief in their ability to cope with pain, and high levels of negative affect, pain intensity, and disability) were significantly more likely to report chronic abdominal pain disorders and experience other comorbid chronic pain conditions in emerging adulthood compared with other pain groups. The groups that were psychologically adaptive had a much lower likelihood of experiencing chronic pain in emerging adulthood, irrelevant of pain severity during adolescence.⁹⁶

3.4.2.4. Personality

Personality has been considered in 3 studies covering chronic pain in emerging adults. A population-based longitudinal study identified that, after controlling for sex, childhood, and maternal history of headache, stress reactivity personality trait at age 18 predicted migraines at age 26.⁹¹ In addition, in a very small study of 14 participants, prevalence of type A personality tendencies were higher in those with chronic pain compared with individuals without pain.¹⁰⁰ In a third study, negative pain outcomes were highest among university students grouped by higher levels of socially prescribed perfectionism and lower self-efficacy for coping with pain.³⁵

3.4.2.5. Cognitive function

Some studies have considered an association between headache and cognitive function in emerging adults. One cross-sectional study of individuals with and without primary headache found that the headache group had reduced selective attention (control of competing cues) during pain-free periods.²⁸ In a longitudinal study, young adults with migraine, compared with TTH and controls, had slightly lower scores on measures of verbal ability, but not reading, verbal expression, and mathematical skills, assessed during their childhood (3–13 years).⁹³ The authors concluded that migraines and lower verbal performance may be associated because of a shared risk factor.

3.4.3. Social and environmental factors

3.4.3.1. Socioeconomic status

One study has directly assessed socioeconomic status as a risk factor for the development of chronic pain in the emerging adulthood. Various proxy measures including family income, parental education, and welfare receipt during the participant's childhood were all nonsignificant in their relationship with chronic pain in emerging adulthood.³¹ Some studies have identified a potential relationship between migraines and aspects of socioeconomic functioning. In a slightly older Swiss cohort (29–30 years), fewer migraineurs reported full-time employment than individuals with TTH or other headaches.⁶⁷ No differences were present for marital status, social class, education level, or number of children. Furthermore, a cross-sectional study conducted in New Zealand identified that at age 26, women with migraine were 75% more likely to earn a low wage (below NZD\$30,000 per year) compared with headache-free controls.⁹⁴

3.4.3.2. Parent mental health and family functioning

One study assessed whether a history of parental anxiety predicted chronic pain and/or depression in emerging adulthood. The risk for each of these conditions increased by 20%; however, the risk of comorbid chronic pain and depression increased 3-fold when parental anxiety was reported.³¹ The same authors assessed whether childhood family functioning predicted chronic pain, finding that adaptive family functioning, including problem solving, open communication, affective responsiveness, affective involvement, and behavioural control, was not related to the presence of chronic pain alone, but resulted in a modest protective effect for comorbid chronic pain and depression.³¹ In another study, Laird et al.⁵⁷ assessed whether caregiver attachment style had an impact on chronic abdominal pain. They found support for their model, concluding that early life interactions with a caregiver that result in a more anxious temperament confer greater risk of poorer outcomes in the context of chronic pain later in life.

3.4.3.3. Childhood abuse

Two large studies support the association between childhood abuse and presence of chronic pain. In a community sample of almost 10,000 emerging adults, Roberts et al.⁷⁶ found that a reported history of sexual or physical/emotional abuse experienced during teenage years was significantly associated with multisite chronic pain in emerging adulthood. Similarly, in 1,500 emerging adults, Gonzalez et al.³¹ found that earlier reports of severe physical abuse doubled the risk of chronic pain. Furthermore, physical or sexual abuse was associated with 4 times the risk of comorbid chronic pain and depression which was categorized separately from chronic pain without this comorbidity.³¹

3.4.3.4. Sexual orientation

A single study has assessed sexual orientation and chronic pain in emerging adults. In a large cross-sectional analysis in the United States,⁷⁶ all minority sexual orientation groups (gay, lesbian, bisexual, mostly heterosexual, and heterosexual with same-sex sexual contact) had elevated prevalence of abdominal pain ($\geq 40\%$ greater risk), and sexual minority groups other than gay and lesbian had a higher prevalence of pelvic ($\geq 70\%$ higher risk) and multisite pain ($\geq 90\%$ higher risk), compared with

heterosexual with no same-sex sexual contact controls. The authors reported that historical childhood abuse in minority groups explained up to a third of the relationship with multisite pain.

3.4.4. Lifestyle factors

3.4.4.1. Sleep

Sleep problems have been implicated with chronic pain in 5 cross-sectional studies, with a variety of definitions for sleep problems used. In community samples, insomnia has been associated with 2.7 times the risk of migraine in women,⁵⁹ and in another study, weekly problems sleeping were associated with twice the likelihood of students reporting chronic lower back pain.⁶⁶ Other studies report that emerging adults with chronic pain have more trouble falling asleep,³⁴ sleep less,³² and have poorer sleep quality³² than individuals without pain. High comorbidity (55%) between both conditions has also been reported in a clinical pain sample.³ One prospective study attempted to address the directional nature of the relationship between sleep and chronic pain in emerging adults.¹² The researchers found a positive relationship between sleep problems in early adulthood and risk of chronic pain 3 years later. Here, poorer sleep predicted both the onset and the maintenance of chronic pain as well as worse musculoskeletal pain severity.

3.4.4.2. Recreational drugs: alcohol, tobacco, and cannabis

Because of the cross-sectional nature of studies assessing recreational drug use and chronic pain, it is not clear whether recreational drug consumption is a risk factor for, or a coping strategy in response to, chronic pain. A US review of 283 tertiary pain clinic patients' medical charts found high prevalence rates of smoking; one-third (31.5%) reported smoking—20.5% smoked cannabis and 21.6% smoked tobacco.³ Consistently, in a cross-sectional Canadian study of 143 cannabis users, almost half of the sample (43.5%) reported having chronic pain, with pain relief reported to be the primary motivator for use.²⁵ Regarding smoking tobacco, a large US cross-sectional twin study ($n = 1,588$) found that smoking doubled the likelihood of chronic musculoskeletal pain,⁶¹ although this was not replicated in a smaller study of 170 nursing students.⁶⁸ A large cross-sectional community-based study of emerging adults ($n = 1,007$) found those with migraine reported higher rates of nicotine dependence and alcohol or illicit drug abuse or dependence than those without migraine.¹⁴ However, again, mixed results were found in smaller samples of university students, in which alcohol consumption,⁶⁰ but not smoking,⁴² was linked to migraine. The largest study on this topic covered a sample of 8,664 Chinese university students, in which both smoking cigarettes and drinking alcohol were associated with an increased likelihood of chronic musculoskeletal pain in a linear pattern consistent with increasing consumption.⁶⁶

3.4.4.3. Body mass

A USA-based clinical chronic pain study assessed body mass index in their sample, finding slightly higher rates of obesity compared with statistics in their local region, with 57% in the normal category and 40% in the overweight (20.8%) and obese (18.5%) categories;³ however, obesity was not associated with pain interference. Furthermore, 3 cross-sectional studies of medical students found no association of body mass index with chronic lower back pain⁴⁰ and primary headaches.^{42,60}

3.4.4.4. Physical activity

Two cross-sectional studies assessed associations of physical activity and chronic pain in university students. One study found low levels of physical activity were associated with migraine,⁶⁰ whereas the second study found higher levels of physical activity were associated with chronic back pain.⁶⁸

3.5. Outcomes of chronic pain

The following outcomes of experiencing chronic pain during emerging adulthood have been reported in the literature. Many studies identify outcomes through cross-sectional surveys of pain-related interference, particularly those based on university cohorts.

3.5.1. Occupational and educational pain-related interference

Most research on this topic focuses on the pain-related impact of headaches on university participation. In cross-sectional university-based surveys, most students with migraine reported their educational performance (83.9%), and the ability to attend classes (78.2%) was reduced during migraine attacks.⁴² Tension-type headache pain-related reductions in academic performance were also reported in 12.4% of students.⁵⁰ When comparing primary headache types, migraines have been associated with a greater decrease in performance during the pain episode, more hours of study interference because of pain and worsening of pain experience around examination time, compared with TTH.⁹ In 1,340 female Saudi Arabian university students, 85.1% with recurrent migraines, compared with 4.5% with TTH, reported headaches limited their ability to study and enjoy life.¹⁸ Similarly, in a New Zealand cohort study assessing the impact of frequent headaches on emerging adults at age 26, individuals with migraine (38.9%) and combined migraine and TTH (35.7%) reported significantly more headache-related work interference than individuals with TTH (11.0%).⁹⁴ This is consistent with a qualitative study in which a clinical sample of emerging adults with chronic pain identified hindered opportunities regarding work and education because of their pain.⁸⁷

3.5.2. Physical limitations

In a 10-year longitudinal follow-up of an adolescent clinical pain sample, those with chronic pain symptoms persisting into adulthood reported significantly lower levels of physical functioning and restriction in daily activities because of physical limitations.⁹⁹ In another study, students with migraines reported more pain-related interference in daily activities and reduced the ability to perform rigorous physical activities.⁹

3.5.3. Psychological outcomes

Longitudinal research supports an increased risk of internalizing disorders with the presence of chronic pain. In a follow-up of almost 1,000 emerging adults, the researchers found that a history of migraine increased the risk of depression at follow-up 14 months later by 4 times, and an anxiety disorder almost 3 times, compared with those without migraines.¹³ Similarly, in a longitudinal study of almost 500 adolescents composed of a clinical sample of chronic functional abdominal pain and controls, those with ongoing chronic functional abdominal pain into emerging adulthood had 7.3 times the risk of a lifetime anxiety

disorder and 4.1 times the risk of a lifetime depressive disorder compared with controls.⁸⁰ In particular, a predisposition to anxiety was found in this study even with the resolution of the chronic pain condition by emerging adulthood.⁸⁰ In addition, regarding sleep problems and chronic pain, a prospective study identified that severe abdominal pain at baseline was associated with an increase in sleep problems at the 3-year follow-up in emerging adults.¹²

3.5.4. Social interference

Two qualitative studies detailing interviews with clinical chronic pain samples of emerging adults provide the greatest insight into this topic. Key social consequences highlighted by participants in both studies were peer isolation and dependency on others, including their parents and health care providers.^{83,87} In addition, young adults reported separation from society's expectations because of pain,⁸⁷ feeling invalidated in their chronic pain condition because of their young age,⁸⁷ and pain-related impacts on their relationship with a significant other.⁸³ Headache-specific impacts have also been identified. In a cross-sectional study assessing the impact of frequent headaches in emerging adults, just over 40% of individuals with migraine, including combined migraine and TTH, and 9.1% of individuals with TTH, reported headache-related interference to social participation.⁹⁴

3.6. Pain management strategies and treatment options

3.6.1. Analgesic medication

Assessment of over-the-counter analgesic medication use occurred primarily in cross-sectional university-based headache studies. Rates of analgesic use for TTH were between 52.4% and 100%.^{18,50,52} For migraines, rates were similar: 72.2% to 100%.^{18,42,52} In both groups, the most commonly used analgesics were paracetamol and nonsteroidal anti-inflammatory drugs, such as ibuprofen.^{18,42} Regarding opioids, in a USA retrospective review of medical charts of 283 tertiary pain clinic patients, 50.0% of the patients had an opioid prescription.³ Importantly, longitudinal analysis of opioid use in young people with chronic pain revealed that individuals with a mental health diagnosis in the 6 months before their pain diagnosis had a 2.4 times increased risk of long-term opioid prescription and 1.8 times increased risk of receiving long-term opioids over some opioids.⁷⁵ Other commonly prescribed medications for emerging adults with a severe pain condition included antidepressant (25.4%) medications and anti-anxiety/mood stabilizers (11.0%). Women tended to be prescribed anticonvulsants and antidepressants more often than men.³ Furthermore, 20.5% of emerging adults smoked cannabis, with men more likely to use cannabis than women.³

3.6.2. Consulting a physician

Six cross-sectional studies of university students assessed whether or not emerging adults sought physician consultations for their pain, with headaches primarily assessed. In a Swedish study of headache, 13.5% sought professional help, with most consulting a doctor (6.1%) or several professions (eg, doctor, physiotherapist, nurse, and others; 6.1%).⁴⁹ Separating primary headache types, 11.9% to 26.4%^{18,52} of those with migraine and 9.4% to 12.4%^{18,52} with TTH sought medical care. A considerably lower rate was found in a Turkish study, in which only 2.9% had sought medical attention for their headaches.⁵⁰ In other pain

types, individuals with musculoskeletal pain sought medical assistance in 18% of cases,⁸⁹ and 39.6% of those with IBS consulted a physician at least once (11.6% reported multiple consultations).³⁴

3.6.3. Passive and active strategies

Three cross-sectional studies of university students assessed other strategies for dealing with pain. In 2 studies assessing strategies for dealing with chronic headaches, most reported using passive treatments such as resting (58.1%),⁵⁰ massage (26.7%),⁵⁰ or sleeping (66.9%).⁵² This was in contrast to university students with musculoskeletal pain in another study who used more active strategies, eg, stretching (55.7%), yoga (19.2%), and weight training (23.5%).⁸⁹

The use of online pain diary application for symptom monitoring has also been assessed in this cohort. Young adults with chronic headaches reported on their ability to self-monitor pain triggers, symptoms, outcomes, and coping strategies with an electronic diary. Ratings were positive, with participants finding it to be particularly helpful for the identification of effective treatments, guidance of self-care behaviours, and to report their symptoms to health professionals and family members.⁴¹

3.6.4. Treatments

A small number of specific physical treatments have been assessed in emerging adults, each with different primary outcomes and involving nonclinical cohorts. In a 1-group pre-post-test assessment of whole-body vibration exercise targeting chronic lower back pain, Zheng et al.¹⁰³ found a significant reduction in lumbar angle deviation in combination with lower ratings of pain intensity. In a second study, using a randomized trial methodology, the effects of exercises for chronic idiopathic neck pain were compared with exercise combined with pain neuroscience education in university students. Only one between-group difference was found; the group receiving education had greater knowledge of pain neuroscience.⁶⁵ Third, a randomized controlled trial of nonpharmacological treatments in emerging adults with headaches identified that all pain parameters were improved by relaxation exercises alone as well as by combined relaxation and physical therapy. Greater effects in headache frequency and intensity were found at the 3-month follow-up in the latter group.²

3.6.5. Barriers to health care

In their qualitative survey of barriers to health care, Stinson and colleagues noted that emerging adults with chronic pain recruited from tertiary care multidisciplinary clinics highlighted barriers to seeking treatment, which included health care system barriers eg, difficulty accessing specialized treatment resulting in consulting a large number of doctors, perceiving a stigma for seeking pain-relieving treatments; societal barriers eg, a lack of understanding and empathy which emerging adults felt may be due to their age; and patient-specific barriers eg, not having money for treatment, difficulty engaging in a consistent pain management regime because of competing and changeable demands (eg, examinations and casual work).⁸³ A second quantitative study on the needs of emerging adults with chronic pain confirmed that perceived invalidity of their illness in the context of age, as well as feelings of dependency on their parents and health care providers, were critical themes faced by emerging adults with chronic pain.⁸⁷

3.6.6. How to better meet the needs of emerging adults

Stinson et al.⁸³ also asked their participants how service delivery can be improved to better meet the needs of young adults. Key considerations included increased awareness of young people as their own advocates, the availability of services outside of work and school hours, and being grouped with age group peers. Important topic young adults with chronic pain identified for inclusion in treatment included sexual interferences of chronic pain and how this may affect important relationships, body image regarding the weight gain side-effects of medications, the link between sleep and worse pain, as well as the importance of an interdisciplinary approach.⁸³

4. Discussion

4.1. Overview of findings

Collectively, these results indicate that approximately 5% to 30% of emerging adults experience chronic pain. The strongest evidence for associated factors was found for familial chronic pain and previous experiences of chronic pain in childhood. Anxiety and depression seemed to have complex relationships with chronic pain, being reported before, in association with, and after the onset of pain. Critically, research has found that accumulating more risk factors increases risk of chronic pain.³¹ In addition to increased risk of internalizing disorders, outcomes of pain include interruptions to study and work, poorer physical functioning, and pain-related interference to socializing. Emerging adults are open to trying a range of solutions for their pain experiences, most frequently using analgesics, as well as seeking medical attention. Cannabis is also used as a pain management strategy in some instances. We observed few pain treatments have been tested specifically in emerging adults, as has been noted in another review in this age cohort.⁷⁷ Barriers to treatment were addressed in qualitative research, and include feeling isolated within health care systems that emerging adults feel has been designed for older adults, as well as difficulty meeting competing priorities from pain treatment, educational requirements, and occupational commitments.^{83,87} In addition, health care systems could better meet the needs of emerging adults by addressing more age-relevant topics, eg, sexual health, the role of sleep in worsening pain, and more availability of online treatment options and out-of-hours appointments.⁸³ A summary of chronic pain experiences and pain management strategies used by emerging adults can be seen in **Figure 3**.

4.2. Themes in the research

Research on this topic was scarce, heterogeneous in methodology, and in many cases based on convenience samples. Most studies meeting our inclusion criteria were cross-sectional, observational, and usually restricted to university students. Almost a quarter of studies (18 studies) covered headache prevalence in university students, with the remaining topics in the field represented by only 60 studies. Race was considered only in 2 epidemiological studies, although neither reported their findings in emerging adult subgroups.^{48,51} Given how critical the emerging adult developmental stage is for life long occupational and socioeconomic success, surprisingly little has been published on chronic pain in this age group.

We excluded a large number of studies from review because of absent chronic pain criteria, such as pain frequency and duration, with significant heterogeneity noted in reporting methods. Classifying pain based on 1-year or 1-month prevalence, without

considering frequency or duration, may introduce misclassification bias into research findings, making it difficult to determine which findings relate to a single pain experience vs an enduring chronic pain condition. To allow findings to be readily comparable, the fields covering individual pain locations need to ensure consistent definitions of chronic pain are used, and chronic pain groups are reported separately from other pain experiences that may be more transient. This issue was absent for headache research, in which a standardized definition of problematic headaches by the IHS⁴³⁻⁴⁵ was routinely used. Similarly, musculoskeletal pain researchers have reached a consensus on defining back pain¹⁹, but stratification by chronic pain was often not reported.

A strength of the research field was the number of longitudinal follow-up studies assessing characteristics determined during childhood and adolescence which were predictive of development of chronic pain in emerging adulthood. These studies made up just under a quarter of our included literature (18 studies). Ultimately, these studies provided good support for the enduring nature of chronic pain from adolescence into young adulthood.

4.3. Strengths and limitations

This study adds to the evidence base, providing an overview of the academic chronic pain literature available on emerging adults. A major strength was our application of a specific definition of chronic pain. Pain experiences in adults are often reported based on pain location or diagnosis rather than on the reoccurring nature of the pain. We attempted to bring together work on headaches, musculoskeletal pain, abdominal pain, and chronic pain using a consistent definition. In addition, using chronic pain phenotypes typical of research and clinical practice, we have been able to match predictors that span developmental stages into the emerging adulthood.

Our methodology has some limitations. Specifically, we used a “title only” search and did not include search terms for pain diagnoses eg, fibromyalgia, chronic regional pain syndrome, temporomandibular joint dysfunction, IBS, or pain-causing conditions eg, rheumatism and inflammatory bowel disease. This may have affected our ability to report accurate prevalence rates. This decision was made based on assessment of costs (eg, time and resources) and benefits (eg, number of additional studies and topics found), and instead opted for a thorough hand-search to meet our aims. Furthermore, we did not complete a quality assessment for each included article, which are not often conducted in scoping reviews.^{4,74} However, a benefit of some form of quality assessment is that it enables further identification of gaps in the literature.⁷⁴ Finally, the international spectrum of research included was both a strength and limitation. Although this approach allowed us to observe the diversity of the field, cultural differences in pain, disability, and health care systems were not systematically assessed.

4.4. Future research directions

Given the relatively small number of studies identified regarding the broad field of chronic pain in emerging adults, future primary research is required in many areas. (1) Data linkage and longitudinal population-based data sets would be useful to determine incidence. (2) Longitudinal study designs are needed to investigate presumptive etiological factors, given the current reliance on cross-sectional research. A more targeted approach to preventing this condition in young adults would result from both epidemiological modelling of cases attributable to risk factors that

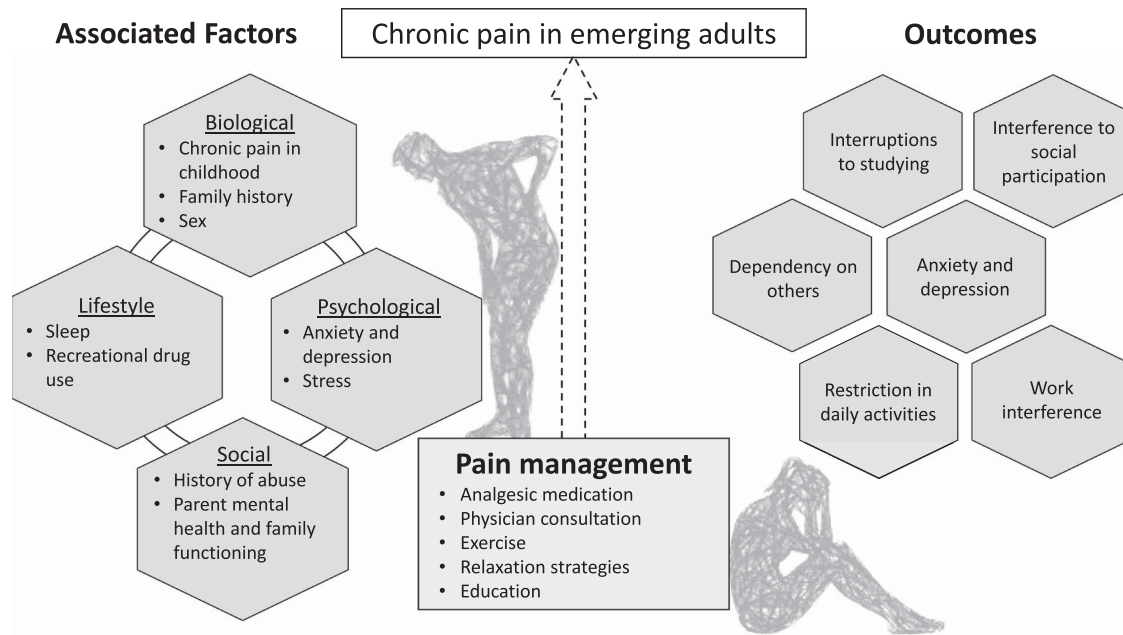


Figure 3. Associated factors, pain management strategies, and outcomes of chronic pain in emerging adults. Examples of each category have been provided. The wider range of factors has been described in the text.

occur in adolescence and identifying characteristics that occur in emerging adults that worsen pain experiences. (3) Longitudinal studies are required to track the outcomes of chronic pain experienced during emerging adulthood. Longitudinal studies following adolescents with severe chronic pain conditions have demonstrated serious socioeconomic outcomes, such as lost educational attainment, lower income potential, greater dependence on welfare, and associated mental health comorbidities.^{21,22,71} These effects may be even stronger for individuals experiencing functionally restricting chronic pain during emerging adulthood. Further research is needed to track these outcomes that are particularly important during this developmental period. (4) Further treatment options should be assessed for this developmental stage. Pain intensity is more predictive of pain interference in emerging adults than in adolescents,²⁷ suggesting reducing pain sensitivity may be particularly useful in this age group. In addition, the impacts of pain-specific psychological constructs, such as anxiety, pain catastrophizing, pain self-efficacy, and active coping styles in emerging adults would be useful to determine, so that their role in treatment is clear. Randomized controlled trials of treatment for chronic pain, including stratified analyses of treatment outcomes in emerging adults, are specifically needed. (5) Exploratory studies to better understand the process by which emerging adults seek treatment for chronic pain would improve triage services, and conducting trials of health care adaptations to meet the needs of emerging adults would improve the relevance of services for emerging adults in the adult health care system. (6) It is critical that racial, ethnic, and social disparities in experiences and treatment of chronic pain in young adults are investigated as these currently remain unexplored.

Secondary research will also become increasingly meaningful. Three specific topics were identified during this review process that require further investigation. (1) A systematic review is needed to identify high-quality research describing the most significant risk factors driving worse chronic pain-related disability in emerging adults, including the most at-risk

adolescent phenotypes for poorer outcomes in young adulthood. (2) We were unable to establish prevalence rates, an important component in defining the issue. Future systematic reviews should focus on establishing prevalence rates of chronic pain in this population by synthesizing data on the full range of pain-causing disorders and pain diagnoses. (3) A systematic review of treatments, including randomized controlled trials and clinical trials with stratified grouping of emerging adults, are needed once enough high-quality treatment studies are available.

4.5. Conclusions

In conclusion, chronic pain in emerging adults has not been well-studied, and much remains unknown regarding incidence, etiology, outcomes, and treatment effects; topics that well-designed longitudinal research could address. More is understood now than a decade ago, and this topic is becoming a greater focus of research. A larger focus on understanding the unique pain experiences during this developmental stage will ultimately lead to improved treatment options and better long-term outcomes.

Disclosures

The authors have no conflicts of interest to declare.

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Appendix A. Supplemental digital content

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