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Characterizing chronic pain in late adolescence and early adulthood: prescription opioids, marijuana use, obesity, and predictors for greater pain interference

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Abstract

Introduction: Chronic pain in late adolescence and young adults is understudied and poorly characterized.

Objectives: We sought to characterize key variables that may impact pain interference in late adolescents and young adults with chronic pain, including prescription opioid use, marijuana use, psychological symptoms, and obesity.

Methods: Retrospective, cross-sectional medical chart review for patients aged 17 to 23 years (N = 283; 61% Females) seeking care at a tertiary care pain clinic. Data on pain characteristics, health behaviors, and mental health distress were examined, in addition to self-reported pain intensity and interference.

Results: Overlapping pain conditions were common in this young adult sample (mean ≥ 2 pain conditions). Back pain was the most commonly cited pain condition, and the majority of pain was of unknown etiology. Results revealed high rates for current opioid prescription, overweight or obese status, and mental health problems. Those using prescription opioids were more likely to endorse tobacco use and had greater pain interference. Importantly, the presence of mental health distress and opioid use were predictive of higher levels of pain-related interference.

Conclusion: Treatment-seeking adolescents and young adults with chronic pain evidence complex care needs that include pain and mental comorbidities, as well as risky health behaviors. Pain and mental health distress were associated with poorer physical health, opioid prescription and marijuana use, and pain-related interference. Findings underscore the need for additional research on pain, treatment patterns, and health behaviors and their impact on developmental trajectories, as well as the need to develop and apply effective early interventions in this at-risk population.

Keywords: Chronic pain, Young adults, Prescription opioids, Marijuana, Anxiety, Depression

1. Introduction

Chronic pain is associated with substantial biopsychosocial burdens, including impediments in daily functioning, and diminished participation in meaningful life pursuits. Late adolescence and young adulthood may be a time of particular vulnerability for individuals with chronic pain. The impacts of pain-related interference may extend beyond daily difficulties in functioning and serve to impede progress through the developmental stages of late adolescent, early adulthood, and transition to independence. Indeed, young adulthood is a critical developmental stage in which personal, professional, and health trajectories are formed and solidified.[23,27,43] Concomitantly, self-regulatory skills for cognition, emotion, behavior, and stress responses remain immature, thereby rendering many in this age group ill-equipped to handle the stresses and consequences of chronic pain within the context of other developmental challenges.[21] Consequently, individuals with chronic pain in this age group may be at risk of mental health distress and of maladaptive

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behaviors—such as smoking or marijuana use. Indeed, the interplay of biopsychosocial factors and their impact on chronic pain are expected to be particularly strong in young individuals.[21] However, only a handful of studies have examined key biobehavioral factors and health behaviors among young adults with chronic pain,[17,18,35,36] despite this being a critical developmental period to potentially mitigate the development and progression of pain and health problems, and to reduce treatment patterns that may have major long-term health consequences, such as prescription opioids.

Data regarding long-term use of opioids among youth and young adults are limited, with studies citing 21% of commercially insured youth with back pain, neck pain, headache, or joint pain having received an opioid prescription,[35] and patients with chronic pain and anxiety/depressive conditions or substance abuse are 2 to 3 times more likely to use and remain on opioids.[40] The likelihood to be prescribed opioids and use them long term has been shown to be higher for males.[35,36] Psychological comorbidity places young adults at higher risk of opioid misuse and worse outcomes, including negatives beliefs, catastrophizing, and greater perceived disability.[37] Given the onset of depression and substance use peaks during the adolescent and young adult period,[29] understanding how mental health conditions are associated with opioid prescription might allow for targeted interventions designed to mitigate long-term opioids to treat chronic pain.

The concerns raised above are particularly salient given the striking prevalence of chronic pain in youth and young adults. Indeed, as many as 20% to 50% of postpubertal adolescents report persistent pain.[15,16,22,42] Among young adults, prevalence estimates for any pain in the previous 6 months are 66.9%, whereas chronic and disabling pain conservatively range between 4% and 14%.[3,4,25] Disabling pain in young adults requires further study as chronic pain, and its impact on functional status remains poorly characterized. Studies have primarily focused on examining quality of life in this population and found reductions in quality of life to be associated with number of pain sites[31,32] and pain intensity.[20] Although the literature remains relatively sparse, a handful of studies on older adolescents have shown increased functional disability among those with overlapping musculoskeletal pain conditions compared with a single pain type.[24,30]

Finally, in regards to additional key health behaviors that may impact pain interference in young adults, research has demonstrated negative impacts of cigarette smoking,[18] alcohol use, poor sleep quality and quantity,[17] and obesity[10] in chronic pain; however, research on their association with pain interference remains limited. Elucidating the interplay of physical and mental health factors that specifically associate with pain-related interference in adolescents and young adults could inform the development of appropriate therapeutic interventions that could minimize secondary impacts on developmental trajectories.

This study sought to fill an important gap in the literature and aimed to: (1) describe key biopsychosocial factors and health behaviors among young adults with chronic pain, which include opioid prescription status, marijuana use, weight and obesity status, and psychiatric symptoms (depression and anxiety); and (2) describe the interplay between these variables and pain interference in a sample of young adults. We hypothesized that the current sample will have high rates of opioid use, obesity and overweight status, and psychiatric symptoms. We also hypothesize that the presence of psychiatric symptoms, sleep disturbance, obesity, and opioid use will be associated with greater pain interference.

2. Methods

2.1. Study design

Retrospective, cross-sectional chart review of the electronic medical record (EMR).

2.2. Participants

The study sample comprised 283 patients aged 17 to 23 years seeking care at a tertiary care pain clinic between 2007 and 2011. All data were extracted from EMRs, including demographics, pain and clinical characteristics, opioid prescription status, and substance use behavior (eg, smoking and marijuana use). In addition, pain intensity and pain interference ratings were retrieved from patient self-report, collected at the initial clinic visit. Inclusion criteria for the study consisted of being between the ages of 17 and 23 years, and the presence of a chronic pain condition (≥3 months). The study was approved by the Oregon Health & Science University Institutional Review Board.

2.3. Measures

Data pertaining to each of the measures were extracted from the EMRs.

2.3.1. Demographic information

Demographic information included participant sex, age, and ethnicity at the date of clinic visit.

2.3.2. Body mass index

Body mass index (BMI) scores were calculated from height and weight measurements using the Adult and Child (for participants younger than 18 years) BMI calculators published by the Centers for Disease Control and Preventions.[33] A binary obesity status variable (yes/no) was created based on BMI scores, where yes = BMI ≥30.

2.3.3. Substance use

Substance use included tobacco and marijuana use, and was extracted from the EMR. All patients at the medical center are routinely asked about tobacco use in a Health History form. Information about marijuana use was taken from the initial clinic intake questionnaire and the physician's intake note. Both were coded as yes/no for the presence or absence of use.

2.3.4. Prescribed medications

Prescribed medications were extracted from the list of active/current medications in the EMR and included the following categories of medications: opioids, anticonvulsants, muscle relaxants, antidepressants, antianxiety/mood stabilizers, sleep aids, and anti-inflammatory medications.

2.3.5. Clinical characteristics

The presence of psychiatric symptoms was recorded by physicians as a binary variable (yes/no) for the presence of depressive and anxiety symptoms, and included in the Problem List in the EMR. Furthermore, depression and anxiety were combined to create a single mental health distress variable indicating the presence of one or more of these symptoms. In

addition, sleep disturbance was based on the presence of physician noted sleep disturbance under the Problem List or Diagnoses in the EMR. This information was also extracted through chart reviews.

2.3.6. Pain characteristics

Pain characteristics included primary pain locations, number of pain locations, pain duration, and pain etiology. The majority of these characteristics were obtained through patient report on the Brief Pain Inventory (BPI)-Short Form,[8] which was completed as part of the clinic intake.

2.3.6.1. Primary pain locations

Primary pain locations were assessed through the body map included in the BPI and were coded into the following regions: face, head, shoulder/neck, chest, arm/hand, abdomen, spine, low back pain, other back pain, leg/knee, hip, pelvic area, and other.

2.3.6.2. Number of pain locations

A number of pain locations were coded from the number of endorsed body regions.

2.3.6.3. Pain duration

Pain duration was assessed by asking patients how long they have experienced ongoing pain in their specified location for (in months or years). This was reported on the clinic intake questionnaire.

2.3.6.4. Pain etiology

Pain etiology was assessed by chart review of the pain physician's initial evaluation note and was coded as injury-related, surgery-related, or unknown.

2.3.6.5. Pain intensity and pain interference

Pain intensity and pain interference were assessed with the short form of the BPI,[8] which was administered as part of the clinic intake questionnaire during patients' initial visit. Pain intensity was rated from 0 (*no pain*) to 10 (*pain as bad as you can imagine*) for current pain, as well as worst, least, and average pain during the past week. The 7 pain interference items include domains related to general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life. Items were rated from 0 (*no interference*) to 10 (*interferes completely*) and were internally consistent in this sample ($\alpha = 0.85$); the items were averaged to yield a single pain interference score. The BPI is one of the most widely used pain measures and has excellent psychometric data, including good reliability and a wealth of validity data demonstrating that the subscales correlate as expected with other measures of pain and functioning.[8,41] This information was available for n = 182 of the sample, as noted in **Table 1**.

2.4. Statistical analyses

Data were analyzed using SPSS version 21. Descriptive statistics were calculated for demographic variables and pain characteristics. The independent samples *t* test was conducted to determine sex differences on continuous study variables, namely pain characteristics (**Table 1**), and χ^2 analyses were used for categorical variables (eg, substance use and medication use). Chi-square analyses were also used to describe key study variables (mental and physical health variables) stratified by opioid use (yes/no) (**Table 2**). Finally, multivariate hierarchical regression analyses were conducted to examine the association of biopsychosocial factors (ie, sleep disturbance, obesity, and mental health distress) and opioid prescription status with pain interference among patients who completed the BPI (n = 182).

3. Results

3.1. Sample characteristics

Sample demographics and clinical characteristics are shown in **Table 1**. In total, 283 patients (females = 173; 61%), with a mean age of 20.28 years (SD = 1.75), were included in the study sample. On average, patients reported having at least 2 pain locations (M = 2.21, SD = 1.75), with an average pain duration of 4.15 years (SD = 4.04, range = 0.08–20.75). Back pain was the most commonly cited pain condition (n = 170, 60.1%), and the majority of pain was of unknown etiology (n = 167, 57%). The

Table 1

Demographics and pain characteristics.

Characteristic	Total (N = 283)	Females (n = 173)	Males (n = 110)	*P*
Age (17–23 y)	20.29 (1.73)	20.16 (1.77)	20.49 (1.65)	0.11
Number of pain locations	2.21 (1.75)	2.36 (2.03)	1.93 (1.03)	0.02
Pain duration in years	4.16 (4.28)	4.38 (4.53)	3.80 (3.87)	0.32
Pain etiology				
Unknown	167 (59.0%)	110 (63.6%)	57 (51.8%)	0.08
Primary pain location				
Back	170 (60.1%)	96 (55.5%)	74 (67.3%)	
Head and neck	17 (6.0%)	13 (7.5%)	4 (3.6%)	
Chest and arms	40 (14.1%)	26 (15.0%)	14 (12.7%)	
Abdomen and pelvic area	22 (7.8%)	15 (8.7%)	7 (6.4%)	
Leg	34 (12.0%)	23 (13.3%)	11 (10.0%)	
BPI*				
Average	6.37 (1.64)	6.35 (1.38)	6.38 (1.78)	0.89
Best	4.70 (2.22)	4.97 (2.22)	4.24 (2.17)	0.03
Worst	8.28 (1.50)	8.26 (1.58)	8.31 (1.37)	0.81
Interference	6.47 (1.97)	6.40 (2.05)	6.60 (1.85)	0.35

* Brief Pain Inventory: n = 182; n = 68 males and n = 114 females.
BPI, Brief Pain Inventory.

Table 2

Sample characteristics stratified by opioid use.

Characteristic	Nonopioid users, (n = 142); n (%)	Opioid users, (n = 140); n (%)	χ^2/t	P
Mental health				
Depression	62 (43.4%)	65 (46.4%)	0.270	0.60
Anxiety	61 (43.0%)	56 (40.0%)	0.254	0.61
Sleep disturbance	73 (51.4%)	84 (60.0%)	2.11	0.15
Smoking				
Tobacco	24 (16.8%)	37 (24.4%)	3.89	0.04
Marijuana	26 (18.6%)	31 (22.5%)	0.646	0.42
Physical health, M (SD)				
BMI	25.55 (8.33)	25.28 (5.71)	0.307	0.76
Pain interference	6.12 (1.98)	6.73 (1.93)	−2.07	0.04

BMI, body mass index.

majority of the sample was of non-Hispanic ethnicity (n = 270; 95%), followed by Hispanic ethnicity (n = 9; 3.2%) and other ethnicities combined (n = 3; 1.2%). No information about racial background was available.

3.2. Pain intensity and pain interference

Pain intensity and pain interference scores were available for 182 patients. Average pain intensity was 6.37 (SD = 1.64) (range = 4.7–8.28), and mean pain interference score was 6.47 (SD = 1.97) ranging from 0.43 to 10. Females had a higher least pain score (M = 4.97, SD = 2.22) than males (M = 4.24, SD = 2.17) (t (180) = −2.176, P = 0.02) and reported more pain locations (t (296) = −2.39, $P < 0.05$); there were no other significant sex differences (**Table 1**).

3.3. Biopsychosocial factors

The average BMI was 25.42 (SD = 7.13); 20.8% of patients were in the overweight category and 18.5% in the obese category. More than half of the sample was in the normal weight category (56.6%), and a minority of patients were underweight (4.2%). More than half of the sample (55.4%) had one or more psychiatric symptoms documented in the medical record problem list. Mental health distress was documented in a notable portion of the sample; 45% (n = 127) of whom had depression and 41% (n = 117) had anxiety. In addition, 55% (n = 157) of the sample had documented sleep disturbance.

3.4. Smoking and marijuana use

Almost one-third of the sample (31.5%) reported smoking a substance (N = 94). Specifically, close to a fifth of the sample smoked tobacco (n = 61, 21.6%) or used marijuana (n = 57, 20.5%).

3.5. Opioid prescription

About half of the patients had a current opioid prescription (n = 140; 50%). Notably, among young adults who were prescribed opioids (**Table 2**), tobacco smoking ($\chi^2(1) = 3.89$, $P = 0.04$) and pain interference (t (192) = −2.07, $P = 0.04$) were significantly higher compared with those who were not prescribed opioids. However, individuals with an opioid prescription did not differ significantly than those without an opioid prescription on their obesity/overweight status or marijuana use.

3.6. Other medications

Other frequently prescribed medications included anti-inflammatory (n = 87, 30.7%) and antidepressant (n = 72, 25.4%) agents. The remaining medications, including antianxiety/mood stabilizers, anticonvulsants, muscle relaxants, and sleep aids, were prescribed to less than 25% of the sample. Complete medication use data can be found in **Table 3**.

3.7. Sex differences

Sex analyses for male (n = 110) and female (n = 173) participants revealed a number of differences (**Tables 1 and 4**). On average, females reported more pain locations (t (296) = −2.39, $P < 0.05$) and tended to endorse more pain conditions with unknown etiology (t (296) = 1.71, P = 0.08). Importantly, in terms of medication prescriptions, more females were prescribed anti-convulsants; χ^2 (1) = 6.161, P = 0.013, and antidepressants; χ^2 (1) = 3.826, P = 0.050, respectively. Males were more likely to endorse marijuana use; $\chi^2(1) = 12.13$, $P < 0.001$, and smoking tobacco; $\chi^2(1) = 4.07$, $P = 0.03$. No sex differences were noted for BMI. Finally, females were more likely to have documented anxiety than males; χ^2 (1) = 6.95, P = 0.008, and no sex/gender differences were noted for depression or sleep disturbance.

3.8. Regression analyses

Table 5 displays the results of a multivariate hierarchical regression analysis. Mental health distress, defined as the

Table 3

Health status and medications.

Characteristic	N (%)
Mental health	
Depression	127 (44.9)
Anxiety	117 (41.5)
Sleep disturbance	157 (55.7)
Smoking	
Tobacco	61 (21.6)
Marijuana	57 (20.5)
Medications	
Opioids	140 (49.5)
Anticonvulsants	51 (18.0)
Muscle relaxant	58 (20.5)
Antidepressant	72 (25.4)
Antianxiety/mood stabilizers	31 (11.0)
Sleep aids	21 (7.4)
Anti-inflammatory	87 (30.7)

Table 4

Sex differences in study variables.

Characteristic	Total, N (%)	Male, (n = 110); n (%)	Female, (n = 173); n (%)	t/χ^2	*P*
Obesity					
BMI, mean (SD)		26.56 (56)	24.74 (4.49)	−2.33	0.035
Mental health					
Depression	127 (44.9%)	47 (42.7%)	80 (46.2%)	0.336	0.562
Anxiety	117 (41.5%)	35 (31.8%)	82 (47.7%)	6.949	0.008
Sleep disturbance	157 (55.7%)	56 (50.9%)	101 (58.7%)	1.659	0.198
Smoking					
Tobacco	61 (21.6%)	31 (28.2%)	30 (17.3%)	4.674	0.031
Marijuana	57 (20.5%)	36 (33.3%)	21 (12.4%)	17.84	0.000

BMI, body mass index.

presence of anxiety and/or depressive symptoms, uniquely contributed to observed variance in pain interference scores, after controlling for pain intensity (first step of model), with obesity status, opioid prescription status, and sleep disturbance (second step), accounting for 29.6% of the variance. The presence of a mental health distress variable was entered in the third step of the model, and was significantly and positively associated with pain interference, contributing uniquely to 2.4% of the variance above and beyond the effects of pain intensity, obesity status, opioid prescription status, and sleep disturbance.

4. Discussion

This study describes important pain and clinical characteristics in a sample of treatment-seeking young adults with chronic pain. A number of key variables were associated with poorer physical and mental health, which in turn was shown to facilitate pain-related interference.

In summary, overlapping pain conditions were common in this sample, and back pain was the most commonly cited pain condition, comprising 60.1% of the sample's primary pain location, with the majority of pain being of unknown etiology. On average, young adults in this sample reported moderate levels of pain interference and average pain intensity scores that are higher than those reported among general community-based young adults.[28] Notably, a large portion of our sample—about 39.3%—was overweight or obese, and the 20.8% obesity rate is significantly higher than the reported 14.5% obesity rate of community young adults (18–24 years) in Oregon.[34] Obesity was not associated with pain interference in this sample, contrary to previous research findings.[26]

Regarding substance use in this sample, tobacco and marijuana usage was comparable with reported rates among young adults in Oregon.[7] In the study sample, males reported greater tobacco and marijuana use than females, and marijuana use was the only health behavior variable examined in this study that predicted pain-related interference. Given that the directionality of effects cannot be determined with cross-sectional data, it is plausible that marijuana use may contribute to pain-related interference, or higher levels of interference may prompt young adults to use marijuana, for pain management or general coping. Importantly, this study was conducted before the legalization of marijuana in Oregon. It is unknown whether patients were using medical marijuana with a medical marijuana card, or whether they were using the substance illicitly. Research confirms that young adults, especially males, may be using tobacco or marijuana as a means of coping with or reducing pain[18] and pain-related anxiety.[11,12]

Depression and anxiety were common in our sample. More females had physician-reported anxiety and used medications, namely antidepressants and anticonvulsants. These findings are consistent with research documenting higher rates of anxiety among women in general, despite findings showing that anxiety and pain sensitivity are more strongly associated for men than women.[13] Importantly, the presence of mental health distress emerged as a unique predictor of pain interference above and beyond the effects of pain intensity and opioid prescription status, which supports previous research findings.[1,6] This finding is consistent with the gate control theory, which posits that with depression and anxiety comes changes in motivational–affective processes (eg, decreased interest and involvement in daily activities, and increased sadness) and cognitive–evaluative processes (eg, irrational and maladaptive thoughts, and overly negative appraisals of coping abilities) that can affect the processing and perception of noxious input. Furthermore, research proposes several mechanisms that underlie pain and psychological distress, including pain catastrophizing,[5] perceived helplessness,[38] and low self-efficacy.[2] Findings highlight the importance of identifying risk factors that predict or contribute to pain interference, as the impacts of pain-related interference may extend beyond daily difficulties in functioning and serve to hinder progress through the developmental stages of late adolescent, early adulthood, and transition to independence.

Patients in our sample were prescribed a variety of different medications. One of the most surprising results was the high rate of opioid prescriptions. As the most frequently prescribed class of medications, about 50% of our sample was prescribed opioids. This was higher than reported opioid use in another young adult sample, which found a rate of 27.4% in a large national Medicaid sample.[35] Importantly, pain interference was significantly higher among young adults who were prescribed opioids; a crucial finding in light of overprescribing trends and negative health effects of long-term opioid use.[9] It is possible that young adults

Table 5

Multivariate hierarchical regression: predictors of pain interference.

	ΔR^2	β entry	β at final step
Step 1	0.265***		
Average pain intensity		0.61***	0.57***
Step 2	0.031*		
Obesity status		0.13	0.14
Sleep disturbance		0.12*	0.08
Opioid use		0.12*	0.14*
Step 3	0.024**		
Mental health distress		0.17*	

*$P < 0.05$, **$P < 0.01$, and ***$P < 0.001$.

seen in tertiary pain clinic settings may be a unique subgroup of individuals with chronic pain in this age range, in terms of the severity of their pain condition, which might contribute to clinical decisions to manage pain with opioids. However, the high rates of prescribed opioids and its association with pain interference reinforce the need for more research and targeted early intervention specific to young adults. In addition, young adults who were prescribed opioids were more likely to report tobacco smoking, a finding that aligns with the adult literature.[19] Our study contributes to a body of evidence suggesting that opioid prescriptions for young adults appear to be on the rise.[14] Previous work has shown that young adults seeking pain relief use pharmacological treatments despite their concerns about the adverse effects and risk of addiction,[39] thereby underscoring the need for improved nonpharmacologic interventions. The current study also highlights the need to address overall health in these older adolescents/young adults, who will face lifelong effects from overweight and obese weight status and tobacco use, in addition to potential negative outcomes from prescription opioids.

As a retrospective chart review, this study has a number of limitations. Our relatively small sample is from one multidisciplinary pain clinic at an academic medical center and may not be generalizable to young adults with chronic pain in the community. We did not have a comparison group (eg, middle-aged adults), thus some findings may not be unique to young adults. In addition, comprehensive information about physical and mental health statuses was not always available in the medical record, and our measure of mental health distress is relatively weak. Despite the salience of alcohol use in this population, we did not have available data on alcohol use, and future work should include alcohol use in describing substance use in this population. Finally, the binary nature of some study variables may have masked their impact on pain interference in the regression model. Future work might incorporate more in-depth and comprehensive assessments of health and psychological functioning in young adults.

Our study is one of the few studies that characterizes chronic pain in late adolescence and early adulthood, and describes associated variables, including opioid prescription, marijuana use, obesity, mental health distress, and associations with pain interference. Findings from this study are notable and inform a growing body of literature, as the impacts of pain-related interference among young adults may extend beyond daily difficulties in functioning and serve to impede progress through the developmental stages of late adolescent, early adulthood, and transition to independence. Hence, variables that contribute to pain interference can become important therapeutic targets for young adults with chronic pain, particularly in regards to reducing psychological risks, such as depression and anxiety, and prescription opioids. Clinical interventions such as pain-cognitive behavioral therapy (pain-CBT) focus on teaching pain-coping skills in addition to coping with pain-related anxiety and depression. Pain-CBT can serve as a key prevention approach among adolescents and young adults with chronic pain who present with psychological risk factors. Overall, findings highlight the importance of further examining the effect of pain on developmental trajectories and identification of early interventions.

Disclosures

The authors have no conflict of interest to declare.

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References

[1] Angst F, Brioschi R, Main CJ, Lehmann S, Aeschlimann A. Interdisciplinary rehabilitation in fibromyalgia and chronic back pain: a prospective outcome study. J Pain 2006;7:807–15.
[2] Arnstein P, Caudill M, Mandle CL, Norris A, Beasley R. Self efficacy as a mediator of the relationship between pain intensity, disability and depression in chronic pain patients. PAIN 1999;80:483–91.
[3] Blyth FM, March LM, Brnabic AJ, Jorm LR, Williamson M, Cousins MJ. Chronic pain in Australia: a prevalence study. PAIN 2001;89:127–34.
[4] Bowsher D, Rigge M, Sopp L. Prevalence of chronic pain in the British population: a telephone survey of 1037 households. Pain Clinic 1991;4:223–30.
[5] Burns JW, Kubilus A, Bruehl S, Harden RN, Lofland K. Do changes in cognitive factors influence outcome following multidisciplinary treatment for chronic pain? A cross-lagged panel analysis. J Consult Clin Psychol 2003;71:81.
[6] Campbell LC, Clauw DJ, Keefe FJ. Persistent pain and depression: a biopsychosocial perspective. Biol Psychiatry 2003;54:399–409.
[7] Centers for Disease Control and Prevention. https://www.cdc.gov/index.htm.
[8] Cleeland C, Ryan K. Pain assessment: global use of the Brief Pain Inventory. Ann Acad Med Singapore 1994;23:129–138.
[9] Darnall BD, Stacey BR, Chou R. Medical and psychological risks and consequences of long-term opioid therapy in women. Pain Med 2012;13:1181–211.
[10] Deere KC, Clinch J, Holliday K, McBeth J, Crawley EM, Sayers A, Palmer S, Doerner R, Clark EM, Tobias JH. Obesity is a risk factor for musculoskeletal pain in adolescents: findings from a population-based cohort. PAIN 2012;153:1932–8.
[11] Ditre JW, Brandon TH, Zale EL, Meagher MM. Pain, nicotine, and smoking: research findings and mechanistic considerations. Psychol Bull 2011;137:1065.
[12] Ditre JW, Zale EL, Kosiba JD, Zvolensky MJ. A pilot study of pain-related anxiety and smoking-dependence motives among persons with chronic pain. Exp Clin Psychopharmacol 2013;21:443.
[13] Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL. Sex, gender, and pain: a review of recent clinical and experimental findings. J Pain 2009;10:447–85.
[14] Fortuna RJ, Robbins BW, Caiola E, Joynt M, Halterman JS. Prescribing of controlled medications to adolescents and young adults in the United States. Pediatrics 2010;126:1108–16.
[15] Ghandour RM, Overpeck MD, Huang ZJ, Kogan MD, Scheidt PC. Headache, stomachache, backache, and morning fatigue among adolescent girls in the United States: associations with behavioral, sociodemographic, and environmental factors. Arch Pediatr Adolesc Med 2004;158:797–803.
[16] Gordon K, Dooley J, Wood E. Self-reported headache frequency and features associated with frequent headaches in Canadian young adolescents. Headache 2004;44:555–61.
[17] Graham JE, Streitel KL. Sleep quality and acute pain severity among young adults with and without chronic pain: the role of biobehavioral factors. J Behav Med 2010;33:335–45.
[18] Holley AL, Law EF, Tham SW, Myaing M, Noonan C, Strachan E, Palermo TM. Current smoking as a predictor of chronic musculoskeletal pain in young adult twins. J Pain 2013;14:1131–9.
[19] Hooten WM, Shi Y, Gazelka HM, Warner DO. The effects of depression and smoking on pain severity and opioid use in patients with chronic pain. PAIN 2011;152:223–9.
[20] Hunfeld JA, Perquin CW, Duivenvoorden HJ, Hazebroek-Kampschreur AA, Passchier J, van Suijlekom-Smit LW, van der Wouden JC. Chronic pain and its impact on quality of life in adolescents and their families. J Pediatr Psychol 2001;26:145–53.
[21] Huntley ED, Campo JV, Dahl RE, Lewin DS. Sleep characteristics of youth with functional abdominal pain and a healthy comparison group. J Pediatr Psychol 2007;32:938–49.
[22] Kristjansdottir G. Prevalence of self-reported back pain in school children: a study of sociodemographic differences. Eur J Pediatr 1996;155:984–6.

[23] Lee TK, Wickrama KA, O'Neal CW, Prado G. Identifying diverse life transition patterns from adolescence to young adulthood: the influence of early socioeconomic context. Soc Sci Res 2018;70:212–28.
[24] Leveille SG, Bean J, Ngo L, McMullen W, Guralnik JM. The pathway from musculoskeletal pain to mobility difficulty in older disabled women. PAIN 2007;128:69–77.
[25] Mallen C, Peat G, Thomas E, Croft P. Severely disabling chronic pain in young adults: prevalence from a population-based postal survey in North Staffordshire. BMC Musculoskelet Disord 2005;6:42.
[26] Marcus DA. Obesity and the impact of chronic pain. Clin J Pain 2004;20: 186–91.
[27] McCracken M, Jiles R, Blanck HM. Peer reviewed: health behaviors of the young adult US population: behavioral risk factor surveillance system, 2003. Prev Chronic Dis 2007;4:A25.
[28] McDonald DD, Poudrier S, Gonzalez T, Brace J, Lakhani K, Landry S, Wrigley P. Pain problems in young adults and pain reduction strategies. Pain Manag Nurs 2002;3:81–6.
[29] McGorry PD, Purcell R, Goldstone S, Amminger GP. Age of onset and timing of treatment for mental and substance use disorders: implications for preventive intervention strategies and models of care. Curr Opin Pyshciatry 2011;24:301–6.
[30] Natvig B, Bruusgaard D, Eriksen W. Localized low back pain and low back pain as part of widespread musculoskeletal pain: two different disorders? A cross-sectional population study. J Rehabil Med 2001;33: 21–5.
[31] Paananen M, Taimela S, Auvinen J, Tammelin T, Zitting P, Karppinen J. Impact of self-reported musculoskeletal pain on health-related quality of life among young adults. Pain Med 2011;12:9–17.
[32] Pellisé F, Balagué F, Rajmil L, Cedraschi C, Aguirre M, Fontecha CG, Pasarín M, Ferrer M. Prevalence of low back pain and its effect on health-related quality of life in adolescents. Arch Pediatr Adolesc Med 2009;163: 65–71.
[33] Prevention CfDCa. BMI percentile calculator for child and teen English version. https://www.cdc.gov/brfss/annual_data/annual_2008.htm.
[34] Prevention CfDCa. CDC Oregon 2008 BRFSS. 2008. https://www.cdc.gov/brfss/annual_data/annual_2008.htm.
[35] Richardson LP, Fan MY, McCarty CA, Katon W, Edlund M, DeVries A, Martin BC, Sullivan M. Trends in the prescription of opioids for adolescents with non-cancer pain. Gen Hosp Psychiatry 2011;33:423–8.
[36] Richardson LP, Russo JE, Katon W, McCarty CA, DeVries A, Edlund MJ, Martin BC, Sullivan M. Mental health disorders and long-term opioid use among adolescents and young adults with chronic pain. J Adolesc Health 2012;50:553–8.
[37] Ruehlman LS, Karoly P, Pugliese J. Psychosocial correlates of chronic pain and depression in young adults: further evidence of the utility of the profile of chronic pain: screen (PCP: S) and the profile of chronic pain: extended assessment (PCP: EA) battery. Pain Med 2010;11:1546–53.
[38] Smith TW, Christensen AJ, Peck JR, Ward JR. Cognitive distortion, helplessness, and depressed mood in rheumatoid arthritis: a four-year longitudinal analysis. Health Psychol 1994;13:213.
[39] Stinson J, White M, Isaac L, Campbell F, Brown S, Ruskin D, Gordon A, Galonski M, Pink L, Buckley N. Understanding the information and service needs of young adults with chronic pain: perspectives of young adults and their providers. Clin J Pain 2013;29:600–12.
[40] Sullivan MD, Edlund MJ, Zhang L, Unützer J, Wells KB. Association between mental health disorders, problem drug use, and regular prescription opioid use. Arch Intern Med 2006;166:2087–93.
[41] Tan G, Jensen MP, Thornby JI, Shanti BF. Validation of the Brief Pain Inventory for chronic nonmalignant pain. J Pain 2004;5:133–7.
[42] Watson KD, Papageorgiou AC, Jones GT, Taylor S, Symmons DP, Silman AJ, Macfarlane GJ. Low back pain in schoolchildren: occurrence and characteristics. PAIN 2002;97:87–92.
[43] Wiium N, Breivik K, Wold B. Growth trajectories of health behaviors from adolescence through young adulthood. Int J Environ Res Public Health 2015;12:13711–29.