

Short Communication

Boluwatife Aluko*, Adrienne N. Mitchell, Dmitry Tumin and Evan Zeldin

Nation-wide decrease in the prevalence of pediatric chronic pain during the COVID-19 pandemic

<https://doi.org/10.1515/sjpain-2022-0102>

Received July 24, 2022; accepted November 10, 2022;

published online December 1, 2022

Abstract

Objectives: The COVID-19 pandemic was expected to increase prevalence and severity of chronic pain. We compared pandemic-era and pre-pandemic prevalence of chronic pain among children in the US.

Methods: Data were obtained from the 2019 and 2020 National Survey of Children's Health, a web-or mail-based survey representative of children living in the US ($n=20,359$ in 2019; 29,159 in 2020). Caregiver-reported prevalence of chronic pain was compared between survey years using bivariate and multivariable methods.

Results: The prevalence of chronic pain among US children decreased from 11 to 8% in the first year of the pandemic. Multivariable analysis adjusting for children's and caregivers' demographics and socioeconomic characteristics confirmed that in 2020, odds of caregiver-reported chronic pain declined by 33% (95% confidence interval: 23%, 42%; $p<0.001$).

Conclusions: The encouraging finding of a nationwide decrease in the prevalence of chronic pain calls into question initial predictions anticipating the pandemic to contribute to onset or persistence of chronic pain among children.

Keywords: chronic pain; COVID-19; pediatrics; survey.

Introduction

Chronic pain, defined as pain recurring or persisting for 3 months or longer, is present among 5–38% of US children [1–3]. The origins of chronic pain are multifactorial, and the biopsychosocial model of pain emphasizes that onset and expression of pain can vary based on psychological status and social and cultural factors [4]. At the outset of the COVID-19 pandemic in 2019–2020, several commentaries have hypothesized that the pandemic would lead to an increase in the prevalence of chronic pain, both due to neuropathic pain complications of individuals infected with SARS-CoV-2, and due to the downstream psychological, social, and economic effects of the pandemic on the general population [5, 6]. For people with existing chronic pain problems, the pandemic also could have led to exacerbation of pain severity, due to reduced access to treatment at a time when health care access was rationed and prioritized for treatment of patients with COVID-19 [6, 7]. Although these expectations were based on plausible mechanisms of chronic pain onset and persistence, limited data were available to support the theory that the pandemic led to an increase in chronic pain prevalence. As one exception, Szilagyi et al. found increasing Web search activity for pain-related keywords after COVID-19 cases were recorded in a given country, but did not correlate this finding with clinical diagnosis or self-reported prevalence of chronic pain [8].

In the second year of the pandemic, novel research in pediatric chronic pain has identified a surprising finding of decreased prevalence and severity of chronic pain among children during the pandemic. For example, Rau and colleagues found from a school-based sample in Germany that chronic pain prevalence decreased after the beginning of the pandemic, compared to pre-pandemic

*Corresponding author: Boluwatife Aluko, BA, Brody School of Medicine at East Carolina University, 600 Moyer Boulevard, Greenville, NC 27834, USA, Phone: +1 (252) 744 3221, Fax: +1 (252) 744 1376, E-mail: alukob12@students.ecu.edu

Adrienne N. Mitchell, Brody School of Medicine at East Carolina University, Greenville, USA, E-mail: mitchellad21@students.ecu.edu

Dmitry Tumin, Department of Pediatrics, Brody School of Medicine at East Carolina University, Greenville, USA, E-mail: tumind18@ecu.edu

Evan Zeldin, Department of Physical Medicine & Rehabilitation, Brody School of Medicine at East Carolina University, Greenville, USA, E-mail: ZELDINE18@ECU.EDU

assessments of the same longitudinal cohort [9]. This finding echoed similar results from longitudinal studies of children in Italy receiving treatment for chronic pain before and during the pandemic, which found decreased pain severity after the pandemic's onset [10, 11]. However, reliance on school-based or clinical samples may lead to over-estimating the population proportion of children with significant chronic pain, and may not be representative of the national burden of chronic pain in the pediatric population [12, 13]. Therefore, we used repeated cross-sectional data from a nationally representative survey in the USA to test whether the prevalence of chronic pain among children declined during the COVID-19 pandemic. Our secondary aim was to determine whether changes in pediatric chronic pain prevalence were attributable to changes in other population characteristics during this time.

Methods

This study was a secondary analysis of deidentified data from the 2019 and 2020 National Survey of Children's Health (NSCH). The NSCH is designed to provide cross-sectional national estimates on the health and well-being (including prevalence of chronic pain) of US children ages 0–17 years [14, 15]. This survey used address-based sampling to identify households with children and sent a detailed questionnaire about one child per household that could be completed by their caregiver online or by mail, with optional questionnaire assistance over telephone. For this analysis, we included children ages 6–17 years old, and excluded children with intellectual disabilities, children with missing data on chronic pain, and children with missing data on other study variables. Because data used for this study were non-identified and publicly available, the study was not subject to Institutional Review Board review.

The primary outcome was the presence of chronic pain, defined as an affirmative answer to the question, "During the past 12 months, has the child had frequent or chronic difficulty with any of the following, repeated or chronic physical pain, including headaches or other back or body pain?" Covariates were selected based on prior descriptive research using the NSCH data [16]. These included the child age, sex, and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic or Latino, or any other race/ethnicity); household structure (mother and father, single mother, or any other structure), caregivers' highest educational attainment (high school or less, some college, college degree, or advanced degree); the child's health insurance coverage (private coverage, public coverage only, other coverage, or no coverage); and whether the child had a usual source of health care (not counting the emergency department) [16].

Categorical data, including the prevalence of chronic pain, were summarized as proportions with 95% confidence intervals (CIs); while continuous data were summarized as means with 95% CI. Data were compared across years (2019 vs. 2020) using Wald tests. A multivariable logistic regression model was then fitted comparing the odds of caregiver report of chronic pain according to survey year and study covariates described above. All analyses incorporated

survey weights and adjustment for the complex sampling design, as indicated by the survey technical documentation. Data analysis was performed using Stata 16.1 (College Station, TX: StataCorp, LP), and $p < 0.05$ was considered statistically significant.

Results

We identified 51,895 children ages 6–17 years in the 2019–2020 NSCH. After excluding 646 children with intellectual disabilities, 195 children with missing data on chronic pain, and 1,536 children with missing data on covariates, we retained 49,518 children for analysis, of whom 20,359 were included in the 2019 survey and 29,159 were included in the 2020 survey. The prevalence of chronic pain decreased from 11% (95% CI: 10%, 12%) in 2019 to 8% (95% CI: 7%, 8%) in 2020 (Wald test $p < 0.001$). Additional child and family characteristics are compared between the survey years in Table 1. There were no statistically significant differences in race, educational status, or insurance coverage between the two years. The proportion of children living in two-parent households decreased slightly from 73% in 2019 to 70% in 2020 ($p = 0.014$), and the proportion of children with a usual source of care decreased from 77 to 75% ($p = 0.046$).

Multivariable analysis of caregiver-reported chronic pain is summarized in Table 2. The odds of reporting chronic pain decreased by 33% in 2020 as compared to 2019 (odds ratio [OR]: 0.67; 95% CI: 0.58, 0.77; $p < 0.001$). In the multivariable model, the prevalence of chronic pain was lower among boys as compared to girls, and among non-Hispanic Black as compared to non-Hispanic White children. However, Hispanic or Latino children had higher prevalence of chronic pain compared to Non-Hispanic White children. Additionally, higher odds of chronic pain were associated with living in a single-mother household (compared to living with 2 parents), and living with caregivers who had some college education (compared to living with caregivers who did not attend college), and having any type of insurance coverage (or no insurance) other than private insurance coverage.

Discussion

Our study addresses the hypothesis that during the COVID-19 pandemic, chronic pain would have become more common among children due to multiple effects of the pandemic acting on the biopsychosocial factors that shape the incidence and persistence of chronic pain. At the

Table 1: Characteristics of children ages 6–17 years represented in the 2019 and 2020 National Survey of Children's Health.

Variable	2019 survey year (n=20,359) Weighted mean or proportion (95% CI)	2020 survey year (n=29,159) Weighted mean or proportion (95% CI)	p-Value
Chronic pain	0.11 (0.10, 0.12)	0.08 (0.07, 0.08)	<0.001
Age (years)	11.5 (11.4, 11.6)	11.6 (11.5, 11.6)	0.697
Male sex	0.51 (0.49, 0.52)	0.51 (0.49, 0.52)	0.987
Race/ethnicity			
Non-hispanic white	0.50 (0.48, 0.52)	0.50 (0.49, 0.52)	0.948
Non-hispanic black	0.13 (0.12, 0.15)	0.13 (0.12, 0.14)	0.741
Hispanic or latino	0.25 (0.24, 0.27)	0.26 (0.25, 0.27)	0.611
Other	0.11 (0.10, 0.12)	0.10 (0.10, 0.11)	0.604
Household structure			
Two parents	0.73 (0.71, 0.74)	0.70 (0.69, 0.71)	0.014
Single mother	0.17 (0.16, 0.18)	0.19 (0.18, 0.20)	0.014
Other	0.10 (0.09, 0.11)	0.11 (0.10, 0.11)	0.603
Caregivers' education			
High school or less	0.24 (0.23, 0.26)	0.25 (0.23, 0.26)	0.887
Some college	0.27 (0.25, 0.28)	0.26 (0.25, 0.27)	0.640
College degree	0.24 (0.22, 0.25)	0.24 (0.23, 0.25)	0.442
Advanced degree	0.25 (0.24, 0.27)	0.25 (0.24, 0.26)	0.665
Insurance coverage			
Private	0.61 (0.60, 0.63)	0.61 (0.60, 0.62)	0.488
Public only	0.28 (0.26, 0.29)	0.28 (0.27, 0.29)	0.773
Other	0.04 (0.03, 0.05)	0.04 (0.03, 0.04)	0.752
None	0.07 (0.06, 0.08)	0.07 (0.07, 0.08)	0.352
Child has usual source of care	0.77 (0.75, 0.78)	0.75 (0.74, 0.76)	0.046

CI, confidence interval.

outset of the pandemic, several sources hypothesized that the pandemic would yield an increase in the prevalence of chronic pain due to pain complications associated with SARS-CoV-2 infection, or due to the pandemic's negative psychological, social, and economic effects [5, 6]. However, our study found a decrease in the prevalence of caregiver-reported pediatric chronic pain on a nationally-representative survey in the US. This decrease in the prevalence of chronic pain during the early phase of the pandemic calls into question the hypothesized mechanisms through which the pandemic was thought to contribute to development or persistence of chronic pain. Furthermore, this finding of declining chronic pain prevalence in the population raises the question of what

Table 2: Multivariable logistic regression caregiver-reported chronic pain among children ages 6–17 years represented in the 2019 and 2020 National Survey of Children's Health (n=49,518).

Variable	OR	95% CI	p-Value
Survey year (2020 vs. 2019)	0.67	0.58, 0.77	<0.001
Age (years)	1.12	1.10, 1.15	<0.001
Male sex	0.65	0.56, 0.76	<0.001
Race/ethnicity			
Non-hispanic white	Ref.		
Non-hispanic black	0.91	0.74, 1.13	0.386
Hispanic or latino	1.19	0.96, 1.47	0.105
Other	0.86	0.69, 1.10	0.154
Household structure			
Two parents	Ref.		
Single mother	1.27	1.06, 1.53	0.010
Other	0.94	0.74, 1.20	0.619
Caregivers' education			
High school or less	Ref.		
Some college	1.20	0.97, 1.48	0.102
College degree	0.89	0.70, 1.12	0.307
Advanced degree	1.00	0.76, 1.33	0.982
Insurance coverage			
Private	Ref.		
Public only	1.55	1.28, 1.86	<0.001
Other	1.33	0.96, 1.86	0.089
None	1.51	1.00, 2.28	0.048
Child has usual source of care	1.14	0.94, 1.40	<0.001

CI, confidence interval; OR, odds ratio.

population-level interventions for chronic pain could be implemented in the future to build upon this trend.

The biopsychosocial model emphasizes the role of individual and environmental stressors in the development and persistence of chronic pain [17]. The stress pathway sends signals to the pituitary gland and the adrenal medulla which elicits neurobiological mechanisms that can potentially lead to many neurophysiological deviances like an increase in muscle tension and neuromuscular excitability, both of which can increase the prevalence of chronic pain [18]. Before the pandemic, various studies have demonstrated how exposure to more or different stressors can lead to higher reporting of pain [19]. Conversely, psychosocial interventions which address daily stressors can lessen the prevalence and severity of chronic pain [20, 21]. Specific pandemic-related stressors postulated to increase pain prevalence have included sleep deprivation, grieving a death in the child's support system, and having to be in quarantine due to viral infection or exposure [5, 6]. Although these expectations were a plausible interpretation of the biopsychosocial model at the outset of the pandemic, our study builds upon recent work which demonstrates paradoxical decreases in the prevalence or intensity of pediatric chronic pain during the pandemic [9–11].

While explanations for our findings are necessarily speculative, our data indicate a need to reconsider the stressors affecting children throughout the pandemic. During our study period, many children transitioned to online learning [22], potentially removing stressors associated with the school setting [9]. This reduction in stressors, in turn, may have led to an increase in positive emotion, an important component of stress resilience [23]. Additionally, being able to spend more time at home with family and loved ones could have provided a source of resilience and positive emotion, reducing children's risk of developing chronic pain, or reducing the intensity of pain among those who had already been experiencing chronic pain. This explanation is consistent with improvement on some domains of child and adolescent mental health during the pandemic, as noted in one study [24], although in the same study, the majority of children and adolescents also experienced deterioration on one or more domains of mental health.

Some limitations of this study should be considered when interpreting our findings. First, data on children's chronic pain were obtained by caregiver report, which could lead to underestimating pediatric chronic pain prevalence [12], although it is unclear if the extent of this bias would have changed during the pandemic. Also, some of the 2020 NSCH data were collected in the pre-pandemic months of January-February 2020, and there was no way to exclude these responses in the analysis of the public-use file. Furthermore, the survey collected limited information about school-related factors which may have affected resilience against chronic pain, such as participation in physical activity, exposure to bullying, or responsibility for other siblings attending school. Lastly, we were unable to account for children's detailed medical history, including pertinent information on the etiology and severity of chronic pain.

In sum, our study documents an unforeseen decrease in the prevalence of pediatric chronic pain during the COVID-19 pandemic. Further work is needed to determine if this was a one-time decrease or the beginning of a sustained downward trend in chronic pain prevalence. Additionally, further research incorporating patient-reported data and more detailed information on pain problems could test some of the potential explanations for this trend, such as increasing resilience during time away from school, or population-wide changes in pain acceptance or pain coping. Despite this encouraging finding, continuing monitoring of chronic pain prevalence among children is needed to detect any potential harmful long-term effects of the ongoing pandemic.

Research funding: No research funding involved.

Author contributions: BA participated in study design, interpretation of results, and drafting of the manuscript. ANM participated in interpretation of results and drafting of the manuscript. DT participated in study design, data analysis, and critical revision of the manuscript. EZ participated in study design, interpretation of results, and critical revision of the manuscript. All authors reviewed and approved the final version for submission.

Competing interests: There are no conflicts of interests from any of the authors included in this manuscript.

Informed consent: No human subjects were included in this study and informed consent was not required.

Ethical approval: This study was considered not human subjects research and did not require Institutional Review Board review.

References

1. Liossi C, Howard RF. Pediatric chronic pain: biopsychosocial assessment and formulation. *Pediatrics* 2016;138:e20160331.
2. Walters CB, Kynes JM, Sobey J, Chimhundu-Sithole T, McQueen KAK. Chronic pediatric pain in low- and middle-income countries. *Children* 2018;5:113.
3. Aliano S. Children, opioids, and pain: the stats & clinical guidelines [online]: Practical Pain Management; 2018. Available from: <https://www.practicalpainmanagement.com/resources/clinical-practice-guidelines/children-opioids-pain-stats-clinical-guidelines> [Accessed 1 May 2022].
4. Ebert MH, Kerns RD. Behavioral and psychopharmacologic pain management. New York, NY: Cambridge University Press; 2010.
5. Attal N, Martinez V, Bouhassira D. Potential for increased prevalence of neuropathic pain after the COVID-19 pandemic. *Pain Rep* 2021;6:e884.
6. Clauw DJ, Häuser W, Cohen SP, Fitzcharles MA. Considering the potential for an increase in chronic pain after the COVID-19 pandemic. *Pain* 2020;161:1694–7.
7. Wong L, Hawkins J, Langness S, Murrell K, Iris P, Sammann A. Where are all the patients? Addressing covid-19 fear to encourage sick patients to seek emergency care. *NEJM Catalyst* 2020. <https://catalyst.nejm.org/doi/full/10.1056/CAT.20>.
8. Szilagyi IS, Ullrich T, Lang-Ilievich K, Klivinyi C, Schitteck GA, Simonis H, et al. Google trends for pain search terms in the world's most populated regions before and after the first recorded COVID-19 case: infodemiological study. *J Med Internet Res* 2021;23:e27214.
9. Rau LM, Grothus S, Sommer A, Grochowska K, Claus BB, Zernikow B, et al. Chronic pain in schoolchildren and its association with psychological wellbeing before and during the COVID-19 pandemic. *J Adolesc Health* 2021;69:721–8.
10. Papetti L, Loro PAD, Tarantino S, Grazi L, Guidetti V, Parisi P, et al. I stay at home with headache. A survey to investigate how the lockdown for COVID-19 impacted on headache in Italian children. *Cephalalgia* 2020;40:1459–73.

11. Gong Q, Liu S, Li R, Yao L, Xiao Z. Overall trend towards headache remission during the COVID-19 pandemic among Chinese patients with pre-existing headache highlights the role of family support. *BMC Neurol* 2021;21:224.
12. King S, Chambers CT, Huguet A, MacNevin RC, McGrath PJ, Parker L, et al. The epidemiology of chronic pain in children and adolescents revisited: a systematic review. *Pain* 2011;152:2729–38.
13. Tumin D, Drees D, Miller R, Wrona S, Hayes D Jr., Tobias JD, et al. Health care utilization and costs associated with pediatric chronic pain. *J Pain* 2018;19:973–82.
14. U.S. Census Bureau (2020). National survey of children's health methodology report; 2021. Available from: [2020-NSCH-Methodology-Report.pdf.(census.gov)] [Accessed 1 May 2022].
15. Groenewald CB, Murray CB, Palermo TM. Adverse childhood experiences and chronic pain among children and adolescents in the United States. *Pain Rep* 2020;5:e839.
16. White J, Morris H, Cortright L, Buckman C, Tumin D, Jamison S. Concordance of data on children's unmet health care needs between 2 national surveys. *J Publ Health Manag Pract* 2022;28:E155–61.
17. Bevers K, Watts L, Kishino ND, Gatchel RJ. The biopsychosocial model of the assessment, prevention, and treatment of chronic pain. *US Neurol* 2016;12:98–104.
18. Alfven G, Grillner S, Andersson E. Review of childhood pain highlights the role of negative stress. *Acta Paediatr* 2019;108: 2148–56.
19. Walker LS, Garber J, Smith CA, Van Slyke DA, Claar RL. The relation of daily stressors to somatic and emotional symptoms in children with and without recurrent abdominal pain. *J Consult Clin Psychol* 2001;69:85–91.
20. Roditi D, Robinson ME. The role of psychological interventions in the management of patients with chronic pain. *Psychol Res Behav Manag* 2011;4:41–9.
21. Coakley R, Wihak T. Evidence-based psychological interventions for the management of pediatric chronic pain: new directions in research and clinical practice. *Children* 2017;4:9.
22. Lemay DJ, Bazalais P, Doleck T. Transition to online learning during the COVID-19 pandemic. *Comput Hum Behav Rep* 2021;4:100130.
23. Sturgeon JA, Zautra AJ. Psychological resilience, pain catastrophizing, and positive emotions: perspectives on comprehensive modeling of individual pain adaptation. *Curr Pain Headache Rep* 2013;17:317.
24. Cost KT, Crosbie J, Anagnostou E, Birken CS, Charach A, Monga S, et al. Mostly worse, occasionally better: impact of COVID-19 pandemic on the mental health of Canadian children and adolescents. *Eur Child Adolesc Psychiatr* 2022;31:671–84.