Title

Cumulative Social Disadvantage Associated with Childhood Arthritis: A Cross-Sectional Analysis of the National Survey of Childrens Health.

Journal

Arthritis Care & Research, 75(1)

Authors

Soulsby, William
Pantell, Matthew
Lawson, Erica

Publication Date

2023

DOI

10.1002/acr.24991

Peer reviewed

HHS Public Access

Author manuscript

Arthritis Care Res (Hoboken). Author manuscript; available in PMC 2024 January 01.

Published in final edited form as:

Arthritis Care Res (Hoboken). 2023 January ; 75(1): 3–8. doi:10.1002/acr.24991.

Cumulative Social Disadvantage is Associated with Childhood Arthritis: A Cross-Sectional Analysis of the National Survey of Children's Health

William Daniel Soulsby, M.D.[1], **Erica Lawson, M.D.**[1], **Matthew S. Pantell, M.D., M.S.**[2,3]

[1]University of California, San Francisco, Department of Pediatrics, Division of Pediatric Rheumatology, San Francisco, CA

[2]University of California, San Francisco, Department of Pediatrics, Division of Pediatric Hospital Medicine, San Francisco, CA

[3]Center for Health and Community, University of California, San Francisco, San Francisco, CA

Abstract

Objective: Health disparities in juvenile idiopathic arthritis (JIA) remain poorly understood. Social disadvantage may have a cumulative impact on health with recent analyses using combined scoring systems to measure their impact on outcomes. Our aim was to investigate cumulative social disadvantage on childhood arthritis by using a cumulative score to analyze its association with arthritis among a nationally representative sample of children.

Methods: A cross-sectional analysis of the National Survey of Children's Health (2016–2019) was performed. A cumulative social disadvantage score was generated (1 point each with maximum score of 4): low guardian education (high school or less), low household income level (0–199% of Federal Poverty Level), underinsured status (public or uninsured), and high ACE score (≥4). Univariate and multivariable (adjusting for age, sex, and race and ethnicity) logistic regression models were used to measure the association between cumulative social risk and the odds of an arthritis diagnosis and moderate-to-severe parent-reported arthritis severity.

Results: 365 children reported current arthritis of 131,774 surveys completed. Cumulative social disadvantage was associated with an arthritis diagnosis, with the highest odds among those with a score of 4 (aOR 12.4, 95% CI: 2.9–53.3). Cumulative social disadvantage also was associated with increased odds of moderate-to-severe arthritis activity (aOR 12.4, 95% CI: 1.8–82.6).

Conclusion: In this nationally representative sample, accumulated social disadvantage, measured via a cumulative social disadvantage score based on income level, guardian education, insurance status, and ACE exposure, was associated with an arthritis diagnosis and moderate-to-severe arthritis activity.

The link between health disparities and poor health outcomes is well established across a variety of chronic illnesses[1]. Although juvenile idiopathic arthritis (JIA) is one of the most

Corresponding Author: William Daniel Soulsby, 550 16th Street, 4th Floor, Box #0632, San Francisco, CA 94158, Phone: (602) 363-9160, Fax: (415) 353-2861, daniel.soulsby@ucsf.edu.

Competing Interests or Conflicts of Interest: The authors declare that they have no competing interests or conflicts of interest.

common chronic diseases of childhood, the role of socioeconomic factors (SEF) in disease development and outcomes remains poorly understood. Prior studies analyzing associations between JIA and poverty, insurance status, and other SEF have yielded inconsistent results in the literature[2,3]. Small retrospective studies in adult inflammatory arthritis and JIA have demonstrated that lower income level and lower guardian education level may be associated with higher disease activity, though these relationships were no longer significant after 1 year of follow up[4,5]. Similarly, family income level was not associated with significantly higher measures of disease activity in a recent cross-sectional analysis of Brazilian patients[6]. The concept of social adversity impacting childhood arthritis was highlighted by a recent analysis demonstrating that increased exposure to adverse childhood experiences (ACEs) yielded higher odds of an arthritis diagnosis[7]. Importantly, individuals experiencing social disadvantage often face multiple social hardships which rarely act in isolation; studying these factors independently may miss underlying disparities. Additionally, although data suggest that social disadvantage may have a cumulative impact on child and adult health[8], with recent analyses using combined scoring systems[9], this approach has not been used to study disparities in childhood arthritis. Better understanding of how social variables associated with disadvantage interact to contribute to health disparities will be key in achieving equitable clinical outcomes for all patients with childhood arthritis.

In this study, our aim was to investigate cumulative social disadvantage and its association with an arthritis diagnosis using variables associated with social, economic, and environmental hardship and previously studied as independent risk factors in childhood arthritis (including household income level, guardian education level, child insurance status, and ACEs) among a nationally representative sample of children using the National Survey of Children's Health (NSCH). Additionally, we investigated the association between cumulative social disadvantage and parental assessment of disease severity. We hypothesized that as levels of social disadvantage increased, the odds of childhood arthritis and moderate-to-severe disease activity would increase.

Methods:

This is a cross-sectional analysis using merged data from the National Survey of Children's Health (NSCH) from 2016–2019[10]. The NSCH is an annual federally administered survey directed by the US Census Bureau and Health Resources and Services Administration's Maternal and Child Health Bureau (HRSA MCHB) designed to produce national and state level data on the physical and emotional health of children 0–17 years of age in the United States. All data are reported by parents or guardians. The dataset includes many variables describing children's health (such as physical and mental health, neighborhood, school, and social context) from households across all 50 United States and the District of Columbia. To generate representative estimates of the U.S. population of non-institutionalized children, the NSCH provides sampling weights that account for the probability of selection, survey nonresponse, household size, household poverty threshold, educational attainment of household respondent, number of children with special health care needs, age, sex, race and ethnicity, and other demographic characteristics[10]. Approval for exemption was obtained from the University of California, San Francisco Institutional Review Board.

First, we dichotomized baseline characteristics of the cohort by the presence or absence of currently reported arthritis. We queried this from the Physical, Oral, and Functional status section of the survey that asks “Does this child currently have arthritis?” with possible answers of “Does not have condition,” “Ever told, but does not currently have condition,” and “Currently has condition.” To target individuals with chronic rheumatic causes of arthritis, we coded those who reported “Ever told, but does not currently have condition” as not having arthritis. We calculated the weighted prevalence of these variables and compared distributions by sociodemographic characteristics using Pearson’s chi-squared or Fisher’s exact tests, as appropriate. We generated a cumulative social disadvantage score (range 0–4) by giving 1 point for each of the following domains: highest education obtained by household respondent is high school or less, household income level is 0–199% of Federal Poverty Level (a level closely associated with Child Health Insurance Program qualification in most U.S. states[10]), child insurance status is public or uninsured, and high ACE score (≥4 of the following ACEs: financial insecurity, guardian divorce, guardian death, guardian in jail, exposure to domestic violence, exposure to neighborhood violence, mental illness in household, substance use in household, or experiencing racism). These four social domains were chosen as they have been previously investigated as risk factors in childhood arthritis outcomes[2–7]. We did not perform imputation because of the low rate of missingness of key demographic and social variables.

We then used logistic regression to calculate unadjusted odds ratios of having an arthritis diagnosis using each individual component of the social disadvantage score. Next, we used univariate logistic regression to calculate unadjusted odds ratios for the association between cumulative social disadvantage score and the odds of an arthritis diagnosis. We then used multivariable logistic regression to analyze the same associations while controlling for the following covariates: age (0–5, 6–11, or 12–17 years), sex (male or female), and race and ethnicity (Hispanic, White non-Hispanic, Black non-Hispanic, and multi-racial or other non-Hispanic).

For our second aim, we queried parent-rated severity of childhood arthritis from the Physical, Oral, and Functional status section of the survey that asks among those reporting current arthritis: “Would you describe [his/her] current arthritis as mild, moderate, or severe?” with possible answers of “Does not currently have condition,” “Current condition rated mild,” and “Current condition rated moderate/severe.” We dichotomized arthritis severity as no arthritis or mild versus moderate-to-severe. We then used logistic regression to calculate the unadjusted odds ratio of having moderate-to-severe parent-reported arthritis severity compared to no or mild arthritis using each individual component of the cumulative social disadvantage score. We then used univariate logistic regression to calculate unadjusted odds ratios for the association between cumulative social disadvantage and the odds of moderate-to-severe disease. Finally, we conducted the aforementioned logistic regression in multivariable models adjusting for age, sex, and race and ethnicity.

Data from all available respondents (n=131,774) were used for both aims.

Results:

Demographic Characteristics:

In total, 365 respondents were reported to currently have arthritis in the 2016–2019 merged years of the NSCH (Table 1). No data was missing among key demographic variables, and there was minimal missingness of social variables among the arthritis cohort (n=8 for insurance and n=5 for education). The cohort was predominantly female among those with arthritis (60%). Families of children with arthritis were more likely to report income between 0–199% below the federal poverty limit (relative prevalence comparing those with versus without arthritis: 70% vs 40%), lower guardian education level of high school or less (58% vs 28%), use of public insurance or uninsured status (46% vs 36%), and high ACE score of ≥4 (36% vs 8%). There were a higher proportion of Black non-Hispanic children in the arthritis cohort (37% vs 13%) and lower proportion of Hispanic patients (5% vs 26%) with other racial/ethnic groups of roughly equivalent proportions. Children with reported arthritis were less likely to report cumulative social disadvantage scores of 0, 1, or 2 compared to children without arthritis. Similarly, a higher proportion of children with arthritis reported cumulative social disadvantage scores of 3 (38% vs 15%) or 4 (16% vs 2%).

Primary Aim:

In unadjusted analysis, low guardian education (odds ratio [OR] 2.4, 95% confidence interval [CI]: 1.3–4.5), low insurance (OR 2.1, 95% CI: 1.1–4.0), and high ACE score (OR 2.9, 95% CI: 1.2–7.0) were independently associated with increased odds of an arthritis diagnosis, while low income was not statistically significant (Table 2). In unadjusted and adjusted analysis, cumulative social disadvantage was associated with increased odds of an arthritis diagnosis (Table 3). Increases in cumulative social disadvantage score demonstrated successive increases in the odds of childhood arthritis (Table 3) though this was only statistically significant for a score of 3 or 4. Children with a score of 4 had the largest increase in odds of an arthritis diagnosis in unadjusted (OR 13.0, 95% CI: 2.6–64.2) and adjusted analyses (adjusted odds ratio [aOR] 12.4, 95% CI: 2.9–53.3).

Secondary Aim:

In unadjusted analysis, low income (OR 4.3, 95% CI: 1.6–11.6), low guardian education (OR 4.2, 95% CI: 1.5–11.8), and high ACE score (OR 8.1, 95% CI: 2.0–32.5) were independently associated with increased odds of moderate-to-severe disease activity, while low insurance status was not statistically significant (Table 2). Cumulative social disadvantage was associated with increased odds of parent-reported moderate-to-severe disease activity for children with a diagnosis of arthritis in both unadjusted and adjusted analyses (Table 3). Increases in cumulative social disadvantage score correlated with successive increases in the odds of moderate-to-severe disease activity (Table 3), though this was only statistically significant for a score of 3 or 4. Children with a cumulative social disadvantage score of 4 had the largest increase in the odds of moderate-to-severe disease activity in unadjusted (OR 16.6, 95% CI: 2.0–134.8) and adjusted (aOR 12.4, 95% CI: 1.8–82.6) analyses.

Discussion:

In a nationally representative sample investigating the association between cumulative social disadvantage and childhood arthritis, children with higher exposure to social disadvantage had increased odds of arthritis, in unadjusted and adjusted analyses. Additionally, cumulative social disadvantage was associated with higher disease severity as compared to those without social risk factors, in unadjusted and adjusted analyses.

Our analysis has several important implications. First, children with arthritis appear to be more socially disadvantaged with statistically significantly higher proportions living in poverty (0–199% FPL), having guardians with high school or lower education, and having higher exposure to ACEs (Table 1). Second, our results corroborate prior work demonstrating that many of these variables have independent associations with childhood arthritis. Increases in the odds of arthritis and disease severity with increased exposure to social disadvantage suggests a social gradient involved in childhood arthritis disparities, though this relationship was only statistically significant among those children with scores of 3 or 4. This trend of cumulative social disadvantage has been demonstrated in children's health generally[8] and through our work demonstrates its relevance to the childhood arthritis population specifically. To understand and ameliorate the impact of these social factors on the development and outcomes of childhood arthritis, researchers should move beyond independent risk analyses to more complex approaches that acknowledge multiple spheres of social influence converging to create differential risk. Such analyses will more accurately reflect the impact of social disadvantage some patients experience.

One such research approach is the application of intersectionality to disparities research in childhood arthritis. Intersectionality is a theory rooted in social science and refers to a framework by which multiple variables related to social disadvantage interact in unique combinations to differentially contribute to health inequalities with non-linear impacts on health[11]. Recent advances have yielded statistical techniques applied to intersectionality principles, including the use of decomposition methods, such as causal mediation analysis, to decompose the effect of a predictor variable into its direct and indirect effects on an outcome[12]. Such analyses may help better understand causal pathways leading to inequalities by quantifying the relative contributions of multiple social factors associated with disadvantage leading to poor outcomes. These methods will be key to developing effective interventions to mitigate disparities with the goal of achieving health equity for all patients.

Beyond research, our findings can be directly applied to clinical practice by supporting the use of social screeners in rheumatology clinics. By screening individuals for exposure to social factors such as those used in our analysis, clinicians may identify patients at highest risk of poor outcomes who may benefit from social work intervention and more careful follow-up. Furthermore, recent work has demonstrated that addressing social needs in general pediatric outpatient clinics through social screening and patient navigation programs leads to improved health and decreased hospitalizations[13,14]. Adopting similar approaches in pediatric rheumatology clinic may therefore improve outcomes, especially among those who are most socially disadvantaged. Limitations exist in practice, however, including lack

of guidelines regarding optimal screening methods, absence of standardized interventions or universal access to social work, cost of navigation services, and time for screening and intervention.

Finally, we need to improve understanding of how social disadvantage impacts both disease development and outcomes. Prior work has demonstrated that social disadvantage is associated with poorer health, chronic illness, and activity limitations in children[8]. Emerging evidence also demonstrates that social disadvantage may be associated with cellular changes, such as biological aging, which may help explain how these factors drive disease development[15]. However, social disadvantage may also drive reduced access to care and other resources after disease development. In our study, the association of cumulative social disadvantage with arthritis severity may suggest its impact on outcomes, and the association of cumulative social disadvantage with a diagnosis of arthritis may suggest its impact on disease development. But importantly, we are unable to demonstrate causality with our cross-sectional analysis, where the timing of exposure versus outcome cannot be delineated. Case-control studies may be illustrative to improve our understanding of the relationship between social disadvantage and disease development, while cohort studies may help elucidate disparities in disease outcomes based on social disadvantage. The results of such studies could have important implications regarding the design and timing of interventions to prevent disparities among children with arthritis. Policy interventions that target eliminating childhood poverty or implementing universal healthcare would be hypothesized to improve disparities via either pathway and have the potential to simultaneously impact multiple levels of social disadvantage.

This study has important limitations, including the cross-sectional nature of our dataset, limiting causal interpretation. Additionally, the magnitude of the association of social disadvantage, while suggested to be cumulative, may be difficult to quantify with precision due to low sample size, as evidenced by very wide 95% confidence intervals for the primary and secondary aims. We attempted to overcome this limitation by using the four most recent available iterations of the NSCH (2016–2019) to maximize our sample size. It is possible, though unlikely due to sampling methods, that subjects were repeated in successive years of the NSCH. Additional limitations include guardian-reported exposure and outcome measures, including an arthritis diagnosis. Finally, unmeasured variables, such as medication use, time from symptom onset to first rheumatologist visit, and distance to care, which were not reported in the NSCH and could not be accounted for in our models, may confound our results. Advantages of our approach include the ability to calculate population-based estimates for arthritis diagnoses with minimal missingness in the dataset, yielding the largest representative sample of children with current arthritis in the U.S. This enhances the generalizability of our study findings to children with arthritis.

Conclusion:

Among a nationally representative population of U.S. children, there is evidence that cumulative social disadvantage is associated with both childhood arthritis and arthritis severity. Next steps include future studies using analytic intersectionality techniques, including three-way decomposition methods such as causal mediation analysis[12], to better

elucidate causal pathways leading to disparities in childhood arthritis. Additionally, our results suggest that social risk screening in pediatric rheumatology clinic may be a useful step in identifying patients with arthritis at high risk for poor outcomes.

Funding & Financial Support:

Dr. Pantell receives funding from the National Institutes of Health Loan Repayment Program (under Award Number 9 L40 HD106442–02A1), the Agency for Healthcare Research and Quality (under Award Number K12HS026383), and the National Center for Advancing Translational Sciences (under Award Number KL2TR001870).

References:

1. Cockerham WC, Hamby BW, Oates GR. The Social Determinants of Chronic Disease. American Journal of Preventive Medicine. 2017;52(1):S5–S12. doi:10.1016/j.amepre.2016.09.010 [PubMed: 27989293]
2. Brunner HI, Taylor J, Britto MT, et al. Differences in disease outcomes between medicaid and privately insured children: possible health disparities in juvenile rheumatoid arthritis. Arthritis Rheum. 2006;55(3):378–384. doi:10.1002/art.21991 [PubMed: 16739206]
3. Lewis KA, Brown SA, Tiziani S, Carrasco R. Sociocultural Considerations in Juvenile Arthritis: A Review. J Pediatr Nurs. 2017;37:13–21. doi:10.1016/j.pedn.2017.08.023 [PubMed: 28911961]
4. Yang G, Bykerk VP, Boire G, et al. Does socioeconomic status affect outcomes in early inflammatory arthritis? Data from a canadian multisite suspected rheumatoid arthritis inception cohort. J Rheumatol. 2015;42(1):46–54. doi:10.3899/jrheum.131382 [PubMed: 25399388]
5. Verstappen SMM, Cobb J, Foster HE, et al. The association between low socioeconomic status with high physical limitations and low illness self-perception in patients with juvenile idiopathic arthritis: results from the Childhood Arthritis Prospective Study. Arthritis Care Res (Hoboken). 2015;67(3):382–389. doi:10.1002/acr.22466 [PubMed: 25187470]
6. Rocha FAC, Landim JIVD, Aguiar MG, et al. Evaluation of disease activity in a low-income juvenile idiopathic arthritis cohort. Rheumatol Int. 2019;39(1):67–71. doi:10.1007/s00296-018-4128-8 [PubMed: 30101369]
7. Rubinstein TB, Bullock DR, Ardalan K, et al. Adverse Childhood Experiences Are Associated with Childhood-Onset Arthritis in a National Sample of US Youth: An Analysis of the 2016 National Survey of Children's Health. J Pediatr. Published online June 15, 2020. doi:10.1016/j.jpeds.2020.06.046
8. Bauman LJ, Silver EJ, Stein RE. Cumulative social disadvantage and child health. Pediatrics. 2006 Apr;117(4):1321–8. doi: 10.1542/peds.2005-1647. PMID: 16585330. [PubMed: 16585330]
9. Pantell MS, Prather AA, Downing JM, Gordon NP, Adler NE. Association of Social and Behavioral Risk Factors With Earlier Onset of Adult Hypertension and Diabetes. JAMA Netw Open. 2019 May 3;2(5):e193933. doi: 10.1001/jamanetworkopen.2019.3933. PMID: 31099868; PMCID: PMC6537925.
10. Child and Adolescent Health Measurement Initiative. National Survey of Children's Health: 2017–2018. Data Resource Center for Child and Adolescent Health supported by the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau (MCHB). Retrieved March 01, 2021 from [www.childhealthdata.org].
11. Mandelbaum J. Advancing health equity by integrating intersectionality into epidemiological research: applications and challenges. J Epidemiol Community Health. 2020;74(9):761–762. doi:10.1136/jech-2020-213847 [PubMed: 32527861] Jun;147(6):e2020024406. doi: 10.1542/peds.2020-024406. Epub 2021 May 17. PMID: 34001641; PMCID: PMC8785753.
12. Bauer GR, Scheim AI. Methods for analytic intercategorical intersectionality in quantitative research: Discrimination as a mediator of health inequalities. Soc Sci Med. 2019 Apr;226:236–245. doi: 10.1016/j.socscimed.2018.12.015. Epub 2019 Jan 21. PMID: 30674435. [PubMed: 30674435]
13. Gottlieb LM, Hessler D, Long D, Laves E, Burns AR, Amaya A, Sweeney P, Schudel C, Adler NE. Effects of Social Needs Screening and In-Person Service Navigation on Child

Health: A Randomized Clinical Trial. JAMA Pediatr. 2016 Nov 7;170(11):e162521. doi: 10.1001/jamapediatrics.2016.2521. Epub 2016 Nov 7. PMID: 27599265.

14. Pantell MS, Hessler D, Long D, Alqassari M, Schudel C, Laves E, Velazquez DE, Amaya A, Sweeney P, Burns A, Harrison FL, Adler NE, Gottlieb LM. Effects of In-Person Navigation to Address Family Social Needs on Child Health Care Utilization: A Randomized Clinical Trial. JAMA Netw Open. 2020 Jun 1;3(6):e206445. doi: 10.1001/jamanetworkopen.2020.6445. PMID: 32478849; PMCID: PMC7265099.
15. Raffington L, Belsky DW, Kothari M, Malanchini M, Tucker-Drob EM, Harden KP. Socioeconomic Disadvantage and the Pace of Biological Aging in Children. Pediatrics. 2021

Innovations and Significance:

- In a nationally representative sample, children with arthritis were more likely to come from households reporting low guardian education level (high school or less), lower household income (0–199% of the federal poverty limit), and high adverse childhood experiences (ACE) exposure (≥4).
- Cumulative social disadvantage, including exposure to low guardian education level (high school or less), underinsured status (public insurance or uninsured), low income level (0–199% of the Federal Poverty Limit), and high ACE score (≥4), was associated with increased odds of an arthritis diagnosis among a nationally representative sample of children in the National Survey of Children's Health, in both unadjusted and adjusted analyses, suggesting a cumulative association between social disadvantage and an arthritis diagnosis.
- Additionally, cumulative social disadvantage was associated with increased odds of moderate-to-severe arthritis activity, suggesting a cumulative association between social disadvantage on arthritis outcomes.

Table 1:

Weighted prevalence estimates (including 95% CI) of key demographic and social variables among children with and without current arthritis in the 2016–2019 versions of the National Survey of Children's Health:

Weighted prevalence (95% CI)	Total Cohort	No Arthritis	Arthritis
Unweighted total (n)	131,774	131,409	365
Age			
0–5 years old	32.1% (30.9–33.3%)	32.2% (31.0–33.4%)	0.8% (0.2–3.5%)
6–11 years old	33.6% (32.4–34.8%)	33.6% (32.4–34.8%)	19.7% (10.1–34.8%)
12–17 years old	34.3% (33.2–35.5%)	34.2% (33.1–35.4%)	79.6% (64.4–89.3%)
Sex			
Male	51.1% (49.9–52.4%)	51.2% (49.9–52.4%)	40.0% (22.8–60.1%)
Female	48.9% (47.6–50.1%)	48.8% (47.6–50.1%)	60.0% (39.9–77.2%)
Race and ethnicity			
Hispanic	25.6% (24.3–27.0%)	25.7% (24.3–27.1%)	4.8% (1.7–12.5%)
White, non-Hispanic	50.2% (49.0–51.4%)	50.2% (49.0–51.4%)	49.2% (30.7–67.9%)
Black, non-Hispanic	13.3% (12.4–14.2%)	13.2% (12.4–14.2%)	36.5% (17.9–60.3%)
Other/Multi-racial, non-Hispanic	10.9% (10.2–11.5%)	10.9% (10.2–11.5%)	9.5% (3.6–22.7%)
Insurance type			
Public health insurance only	29.4% (28.2–30.7%)	29.4% (28.2–30.7%)	41.8% (24.1–61.9%)
Private health insurance only	58.9% (57.6–60.2%)	59.0% (57.6–60.3%)	38.7% (23.2–56.9%)
Public and private insurance	4.9% (4.3–5.6%)	4.9% (4.3–5.5%)	14.8% (3.4–46.3%)
Uninsured	6.8% (6.1–7.6%)	6.8% (6.1–7.6%)	4.8% (1.5–13.8%)
Household income			
0–199% FPL	40.3% (39.0–41.6%)	40.2% (38.9–41.5%)	70.1% (54.5–82.1%)
200–299% FPL	16.9% (16.0–17.8%)	16.9% (16.0–17.8%)	10.8% (5.2–21.4%)
300–399% FPL	12.0% (11.3–12.8%)	12.1% (11.4–12.8%)	6.6% (2.9–14.3%)
400% FPL or greater	30.8% (29.8–31.9%)	30.9% (29.8–31.9%)	12.5% (6.1–24.0%)
Guardian education			
Less than high school	9.2% (8.2–10.4%)	9.2% (8.2–10.3%)	25.9% (9.0–55.2%)
High school or GED	18.9% (17.9–20.0%)	18.9% (17.9–20.0%)	31.8% (17.8–50.0%)
Some college or technical school	21.8% (20.8–22.8%)	21.8% (20.8–22.8%)	15.8% (8.3–28.1%)
College degree or higher	50.1% (48.8–51.3%)	50.1% (48.9–51.4%)	26.5% (15.3–41.9%)
Cumulative social disadvantage [1]			
0	45.1% (43.9–46.3%)	45.1% (43.9–46.3%)	23.9% (13.6–38.5%)
1	18.6% (17.7–19.6%)	18.6% (17.7–19.7%)	10.4% (5.0–20.4%)
2	18.0% (17.0–19.1%)	18.1% (17.0–19.1%)	12.6% (6.1–24.4%)
3	16.1% (15.0–17.2%)	16.0% (14.9–17.2%)	38.2% (20.6–59.5%)
4	2.2% (1.8–2.8%)	2.2% (1.7–2.7%)	14.9% (3.6–45.3%)
Low income level [2]			
No	59.7% (58.4–61.0%)	59.8% (58.5–61.1%)	29.9% (17.9–45.6%)
Yes	40.3% (39.0–41.6%)	40.2% (38.9–41.5%)	70.1% (54.5–82.1%)

Weighted prevalence (95% CI)	Total Cohort	No Arthritis	Arthritis
Low guardian education [3]			
No	71.9% (70.5–73.2%)	71.9% (70.6–73.2%)	42.3% (26.2–60.3%)
Yes	28.2% (26.9–29.5%)	28.1% (26.8–29.4%)	57.7% (39.7–73.8%)
Underinsured status [4]			
No	64.5% (63.2–65.7%)	64.5% (63.2–65.8%)	53.9% (34.6–72.1%)
Yes	35.5% (34.3–36.8%)	35.5% (34.2–36.8%)	46.1% (27.9–65.4%)
High ACE score (≥4)			
No	92.3% (91.5–93.0%)	92.4% (91.6–93.1%)	64.0% (39.7–82.7%)
Yes	7.7% (7.0–8.5%)	7.6% (6.9–8.4%)	36.0% (17.3–60.3%)

[1]Cumulative social disadvantage score: score of 1 given for each of the following domains: low-income level (0–199% federal poverty limit), low guardian education (high school or less), low insurance (public insurance or uninsured), and high adverse childhood experiences score (≥4)

[2]Defined as 0–199% federal poverty limit

[3]Defined as high school level or less

[4]Defined as public insurance or uninsured status

Table 2

Unadjusted associations between individual components of the cumulative social disadvantage score and the odds of an arthritis diagnosis (top) and the odds of moderate-to-severe arthritis activity (bottom):

Individual component of score:	Odds ratio for an arthritis diagnosis	95% CI	p-value
Low household income[1]	1.4	0.7–2.6	0.30
Low guardian education[2]	2.4	1.3–4.5	0.01
Underinsured status[3]	2.1	1.1–4.0	0.02
High ACE score[4]	2.9	1.2–7.0	0.02
Individual component of score:	**Odds ratio for arthritis severity**	**95% CI**	**p-value**
Low household income[1]	4.3	1.6–11.6	0.004
Low guardian education[2]	4.2	1.5–11.8	0.01
Underinsured status[3]	1.4	0.4–4.8	0.55
High ACE score[4]	8.1	2.0–32.5	0.003

[1] Income of 0–199% federal poverty limit)

[2] Guardian education of high school or less

[3] Public insurance or uninsured

[4] Adverse childhood experiences score ≥4

Table 3:

Unadjusted and adjusted associations between cumulative social disadvantage score and a current arthritis diagnosis among children in the 2016–2019 National Survey of Children's Health (top) and unadjusted and adjusted associations between cumulative social disadvantage score and moderate-to-severe versus mild parent-rated severity of arthritis among children in the 2016–2019 National Survey of Children's Health (bottom):

Cumulative social disadvantage[1]	Unadjusted odds ratio for current arthritis diagnosis	95% CI	p-value	Adjusted odds ratio for current arthritis diagnosis[2]	95% CI	p-value
0	—	—	—	—	—	—
1	1.1	0.5–2.4	0.89	1.0	0.5–2.4	0.92
2	1.3	0.6–3.0	0.51	1.4	0.6–3.6	0.48
3	4.5	1.9–11.0	0.001	5.6	2.2–13.4	0.000
4	13.0	2.6–64.2	0.002	12.4	2.9–53.3	0.001
Cumulative social disadvantage[1]	**Unadjusted odds ratio for moderate-to-severe arthritis**	**95% CI**	**p-value**	**Adjusted odds ratio for moderate-to-severe arthritis[2]**	**95% CI**	**p-value**
0	—	—	—	—	—	—
1	1.0	0.3–3.4	0.97	0.8	0.2–2.8	0.76
2	1.0	0.3–2.9	1.00	0.8	0.3–2.5	0.72
3	4.8	1.3–17.1	0.02	4.6	1.5–13.9	0.01
4	16.6	2.0–134.8	0.01	12.4	1.8–82.6	0.01

[1] Cumulative social disadvantage score: score of 1 given for each of the following domains: low household income level (0–199% federal poverty limit), low guardian education (high school or less), insurance status (public insurance or uninsured), and high adverse childhood experiences score (≥4)

[2] Multivariate model adjusted for age, sex, and race and ethnicity