Childhood Exposure to Violence and Chronic Physical Conditions in a National Sample of US Adolescents

Katie A. McLaughlin, PhD, Archana Basu, PhD, Kate Walsh, PhD, Natalie Slopen, ScD, Jennifer A. Sumner, PhD, Karestan C. Koenen, PhD, and Katherine M. Keyes, PhD

ABSTRACT

Objectives: Exposure to violence is associated with chronic physical conditions in adults. Although violence exposure is common among youths, it is unknown whether violence is associated with chronic physical conditions in childhood and adolescence. We examined the associations of violence exposure with chronic physical conditions in a population-representative sample of US adolescents and determined whether associations were explained by co-occurring mental disorders.

Methods: Data were drawn from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A), a national cross-sectional survey of 6,483 adolescents (ages 13–17). Lifetime exposure to violence; *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* mood, anxiety, and substance disorders; and self-reported arthritis, frequent headaches, back or neck problems, other chronic pain, asthma, and allergies were assessed.

Results: One in 4 (24.99%) adolescents reported exposure to violence. Violence exposure was associated with elevated odds of back/neck pain, headaches, chronic pain, allergies, and asthma (odds ratio [OR], 1.5–2.1; 95% confidence interval [CI], 1.1–3.5) after adjustment for sociodemographics, socioeconomic status, and lifetime mental disorders. Regarding new onsets, violence exposure was associated with greater hazard for subsequent first-onset only of back/neck pain (hazard ratio, 1.9; 95% CI, 1.2–3.0) and headaches (hazard ratio, 1.4; 95% CI, 1.1–1.8), and these associations were explained by early-onset mental disorders.

Conclusions: Childhood violence exposure is associated with chronic physical conditions that emerge early in the life course, although associations are stronger for prevalent than incident conditions. Violence exposure predicts incident pain conditions only, and these associations are explained by mental disorders that begin after violence exposure. Interventions and policies aimed at preventing violence and detecting and treating early-onset mental disorders have the potential to reduce morbidity, mortality, and health disparities beginning early in development.

Key words: violence, adolescence, chronic conditions, pain, adversity.

INRODUCTION

Social and environmental experiences early in life have lasting influences on morbidity and mortality in adulthood (1–4). Exposure to violence, the intentional use of force to inflict harm on another person, may be an important social determinant of health across the life course. Violence exposure is pervasive in society, including among children and adolescents. Evidence from population-based studies in the United States indicates that at least 1 in 4 and as many as 2 in 5 youths will be the victim of violence by the time they reach adulthood (5,6). Violence represents a significant environmental threat that can disrupt numerous aspects of emotional, cognitive, and neurobiological development (7,8). Children who have experienced violence are at elevated risk for the onset of mental disorders, not only in

CIDI = Composite International Diagnostic Interview, **NCS-A** = National Comorbidity Survey Replication–Adolescent Supplement, **NCS-R** = National Comorbidity Survey Replication, **PTSD** = posttraumatic stress disorder, **SAQ** = self-administered questionnaire, **SES** = socioeconomic status

From the Department of Psychology (McLaughlin), University of Washington; Department of Epidemiology (Basu, Sumner, Koenen), Harvard School of Public Health; Department of Epidemiology (Walsh, Keyes), Mailman School of Public Health, Columbia University; Department of Epidemiology and Biostatistics (Slopen), University of Maryland College Park; and Center for Behavioral Cardiovascular Health (Sumner), Columbia University Medical Center.

Address correspondence and reprint requests to Katie A. McLaughlin, PhD, Department of Psychology, University of Washington, Box 351525, Seattle, WA 98195. E-mail: mclaughk@uw.edu

Received for publication December 29, 2015; revision received April 12, 2016.

DOI: 10.1097/PSY.0000000000000366

childhood but also in adulthood (5,9,10). Disruptions in core developmental processes are thought to play a central role in the etiology of psychopathology among children exposed to violence (7,8) and might also contribute to the onset of physical health problems.

Indeed, violence exposure is associated with chronic physical conditions in adults. In a cross-national survey of adults from 14 countries, lifetime exposure to traumatic events, many of which involved violence, was associated with elevated odds of developing adult chronic physical conditions including heart disease, hypertension, asthma, chronic pain, and gastrointestinal conditions (11). Child abuse, a common and often chronic form of violence, has been linked to elevated risk for poor physical health and chronic pain in adulthood (12,13), with effect sizes comparable to those for mental disorders (14). Disease prevention efforts require greater understanding of when in the life-course chronic physical conditions related to violence exposure first emerge. However, scant research has examined the associations of violence exposure with child and adolescent physical health.

Existing studies examining violence exposure and physical health in children have been limited by a focus on a narrow set of physical health outcomes, typically pain or changes in appetite and sleep (15–18). These studies suggest that violence exposure is associated with higher rates of somatic symptoms (15–17), including headaches (16,18), stomachaches (16), and poor self-rated health (19,20) in children. Few studies have examined the associations of violence exposure with common chronic physical conditions in youths, such as asthma and allergies, which have been associated with violence in studies of adults (11). Moreover, it remains unclear whether associations of violence with physical health in children exist only for more severe forms of violence (e.g., direct forms of violence such as child abuse or assault versus indirect forms of violence like witnessing violence occurring to another person). Evaluating these distinctions is important for targeting preventive interventions.

Although some evidence indicates an association of violence exposure with pain and somatic symptoms in children, the mechanisms underlying these associations are unknown. One potential mechanism involves the onset of mental disorders following violence exposure. Childhood exposure to violence is associated with the subsequent onset of mental disorders (5,9,10). Adults with mental disorders are more likely to develop many common chronic physical conditions than those without psychopathology, including asthma, arthritis, chronic headaches, back/neck problems, diabetes, and heart disease (21–23). As such, early-onset mental disorders may explain, at least in part, the link between violence exposure and childhood physical health. We are unaware of previous research examining this possibility.

We examined associations of multiple forms of violence exposure with common chronic physical health conditions in a national sample of US adolescents. Data were drawn from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A), a population-based national survey of mental disorders in US adolescents. In addition to assessing mental disorders, the NCS-A assessed lifetime exposure to multiple forms of direct and indirect violence as well as a range of chronic physical health conditions. We focus here on conditions that are common among children and adolescents and that have been linked to violence exposure in adult studies, including asthma, allergies, arthritis, back/neck pain, frequent headaches, and other forms of chronic pain.

METHODS

Sample

The NCS-A was conducted between February 2001 and January 2004. Adolescents aged 13 to 18 were interviewed face-to-face in dual-frame household and school samples. A self-administered questionnaire (SAQ) was completed by a parent/guardian of each adolescent. Written informed consent was obtained from parents, and written assent was obtained from adolescents. Adolescents and parents were each paid $50 for participation. Recruitment and consent procedures were approved by the Human Subjects Committees of Harvard Medical School and the University of Michigan. Greater details about the NCS-A design and survey are provided elsewhere (24,25).

The total NCS-A sample included 10,123 adolescents. The NCS-A household sample (n = 879) included adolescents recruited from households that participated in the National Comorbidity Survey Replication (NCS-R), a national household survey of adult mental disorders (26). The response rate of the household sample was 86.8% (conditional on adult NCS-R participation). The remaining adolescents (n = 9,244) were recruited from a representative sample of schools in NCS-R sample areas. The adolescent response rate in the school sample was 82.6% (conditional on school participation). The proportion of initially selected schools that participated in the NCS-A was low (28.0%), but replacement schools were recruited and carefully matched to the original schools. No bias in estimates of prevalence or correlates of mental disorders was found when household sample respondents from nonparticipating schools were compared with school sample respondents from replacement schools (24).

The response rate of the parent SAQ (conditional on adolescent response) was 82.5% to 83.7% in the household-school samples. A total of 8,470 parents completed SAQs, including 6,483 who completed the long-form SAQ and 1,987 who completed a short form when the long form could not be obtained.

The current report includes the 6,483 adolescent-parent pairs for whom data were available from both adolescent interviews and long-form parent SAQs. Cases were weighted for variation in within-household probability of selection in the household sample, differential nonresponse, and residual discrepancies between sample and population sociodemographic and geographic distributions. Sociodemographic information on the NCS-A sample is provided elsewhere (27). The weighted household and school samples were adjusted for design effects, as described elsewhere (24). The weighted sociodemographic distributions of the NCS-A sample closely approximate those of the census population (25).

Measures

Violence Exposure

Exposure to violence was assessed in the posttraumatic stress disorder (PTSD) section of the Composite International Diagnostic Interview

(CIDI), a fully structured interview administered to adolescents by trained lay interviewers (28). The PTSD assessment began with questions about lifetime exposure to numerous traumatic events, including direct and indirect violence. This section began with the following statement: "In the next part of the interview, we ask about very scary things that might have happened in your life." Items about each type of violence queried whether the participant had ever experienced the event (e.g., "were you ever beaten up badly by someone you were dating or with whom you were romantically involved?" assessed intimate partner violence). Direct exposure to violence included physical abuse by a caregiver, intimate partner violence, violent victimization by someone other than a caregiver or partner, mugging or being held up with a weapon, rape, sexual assault, and being stalked. Indirect exposure to violence included witnessing family violence and witnessing someone being beaten up, badly injured, or killed. If a respondent endorsed lifetime exposure to an event, follow-up questions asked about the timing of first exposure to the endorsed event and the number of lifetime occurrences of the event. We created 3 dichotomous variables indicating the presence of lifetime exposure to any violence, direct violence, and indirect violence. We created a count variable denoting the total number of events involving exposure to any type of violence, coded as 0, 1, 2, and 3+.

Chronic Physical Conditions

Chronic physical conditions were assessed with a checklist based on the National Health Interview Survey. Adolescents were asked whether they ever had a series of chronic conditions in their lifetime. Interview-based reports of chronic conditions have been shown to have reasonable validity when compared to diagnoses based on medical examination and medical records (29,30). We focused here on chronic symptom-based conditions that can emerge in childhood and adolescence. These included a variety of chronic pain conditions (arthritis, frequent or very bad headaches, chronic back or neck problems, and any other chronic pain) and autoimmune conditions (asthma and seasonal allergies). We modeled each condition individually. Adolescents who endorsed a condition were asked about the age when the condition first started.

Covariates

We adjusted for a range of sociodemographic factors including sex, age, race/ethnicity (white, black, Hispanic, other), parent education (<high school, high school graduate, some college, and college degree), and household income-to-needs, which was defined relative to the poverty line based on family size (low, household income <1.5 times the poverty line; low-average, 1.5–3 times the poverty line; high-average, 3–6 times the poverty line; high, 6+ times the poverty line).

We also adjusted for *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* mood disorders (major depression/dysthymia), anxiety disorders (generalized anxiety disorder, social phobia, panic disorder with or without agoraphobia, and PTSD), and substance disorders (alcohol and drug abuse and dependence, and nicotine dependence), assessed with the CIDI. Age-of-onset was assessed with methods shown experimentally to improve the accuracy of such reports (31). For MDD/dysthymia symptoms, parents provided additional information about adolescent symptoms. Parents' and adolescents' reports showed generally good concordance and were combined at the symptom level using an "or" rule (27). A clinical reappraisal study that blindly reinterviewed a subsample of NCS-A respondents found good concordance between lifetime diagnoses based on the CIDI/SAQ and clinical interviews (32).

Analysis Methods

We first estimated a series of progressively more complex logistic regression models to examine associations of both direct and indirect violence exposure with lifetime occurrence of each chronic physical condition. The first model included no covariates, the second controlled for demographic factors (i.e., sex, age, and race/ethnicity), the third additionally controlled for socioeconomic status (SES) (i.e., parent education and income-to-needs), and the last added additional controls for lifetime mental disorders. We examined the association of number of lifetime violent events with physical conditions and with the total number of conditions in a final model using multinomial logistic regression.

We next evaluated whether violence exposure was associated with the subsequent first onset of chronic conditions using survival analysis. Time-varying indicators for age of first exposure to direct, indirect, and any violence were entered as predictor variables, and hazard ratios were estimated for associations with subsequent first-onset chronic conditions using Cox proportional hazards models. Individuals who did not experience each chronic condition were censored at their age at the interview. Individuals who experienced chronic conditions before the first violence exposure were considered unexposed to violence at the time of condition onset. Covariates were entered in progressively more complex models, as previously described. In the final model, time-varying indicators were included for mental disorders occurring after first exposure to violence but before first onset of the focal chronic condition.

We tested for sex differences in associations using interactions terms and found no evidence of sex differences in associations. We therefore present results for the total sample. Significance tests were evaluated using .05-level 2-sided tests. The design-based Taylor series method implemented in the SAS software system (33) was used to estimate standard errors.

RESULTS

Prevalence of Violence Exposure

Approximately 1 in 4 adolescents (24.99%) reported exposure to violence at some point in their lifetime (Table 1). Direct violence exposure was more common (13.4%) than indirect exposure (9.4%). Overall and direct exposure to violence were similar among males and females, but males had greater odds of exposure to indirect violence than females (Table 1). Violence exposure was more commonly reported by older adolescents and among adolescents whose parents had less than a college education. A higher proportion of adolescents with a lifetime mental disorder were exposed to violence than those without a lifetime disorder.

Prevalence of Chronic Physical Conditions

Pain conditions were common among adolescents (Table 2). Frequent and severe headaches were the most common pain condition (26.8%), followed by chronic back and neck problems (11.8%), other chronic pain (6.0%), and arthritis (2.1%). All pain conditions were more common among females than males and among adolescents with lifetime mental disorders (Table 2). Allergies (28.4%) and asthma (17.3%) were also common and increased as parent education increased but did not vary by lifetime mental disorder.

Violence Exposure and Lifetime Chronic Physical Conditions

Exposure to violence was associated with elevated odds of back/neck pain (odds ratio [OR = 2.7), headaches (OR = 2.1), chronic pain (OR = 1.9), allergies (OR = 1.3), and asthma (OR = 1.5 Table 3). Associations were stronger for exposure to direct than indirect violence for all outcomes, with the exception of chronic pain. These associations remained similar after controlling for parent SES, but

TABLE 1. Prevalence of Violence Exposure by Sociodemographics and Lifetime Mental Disorders in the NCS-A (N = 6,483)[a]

	Any Violence		Direct Violence		Indirect Violence	
Variables	%	SE	%	SE	%	SE
Sex						
Male	24.31	(1.77)	13.45	(1.28)	10.96	(1.54)
Female	25.67	(2.41)	13.34	(1.57)	7.84	(1.52)
χ^2_1 =	0.18		0.00		1.37	
Age, years						
13	16.30	(2.95)	8.82	(2.19)	6.03	(1.45)
14	21.57	(3.04)	12.16	(2.25)	8.02	(1.69)
15	21.29	(2.23)	9.92	(1.32)	9.54	(1.61)
16	29.18	(2.78)	14.83	(1.98)	12.36	(1.91)
17–18	36.13	(3.37)	20.37	(2.43)	11.46	(2.46)
χ^2_4 =	27.66*		20.09*		7.23	
Race/Ethnicity						
White	21.27	(1.55)	11.51	(0.98)	7.92	(1.00)
Black	33.80	(4.06)	14.10	(2.43)	16.41	(3.77)
Hispanic	34.50	(4.79)	20.78	(3.86)	11.37	(2.72)
Other	28.32	(5.03)	17.06	(4.28)	9.28	(2.91)
χ^2_3 =	18.24*		11.81*		9.74*	
Parent education						
<High school	29.49	(3.51)	17.32	(2.91)	11.06	(1.75)
High school graduate	30.05	(2.74)	15.73	(1.77)	11.69	(1.72)
Some college	32.37	(3.81)	16.64	(2.69)	12.34	(1.98)
College degree	16.53	(1.38)	8.77	(1.08)	6.30	(1.08)
χ^2_3 =	30.81*		16.33*		13.53*	
Household income-to-needs, times poverty						
≤1.5	27.59	(3.03)	15.08	(1.93)	9.64	(2.28)
>1.5 to ≤ 3	29.29	(2.24)	13.37	(1.86)	14.81	(1.88)
>3 to ≤ 6	23.45	(2.21)	12.96	(1.37)	7.32	(1.46)
>6	23.22	(2.15)	13.15	(1.60)	8.38	(1.58)
χ^2_3 =	5.56		0.85		9.15*	
Lifetime mental disorders						
Any mood disorder	55.53	(5.83)	32.95	(4.84)	21.03	(5.12)
No mood disorder	21.88	(1.41)	11.33	(1.00)	8.63	(0.78)
χ^2_1 =	39.84*		34.29*		10.72*	
Any anxiety disorder	43.15	(3.91)	22.91	(3.27)	18.23	(3.37)
No anxiety disorder	21.26	(1.44)	11.36	(0.94)	7.93	(0.97)
χ^2_1=	34.67*		17.22*		10.41*	
Any substance disorder	62.03	(4.47)	43.56	(4.92)	15.24	(4.24)
No substance disorder	20.12	(1.25)	9.49	(0.79)	9.01	(0.85)
χ^2_1 =	120.80*		107.86*		2.70	

* Significant at the $p < .05$ level, 2-sided test.

[a] Prevalence estimates are the weighted proportion of the 6,483 youths in the total sample who reported ever experiencing any type of violence exposure.

TABLE 2. Prevalence of Chronic Health Conditions by Sociodemographic and Lifetime Mental Disorders in the NCS-A (N = 6,483)

	Arthritis		Back/Neck Pain		Headache		Chronic Pain		Allergies		Asthma	
Variables	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Sex												
Male	1.68	0.36	9.40	0.84	21.44	1.10	5.52	0.58	26.71	1.44	17.04	1.14
Female	2.45	0.41	14.22	1.20	32.52	1.23	6.51	0.57	30.06	1.52	17.50	1.72
χ^2_1 =	1.99		12.97*		55.46*		1.32		4.25*		0.04	
Age, years												
13	0.67	0.29	7.71	1.05	26.48	2.07	4.95	0.95	25.10	2.23	14.78	1.51
14	1.61	0.74	10.65	1.95	26.95	2.10	4.68	0.99	26.46	2.03	17.45	1.43
15	2.57	0.66	11.57	1.35	26.15	1.92	7.93	0.93	32.30	2.32	20.82	1.51
16	2.55	0.70	14.31	1.20	29.07	2.34	6.08	0.71	28.13	2.93	16.26	1.51
17–18	2.46	0.68	13.35	1.93	25.57	2.02	6.03	0.87	28.75	2.45	16.32	1.71
χ^2_4 =	5.50		9.90*		1.70		7.71		5.28		9.88*	
Race/Ethnicity												
White	2.13	0.41	10.95	0.95	25.24	1.09	5.57	0.50	30.84	1.29	16.97	1.01
Black	2.26	0.67	14.33	1.33	30.33	1.83	6.54	1.30	25.63	1.97	17.12	1.74
Hispanic	1.56	0.55	13.75	2.61	29.57	2.88	7.51	1.72	20.36	3.61	18.58	2.14
Other	1.86	0.88	8.65	2.40	29.53	4.70	5.63	2.32	26.90	3.97	17.67	3.20
χ^2_3 =	0.74		4.99		5.69		1.67		13.24*		0.64	
Parent Education												
< High School	2.19	1.23	12.89	2.18	29.86	2.59	6.49	1.72	20.37	2.62	14.69	2.07
High school graduate	1.44	0.26	11.12	1.01	28.05	1.79	4.27	0.64	26.92	1.70	15.57	1.19
Some college	1.88	0.48	14.77	2.10	28.82	2.38	7.72	0.97	29.56	1.93	18.32	1.46
College degree	2.59	0.57	10.14	1.00	23.75	1.77	6.22	0.66	31.41	1.45	18.83	1.24
χ^2_3 =	2.42		6.56		5.42		6.98		19.16*		6.75	
Household Income-to-Needs												
≤1.5	1.71	0.55	12.05	1.76	27.77	1.93	3.50	1.02	26.89	2.63	13.62	1.50
>1.5–≤ 3	2.24	1.03	14.56	1.51	29.13	1.73	7.86	1.13	25.78	1.98	18.49	1.97
>3–≤ 6	2.18	0.52	10.78	0.93	26.74	1.53	5.92	0.84	27.84	1.80	16.75	1.78
>6	1.98	0.55	10.95	1.40	25.22	1.71	6.10	0.66	30.94	1.74	18.62	1.07
χ^2_3 =	0.26		5.08		2.98		7.04		5.02		4.97	
Lifetime mental disorder												
Any mood disorder	4.99	1.46	19.95	2.87	44.13	4.10	9.50	1.60	33.59	3.67	20.95	2.85
No mood disorder	1.69	0.29	10.73	0.68	24.69	0.78	5.56	0.40	27.69	1.25	16.80	0.83
χ^2_1 =	8.98*		18.92*		30.45*		8.04*		2.77		2.68	
Any anxiety disorder	3.89	0.86	20.32	2.58	42.52	2.27	8.57	1.22	30.39	2.84	16.91	1.75
No anxiety disorder	1.59	0.26	9.58	0.87	22.88	0.93	5.35	0.43	27.83	1.37	17.35	0.85
χ^2_1 =	11.38*		18.78*		80.53*		7.14*		0.69		0.07	
Any substance disorder	4.18	1.09	23.27	2.83	37.59	3.40	6.23	1.22	26.54	2.41	17.48	2.27
No substance disorder	1.71	0.25	9.88	0.61	25.09	1.01	5.96	0.46	28.64	1.24	17.23	0.90
χ^2_1 =	9.93*		50.93*		13.11*		0.03		0.87		0.01	

* Significant at the $p < .05$ level, 2-sided test.

[a] Prevalence estimates reflect weighted proportion of the 6,483 youths in the total sample who reported ever experiencing any type of violence exposure.

TABLE 3. Associations (Odds Ratios) of Direct and Indirect Violence Exposure with Chronic Physical Conditions in the National Comorbidity Survey Replication Adolescent Supplement (NCS-A) (N = 6,483)

	Arthritis							
	Unadjusted		Demographics[a]		SES[b]		Lifetime Mental Disorders[c]	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Any violence	1.72	(0.73–4.10)	1.58	(0.73–3.44)	1.78	(0.73–4.33)	1.57	(0.63–3.92)
Direct violence	1.95	(0.76–5.03)	1.98	(0.85–4.61)	2.17	(0.89–5.30)	1.53	(0.52–4.46)
Indirect violence	1.09	(0.35–3.45)	0.93	(0.28–3.15)	0.94	(0.20–4.48)	0.95	(0.20–4.63)
	Back/neck Pain							
			Demographics[a]		**SES[b]**		**Lifetime Mental Disorders[c]**	
	OR	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Any violence	2.68*	(1.67–4.32)	2.62*	(1.65–4.18)	2.58*	(1.67–3.98)	1.77*	(1.14–2.73)
Direct violence	2.50*	(1.51–4.14)	2.41*	(1.52–3.81)	2.40*	(1.56–3.67)	1.52*	(1.04–2.21)
Indirect violence	1.71	(0.83–3.49)	1.68	(0.77–3.63)	1.74	(0.81–3.76)	1.56	(0.73–3.35)
	Headaches							
			Demographics[a]		**SES[b]**		**Lifetime Mental Disorders[c]**	
	OR	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Any violence	2.11*	(1.51–2.95)	2.21*	(1.62–3.02)	2.12*	(1.57–2.86)	1.59*	(1.14–2.22)
Direct violence	2.27*	(1.64–3.13)	2.31*	(1.68–3.18)	2.24*	(1.65–3.04)	1.71*	(1.26–2.32)
Indirect violence	1.28	(0.70–2.33)	1.32	(0.76–2.30)	1.32	(0.77–2.26)	1.19	(0.66–2.14)
	Chronic Pain							
			Demographics[a]		**SES[b]**		**Lifetime Mental Disorders[c]**	
	OR	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Any violence	1.90*	(1.21–2.96)	1.92*	(1.23–3.02)	2.05*	(1.30–3.23)	2.06*	(1.19–3.55)
Direct violence	1.06	(0.68–1.67)	1.04	(0.63–1.70)	1.11	(0.67–1.85)	1.06	(0.57–1.95)
Indirect violence	3.27*	(1.88–5.69)	3.24*	(1.93–5.46)	3.21*	(1.85–5.57)	2.84*	(1.44–5.58)
	Allergies							
			Demographics[a]		**SES[b]**		**Lifetime Mental Disorders[c]**	
	OR	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Any violence	1.29*	(1.04–1.59)	1.41*	(1.12–1.78)	1.47*	(1.17–1.86)	1.49*	(1.19–1.87)
Direct violence	1.29	(0.92–1.79)	1.36	(0.96–1.93)	1.39	(0.98–1.98)	1.42*	(1.01–1.99)
Indirect violence	1.09	(0.70–1.70)	1.17	(0.77–1.79)	1.20	(0.79–1.83)	1.16	(0.74–1.83)
	Asthma							
			Demographics[a]		**SES[b]**		**Lifetime Mental Disorders[c]**	
	OR	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Any violence	1.45*	(1.13–1.86)	1.46*	(1.12–1.90)	1.50*	(1.13–1.99)	1.68*	(1.25–2.24)
Direct violence	1.31	(0.92–1.87)	1.32	(0.90–1.93)	1.37	(0.95–2.00)	1.43	(0.99–2.06)
Indirect violence	1.30	(0.61–2.77)	1.24	(0.54–2.84)	1.25	(0.53–2.94)	1.34	(0.55–3.23)

* Significant at the $p < .05$ level, 2-sided test.

[a] Logistic regression model adjusts for sex, age, and race/ethnicity.

[b] Logistic regression model adjusts for sex, age, race/ethnicity, parent education, and household income-to-needs.

[c] Logistic regression model adjusts for sex, age, and race/ethnicity, parent education, household income-to-needs, and lifetime mood, anxiety, and substance disorder.

adjustment for lifetime mental disorders attenuated associations of violence exposure with back/neck pain (by 31.4%) and headaches (by 25.0%). Violence exposure continued to predict elevated odds of all conditions except arthritis after adjustment for demographics, SES, and lifetime mental disorders.

Next, we examined associations of number of distinct lifetime violent events with each of the chronic physical conditions based on the fully adjusted model (Table 4). Violence exposure was associated with back/neck pain only for adolescents who reported 3+ experiences with violence (OR = 3.3) and with headaches and allergies only for adolescents who reported 2 (OR = 2.7 and 1.9, respectively) or 3+ (OR = 2.2 and 1.5, respectively) exposures. In contrast, violence exposure was associated with asthma and chronic pain at lower levels of exposure only (OR = 1.8–2.5).

Violence Exposure and Incident Chronic Physical Conditions

We used survival analysis to determine whether the first reported occurrence of violence exposure was associated with the subsequent first onset of chronic physical conditions (Table 5). After adjustments for demographics and SES, associations of violence exposure with chronic conditions were universally attenuated in these models and remained significant and positive only for back/neck pain (HR = 1.9) and for headaches (HR = 1.4) following direct violence. In both cases, the association of violence with the focal pain condition was no longer significant after adjustment for mental disorders occurring after exposure to violence but before the onset of the chronic condition (HR = 1.1–1.3).

In survival models, the associations of violence exposure with asthma and allergies were significant but in the opposite direction, indicating that violence exposure was associated with lower hazard of developing subsequent allergies or asthma (HR = 0.45–0.48).

DISCUSSION

Exposure to violence is common among US youths. Our findings indicate that youths who have experienced violence, particularly direct violence, are more likely to report numerous chronic physical health problems, including back/neck pain, headaches, chronic pain, allergies, and asthma. However, violence exposure is associated only with the subsequent onset of back/neck pain and headaches, and these associations are explained entirely by the onset of mental disorders after exposure to violence. Taken together, these results suggest that pain conditions related to violent victimization emerge early in the life course and are already present by adolescence. The onset of psychopathology after violence exposure might play an important role in the etiology of pain related to interpersonal violence.

Although violence exposure was associated with multiple lifetime chronic conditions, most of these associations disappeared in our analysis of incident chronic conditions. What might explain this discrepancy? One possibility is that for some conditions with a particularly early age of onset (e.g., allergies, asthma), the chronic condition began earlier than the child's first exposure to violence and factors related to both violence exposure and onset of these chronic conditions were not adequately adjusted for in our models, resulting in residual confounding. Violence exposure is socially patterned early in development, with greater exposure among racial/ethnic minorities, children living in urban areas, and children from single-parent households (5). Similarly, disparities in childhood chronic disease onset and severity according to race/ethnicity and SES are well documented (34,35). For example, black children and children from low-SES families have high rates of asthma and symptoms of greater severity and chronicity than white children and children from higher-SES families (36,37). As such, it is possible that social factors associated with both violence and chronic conditions confounded these associations, despite our controls for demographics and SES. A second possibility is recall bias. Retrospective assessment of violence during adolescence will likely result in underreporting of some forms of exposure, particularly those occurring in the first several years of life. Physical abuse of children is most common during this period, and children who were exposed to early forms of violence are also likely to experience other forms of victimization later in development; this pattern may have contributed to the associations of violence exposure with most lifetime chronic conditions but only a few incident conditions.

Our findings are consistent in showing an association between violence exposure and elevated risk of developing conditions involving pain. How might violence exposure lead to the onset of pain in children and adolescents? One pathway supported by our findings is that violence increases risk for pain through associations with psychological distress and mental disorders. Extensive evidence indicates that people with anxiety disorders and major depression are more likely to experience pain conditions than those without a history of psychopathology (38–40). The presence of anxiety and/or depression may increase risk for chronic pain through a variety of mechanisms including attention biases toward potential threats and heightened anxiety sensitivity—or fear of anxiety symptoms, including bodily sensations, which results from beliefs about the harmful consequences of such symptoms (39,41). Heightened attention to potential threats and elevated anxiety sensitivity have also been reported among children who have experienced violence and other forms of environmental adversity (42,43), suggesting that these potential mechanisms may also explain direct associations of violence exposure with pain, independent of co-occurring psychopathology.

Dysregulation in physiological stress response systems might also underlie the associations of violence and pain. Violence is an acute threat associated with lasting alterations

TABLE 4. Associations (Odds Ratios) of Frequency of Lifetime Exposure to Violence with Chronic Physical Conditions in the NCS-A ($N = 6,483$)[a]

Model Adjusting for Sociodemographics and SES[a]												
	Arthritis		Back/Neck Pain		Headaches		Chronic Pain		Allergies		Asthma	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
No violence exposure	—	—	—	—	—	—	—	—	—	—	—	—
1 violent event	1.37	(0.39–4.80)	1.33	(0.67–2.63)	1.13	(0.75–1.71)	2.53*	(1.47–4.35)	1.38	(0.99–1.92)	1.68*	(1.15–2.47)
2 violent events	0.32	(0.04–2.47)	2.49*	(1.27–4.89)	3.39*	(1.83–6.31)	1.85	(0.74–4.63)	1.87*	(1.21–2.89)	1.83*	(1.06–3.13)
3+ violent events	3.10*	(1.07–9.00)	5.08*	(3.12–8.26)	3.27*	(2.20–4.85)	1.76	(0.75–4.14)	1.45	(0.96–2.17)	0.99	(0.61–1.61)
Model Adjusting for Sociodemographics, SES, and Lifetime Mental Disorders[b]												
	Arthritis		**Back/Neck Pain**		**Headaches**		**Chronic Pain**		**Allergies**		**Asthma**	
	OR	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
No violence exposure	—	—	—	—	—	—	—	—	—	—	—	—
1 violent event	1.26	(0.36–4.37)	1.05	(0.55–2.00)	0.91	(0.57–1.46)	2.49*	(1.35–4.59)	1.37	(0.97–1.95)	1.78*	(1.24–2.56)
2 violent events	0.27	(0.03–2.45)	1.82	(0.93–3.56)	2.74*	(1.46–5.15)	1.88	(0.68–5.26)	1.91*	(1.23–2.98)	1.97*	(1.15–3.36)
3+ violent events	2.68	(0.87–8.30)	3.26*	(1.93–5.48)	2.19*	(1.41–3.41)	1.77	(0.70–4.49)	1.48*	(1.04–2.12)	1.14	(0.74–1.76)

* Significant at the $p < .05$ level, 2-sided test.

[a] Logistic regression model adjusts for sex, age, and race/ethnicity, parent education, and household income-to-needs.

[b] Logistic regression model adjusts for sex, age, and race/ethnicity, parent education, household income-to-needs, and lifetime mood, anxiety, and substance disorders.

TABLE 5. Hazard Ratios of Types of Violence Exposure with Chronic Physical Conditions in the NCS-A (N = 6,483)

	Arthritis							
	Unadjusted		Demographics[a]		SES[b]		Incident Mental Disorders[c]	
	HR	(95% CI)	HR	(95% CI)	HR	(95% CI)	HR	(95% CI)
Any violence	0.90	(0.34–2.36)	0.95	(0.39–2.33)	1.04	(0.38–2.86)	0.92	(0.38–2.21)
Direct violence	1.08	(0.37–3.11)	1.23	(0.46–3.34)	1.30	(0.47–3.56)	0.87	(0.28–2.67)
Indirect violence	0.49	(0.08–3.14)	0.42	(0.07–2.69)	0.47	(0.06–3.77)	0.49	(0.05–4.92)
	Back/Neck Pain							
			Demographics[a]		**SES[b]**		**Incident Mental Disorders[c]**	
	HR	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**
Any violence	1.89*	(1.11–3.20)	1.98*	(1.22–3.22)	1.93*	(1.24–3.00)	1.28	(0.81–2.02)
Direct violence	1.79*	(1.01–3.17)	1.86*	(1.15–3.01)	1.86*	(1.21–2.87)	1.28	(0.78–1.60)
Indirect violence	1.27	(0.58–2.77)	1.30	(0.58–2.96)	1.37	(0.61–3.06)	1.28	(0.55–2.66)
	Headaches							
			Demographics[a]		**SES[b]**		**Incident Mental Disorders[c]**	
	HR	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**
Any violence	1.26	(0.89–1.78)	1.35	(0.99–1.83)	1.30	(0.97–1.73)	0.96	(0.68–1.36)
Direct violence	1.36	(0.97–1.90)	1.42*	(1.05–1.90)	1.37*	(1.05–1.81)	1.06	(0.80–1.40)
Indirect violence	0.83	(0.42–1.62)	0.89	(0.48–1.65)	0.88	(0.48–1.64)	0.79	(0.41–1.55)
	Chronic Pain							
			Demographics[a]		**SES[b]**		**Incident Mental Disorders[c]**	
	HR	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**
Any violence	0.66	(0.36–1.21)	0.71	(0.39–1.31)	0.76	(0.40–1.44)	0.65	(0.32–1.30)
Direct violence	0.73	(0.39–1.38)	0.75	(0.38–1.46)	0.79	(0.40–1.56)	0.74	(0.35–1.56)
Indirect violence	0.45	(0.14–1.45)	0.48	(0.15–1.57)	0.47	(0.14–1.55)	0.39	(0.12–1.28)
	Allergies							
			Demographics[a]		**SES[b]**		**Incident Mental Disorders[c]**	
	HR	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**
Any violence	0.43*	(0.33–0.55)	0.47*	(0.36–0.62)	0.49*	(0.37–0.65)	0.45*	(0.34–0.60)
Direct violence	0.48*	(0.34–0.68)	0.52*	(0.36–0.75)	0.53*	(0.36–0.77)	0.50*	(0.35–0.73)
Indirect violence	0.31*	(0.18–0.52)	0.33*	(0.20–0.56)	0.35*	(0.21–0.60)	0.33*	(0.19–0.57)
	Asthma							
			Demographics[a]		**SES[b]**		**Incident Mental Disorders[c]**	
	HR	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**	**HR**	**(95% CI)**
Any violence	0.45*	(0.29–0.70)	0.46*	(0.29–0.72)	0.47*	(0.29–0.76)	0.52*	(0.32–0.85)
Direct violence	0.45*	(0.28–0.72)	0.47*	(0.28–0.78)	0.49*	(0.30–0.80)	0.51*	(0.31–0.85)
Indirect violence	0.37	(0.10–1.32)	0.35	(0.09–1.27)	0.35	(0.09–1.34)	0.37	(0.10–1.43)

* Significant at the $p < .05$ level, 2-sided test.

[a] Survival model adjusts for sex, age, and race/ethnicity.

[b] Survival model adjusts for sex, age, race/ethnicity, parent education, and household income-to-needs.

[c] Survival model adjusts for sex, age, and race/ethnicity, parent education, household income-to-needs, and lifetime mood, anxiety, and substance disorders.

in the functioning of the autonomic nervous system and hypothalamic-pituitary-adrenal axis (HPA axis) in children (44,45). Exposure to environmental threats is associated with hypocortisolism, which involves blunted HPA-axis response to stress and a flat diurnal rhythm (46). Hypocortisolism and environmental stress have each been linked to glucocorticoid resistance (47). Because glucocorticoids suppress the production of proinflammatory cytokines and other inflammatory responses, glucocorticoid resistance may ultimately result in elevated and prolonged inflammation (48,49). Childhood maltreatment and other adversities are associated with elevations in inflammatory markers such as C-reactive protein and interleukin-6 and poor cell-mediated immunity beginning in childhood and continuing into adulthood (50–53). Heightened inflammation may increase risk for numerous health problems, including pain (54,55).

A key limitation of the study involves assessment of violence exposure in face-to-face interviews, which underestimate the prevalence of violence relative to methods that are more anonymous (e.g., telephone interviews) owing to reduced willingness to disclose sensitive information to a stranger. Indeed, other national surveys of adolescents using telephone interviews observed higher levels of violence exposure than the NCS-A (56). These underestimates would attenuate associations of violence with physical conditions. This study is also limited by reliance on adolescent self-reports of chronic conditions. Negative recall bias is a possibility for both violence exposure and physical symptoms, and such bias might be particularly pronounced in youths with mental disorders. However, evidence suggests that youth reports of physical health are both reliable and valid, particularly after the age of 8 years, and predict health care use more than parent reports (57,58). For adolescents who have some autonomy from parents and may not consistently inform parents of fluctuations in symptoms, adolescent-reported information is important for symptom-based conditions (59). Nonetheless, these findings warrant replication in samples using medical records, claims data, or physician report. Because the NCS-A is a cross-sectional study, our incidence analyses are limited by retrospective recall of age of violence exposure and chronic condition onset. Given the stronger association of violence with prevalent than incident conditions, it is possible that children with physical conditions were more likely to be exposed to violence, rather than the reverse; longitudinal data are needed to evaluate this empirically. Not all chronic conditions were assessed in the NCS-A, including some that have been linked to environmental stress (e.g., chronic fatigue syndrome). Finally, childhood adversities other than those involving violence (e.g., emotional abuse and neglect) are likely to be associated with chronic conditions; examining these associations in children and adolescents is an important goal for future research.

Childhood violence exposure is a social determinant of pain conditions that emerge early in development, and early-onset mental disorders play a meaningful role in explaining this relationship. Interventions aimed at reducing exposure to violence or altering the adverse psychological and physiological processes that are triggered by violence exposure have the potential to reduce morbidity, mortality, and health disparities across the life course.

Source of Funding and Conflict of Interest: The authors have no conflicts of interest to report. This research was funded by National Institutes of Health grants K01-MH092526, R01-MH103291, R01-MH106482 (McLaughlin), K01-HL130650 (Sumner), and K01-AA021511 (Keyes), an IMHRO Rising Star Award, and a Jacobs Foundation Early Career Fellowship (McLaughlin).

REFERENCES

1. Shonkoff JP, Garner AS. The lifelong effects of early childhood adversity and toxic stress. Pediatrics 2012;129:232–46.
2. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. Am J Prev Med 1998;14:245–58.
3. Scott KM, Von Korff M, Angermeyer MC, Benjet C, Bruffaerts R, de Girolamo G, Haro JM, Lépine J-P, Ormel J, Posada-Villa J, Tachimori H, Kessler RC. Association of childhood adversities and early-onset mental disorders with adult-onset chronic physical conditions. Arch Gen Psychiatry 2011;68:838–44.
4. McLaughlin KA, Breslau J, Green JG, Lakoma MD, Sampson NA, Zaslavsky AM, Kessler RC. Childhood socio-economic status and the onset, persistence, and severity of DSM-IV mental disorders in a US national sample. Soc Sci Med 2011;73:1088–96.
5. McLaughlin KA, Koenen KC, Hill E, Petukhova M, Sampson NA, Zaslavsky A, Kessler RC. Trauma exposure and posttraumatic stress disorder in a US national sample of adolescents. J Am Acad Child Adolesc Psychiatry 2013;52:815–30.
6. Finkelhor D, Turner HA, Shattuck A, Hamby SL. Violence, crime, and abuse exposure in a national sample of children and youth: an update. JAMA Pediatrics 2013;167:614–21.
7. McLaughlin KA, Sheridan MA, Lambert HK. Childhood adversity and neural development: deprivation and threat as distinct dimensions of early experience. Neurosci Biobehav Rev 2014;47:578–91.
8. McLaughlin KA. Future directions in childhood adversity and youth psychopathology. J Clin Child Adolesc Psychol 45:361–82.
9. McLaughlin KA, Green JG, Gruber MJ, Sampson NA, Zaslavsky A, Kessler RC. Childhood adversities and first onset of psychiatric disorders in a national sample of adolescents. Arch Gen Psychiatry 2012;69:1151–60.
10. Green JG, McLaughlin KA, Berglund P, Gruber MJ, Sampson NA, Zaslavsky AM, Kessler RC. Childhood adversities and adult psychopathology in the National Comorbidity Survey Replication (NCS-R) I: associations with first onset of *DSM-IV* disorders. Arch Gen Psychiatry 2010;62:113–23.
11. Scott KM, Koenen KC, Aguilar-Gaxiola S, Alonso J, Angermeyer M, Benjet C, Bruffaerts R, Caldas-de-Almeida JD, de Girolamo D, Florescu S, Iwata N, Levinson D, Lim CCW, Murphy S, Ormel J, Posada-Villa J, Kessler RC.

Associations between lifetime traumatic events and subsequent chronic physical conditions: A cross-national, cross-sectonal study. PloS One 2013;8.
12. Davis DA, Luecken LJ, Zautra AJ. Are reports of childhood abuse related to the experience of chronic pain in adulthood? A meta-analytic review of the literature. Clin J Pain 2005;21: 398–405.
13. Widom CS, Czaja SJ, Bentley T, Johnson MS. A prospective investigation of physical health outcomes in abused and neglected children: new findings from a 30-year follow-up. Am J Public Health. 2012;102:1135–44.
14. Wegman HL, Stetler C. A meta-analytic review of the effects of childhood abuse on medical outcomes in adulthood. Psychosom Med 2009;71:805–12.
15. Halpern CT, Tucker CM, Bengtson A, Kupper LL, McLean SA, Martin SL. Somatic symptoms among US adolescent females: Associations with sexual and physical violence exposure. Matern Child Health J 2013;17:1951–60.
16. Bailey BN, Delaney-Black V, Hannigan JH, Ager J, Sokol RJ, Covington CY. Somatic complaints in children and community violence exposure. J Dev Behav Pediatr 2005;26:341–8.
17. Lamers-Winkelman F, De Schipper JC, Oosterman M. Children's physical health complaints after exposure to intimate partner violence. Br J Health Psychol 2012;17:771–84.
18. Stenslad S, Thoresen S, Wentzel-Larsen T, Zwart J-A, Dyb G. Recurrent headache and interpersonal violence in adolescence: the roles of psychological distress, loneliness and family cohesion: the HUNT study. J Headache Pain 2014;15:35.
19. Boynton-Jarrett R, Ryan LM, Berkman LF, Wright RJ. Cumulative violence exposure and self-rated health: longitudinal study of adolescents in the United States. Pediatrics 2008; 122:961–70.
20. Annerback EM, Sahlqvist L, Svedin CG, Wingren C, Gustafsson PA. Child physical abuse and concurrence of other types of child abuse in Sweden—associations with health and risk behaviors. Child Abuse Negl 2012;36:585–95.
21. Scott KM, Bruffaerts R, Tsang A, Ormel J, Alonso J, Angermeyer MC, Benjet C, Bromet E, De Girolamo G, De Graaf R, Gasquet I, Gureje O, Haro JM, He Y, Kessler RC, Levinson D, Mneimneh Z, Oakley Browne M, Posada-Villa J, Stein DJ, Takeshima T, von Korff M. Depression-anxiety relationships with chronic physical conditions: results from the World Mental Health Surveys. J Affect Disord 2007; 103:113–20.
22. Wells KB, Golding JM, Burnam MA. Chronic medical conditions in a sample of the general population with anxiety, affective, and substance use disorders. Am J Psychiatry 1989;146: 1440–6.
23. Katon WJ, Ciechanowski PS. Impact of major depression on chronic medical illness. J Psychosom Res 2002;53:859–63.
24. Kessler RC, Avenevoli S, Costello EJ, Green JG, Gruber MJ, Heeringa S, Merikangas KR, Pennell B-P, Sampson NA, Zaslavsky AM. Design and field procedures in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). Int J Methods Psychiatr Res 2009;18:69–83.
25. Kessler RC, Avenevoli S, Costello EJ, Green JG, Gruber MJ, Heeringa S, Merikangas KR, Pennell B-P, Sampson NA, Zaslavsky AM. National comorbidity survey replication adolescent supplement (NCS-A): II. Overview and design. J Am Acad Child Adolesc Psychiatry 2009;48:380–5.
26. Kessler RC, Berglund P, Chiu WT, Demler O, Heeringa S, Hiripi E, Jin R, Pennell B-P, Walters EE, Zaslavsky A, Zheng H. The US National Comorbidity Survey Replication (NCS-R): design and field procedures. Int J Methods Psychiatr Res 2004;13:69–92.
27. Kessler RC, Avenevoli S, Costello EJ, Georgiades K, Green JG, Gruber MJ, He J, Koretz D, McLaughlin KA, Sampson NA, Zaslavsky A, Merikangas KR. Prevalence, persistence, and socio-demographic correlates of DSM-IV disorders in the U.S. National Comorbidity Survey Replication Adolescent (NCS-A) Supplement. Arch Gen Psychiatry. 2012;69:372–80.
28. Kessler RC, Üstun TB. The World Mental Health (WHM) Survey Initiative Version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). Int J Methods Psychiatr Res 2004;13:93–121.
29. Hellovaara M, Aromaa A, Klaukka T, Knekt P, Joukamaa M, Impivaara O. Reliability and validity of interview data on chronic diseases: the mini-Finland health survey. J Clin Epidemiol 1993;46:181–91.
30. Edwards WS, Winn DM, Kulantzick V, Sheridan S, Berk ML, Retchin S, Collins JG. Evaluation of National Health Interview Survey Diagnostic Reporting. Vital Health Stat 2 1994; 120:1–116.
31. Knauper B, Cannell CF, Schwarz N, Bruce ML, Kessler RC. Improving the accuracy of major depression age of onset reports in the US National Comorbidity Survey. Int J Methods Psychiatr Res 1999;8:39–48.
32. Kessler RC, Avenevoli S, Green JG, Gruber MJ, Guyer M, He Y, Jin R, Kaufman J, Sampson NA, Zaslavsky AM, Merikangas KE. The National Comorbidity Survey Replication Adolescent Supplement (NCS-A): III. Concordance of *DSM-IV/CIDI* diagnoses with clinical reassessments. J Am Acad Child Adolesc Psychiatry 2009;48:386–99.
33. SAS Institute Inc. SAS Software Version 9.2. Cary, NC2008.
34. Chen E, Martin AD, Matthews KA. Understanding health disparities: the role of race and socioeconomic status in children's health. Am J Public Health 2006;96:702–8.
35. Braveman PA, Barclay C. Health disparities beginning in childhood: a life-course perspective. Pediatrics 2009;124: S163–S75.
36. Mielck A, Reitmeir P, Wjst M. Severity of childhood asthma by socioeconomic status. Int J Epidemiol 1996;25:388–93.
37. Litonjua AA, Carey VJ, Weiss ST, Gold DR. Race, socioeconomic factors, and area of residence are associated with asthma prevalence. Pediatr Pulmonol 1999;28.
38. McWilliams LA, Cox BJ, Enns MW. Mood and anxiety disorders associated with chronic pain: an examination in a nationally representative sample. Pain 2003;106:127–33.
39. Asmundson GJ, Katz J. Understanding the co-occurrence of anxiety disorders and chronic pain: state-of-the-art. Depress Anxiety 2009;26:888–901.
40. McWilliams LA, Goodwin RD, Cox BJ. Depression and anxiety associated with three pain conditions: results from a nationally representative sample. Pain 2004;111:77–83.
41. Sharp TJ, Harvey AG. Chronic pain and posttraumatic stress disorder: mutual maintenance? Clin Psychol Rev 2001:857–77.
42. McLaughlin KA, Hatzenbuehler ML. Stressful life events, anxiety sensitivity, and internalizing symptoms in adolescents. J Abnorm Psychol 2009;118:659–69.
43. Pollak SD, Vardi S, Putzer Bechner AM, Curtin JJ. Physically abused children's regulation of attention in response to hostility. Child Dev 2005;76:968–77.
44. McLaughlin KA, Sheridan MA, Alves S, Mendes WB. Child maltreatment and autonomic nervous system reactivity: identifying dysregulated stress reactivity patterns using the biopsychosocial model of challenge and threat. Psychosom Med 2014;76:538–46.
45. MacMillan HL, Georgiades K, Duku EK, Shea A, Steiner M, Niec A, Tanaka M, Gensey S, Spree S, Vella E, Walsh CA, De Bellis MD, Van Der Meulen J, Boyle MH, Schmidt LA.

Cortisol response to stress in female youths exposed to childhood maltreatment: results of the Youth Mood Project. Biol Psychiatry 2009;66:62–8.
46. Gunnar MR, Vazquez DM. Low cortisol and a flattening of expected daytime rhythm: potential indices of risk in human development. Dev Psychopathol 2001;13:515–38.
47. Silverman MN, Sternberg EM. Glucocorticoid regulation of inflammation and its functional correlates: from HPA axis to glucocorticoid receptor dysfunction. Ann NY Acad Sci 2012;1261:55–63.
48. Cohen S, Janicki-Deverts D, Doyle WJ, Miller GE, Frank E, Rabin BS, Turner RB. Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk. Proc Natl Acad Sci U S A 2012;109:5995–9.
49. Barnes PJ, Adcock IM. Glucocorticoid resistance in inflammatory diseases. Lancet 2009;9678:1905–17.
50. Slopen N, Kubzansky LD, McLaughlin KA, Koenen KC. Childhood adversity and inflammation in youth: a prospective study. Psychoneuroendocrinology 2013;38:188–200.
51. Danese A, Pariante CM, Caspi A, Taylor A, Poulton R. Childhood maltreatment predicts adult inflammation in a life-course study. Proc Natl Acad Sci U S A 2007;104:1319–24.
52. Slopen N, McLaughlin KA, Dunn EC, Koenen KC. Childhood adversity and cell-mediated immunity in young adulthood: does type and timing matter? Brain Behav Immun 2013;28:63–71.
53. Schreier HM, Roy LB, Frimer LT, Chen E. Family chaos and adolescent inflammatory profiles: the moderating role of socioeconomic status. Psychosom Med 2014;76:460–7.
54. Vanmolkot F, Hoon JD. Increased C-reactive protein in young adult patients with migraine. Cephalalgia 2007;27:843–6.
55. Sommer C, Kress M. Recent findings on how proinflammatory cytokines cause pain: peripheral mechanisms in inflammatory and neuropathic hyperalgesia. Neurosci Lett 2004;361:184–7.
56. Amstadter AB, Elwood LS, Begle AM, Gudmundsdottir B, Smith DW, Resnick HS, Hanson RF, Saunders BE, Kilpatrick DG. Predictors of physical assault victimization: findings from the National Survey of Adolescents. Addict Behav 2011;36:814–20.
57. Riley AW. Evidence that school-age children can self-report on their health. Ambul Pediatr 2004;4:371–6.
58. Forrest CB, Riley AW, Vivier PM, Gordon NP, Stafield B. Predictors of children's healthcare use: the value of child versus parental perspectives on healthcare needs. Med Care. 2004;42:232–8.
59. Houle CR, Joseph CLM, Caldwell CH, Conrad FG, Parker EA, Clark NM. Congruence between urban adolescent and caregiver responses to questions about the adolescent's asthma. J Urban Health 2010;88:30–40.