Association of Early-Life Exposure to Income Inequality With Bullying in Adolescence in 40 Countries

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➕ **Supplemental content**

IMPORTANCE While the association between income inequality and interpersonal violence has been attributed to the psychosocial effects of inequality (eg, increased class anxiety, reduced social capital), longitudinal evidence for this pathway is limited by a reliance on small ecological studies and cross-sectional data. The developmental consequences of early-life inequality for subsequent involvement in violence have not been investigated.

OBJECTIVE To examine the association between income inequality during infancy and early childhood and adolescents' involvement in bullying others, experiences of being bullied, or both.

DESIGN, SETTING, AND PARTICIPANTS The Health Behavior in School-aged Children survey study was conducted in European and North American schools. This analysis used individual data on bullying (being bullied, bullying others, or both) from 6 consecutive school-based surveys of 11-year-old to 15-year-old students carried out in 40 countries between February 1994 to March 2014. Data analysis occurred from March 2018 to January 2019.

EXPOSURE National Gini indices of income inequality for every year of life spanning a 35-year period (1979 to 2014).

MAIN OUTCOMES AND MEASURES Being bullied, bullying others, and both outcomes were measured using a common definition and questions adapted from the Bully-Victim Questionnaire and translated to many languages.

RESULTS The sample included 425 938 male students and 448 265 female students from 162 country–survey year groups in 29 196 schools. Linear regression coefficients indicated that early-life income inequality from birth to 4 years was positively associated with being bullied (male students: linear regression coefficient, 18.26 [95% CI, 11.04-25.47]; $P < .001$; female students: linear regression coefficient, 15.67 [95% CI, 10.02-21.33]; $P < .001$), and dual involvement in being bullied and bullying others (male students: linear regression coefficient, 5.55 [95% CI, 2.67-8.44]; $P < .001$; female students: linear regression coefficient, 2.45 [95% CI, 0.93-3.97]; $P < .001$), after differences in lifetime mean income inequality (from birth to when bullying was measured), national per capita income, family socioeconomic position, age, and cohort were controlled. No such association was found with bullying others after differences in being bullied were controlled.

CONCLUSIONS AND RELEVANCE Being bullied is associated with early-life exposure to income inequality. Although further research on the underlying pathways is needed to guide intervention, these results suggest temporality in the association between inequality and violence and suggest that growing up in areas of high income inequality is associated with victimization in adolescence.

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Bullying is defined as a series of repeated, unwanted, aggressive acts intended to harm or intimidate someone less powerful.[1] The aggression may be direct (eg, physical assaults, verbal attacks) or relational (eg, social exclusion, spreading rumors) and may carry serious mental and physical health consequences for both targeted individuals and perpetrators.[2-5] Evidence shows that youth who are both bullied and bully others are most at risk of long-term emotional and behavioral problems, including posttraumatic stress disorder.[4,5]

While antibullying efforts focus on school contexts and the social relationships of targeted individuals and perpetrators,[6] epidemiological studies have identified links between bullying and area-level income inequality.[7-9] One such study[7] found that national income inequality was correlated with bullying by 11-year-olds in 37 countries ($r = 0.62$) after controlling for family socioeconomic position (SEP) and area-level wealth. This association is consistent with research in criminology that has found that various forms of interpersonal violence (eg, firearm assaults, sexual assaults, racism, homicides, child maltreatment) are more prevalent in areas where income inequality is greater.[10-13] One explanation of these associations is that inequality elicits stress by intensifying relative poverty and class anxiety, reducing social trust and norms of reciprocity, and promoting class discrimination, teasing, shame, and retaliation.[11,14,15] The association between income inequality and bullying is also consistent with developmental research on childhood stress and trauma.[16,17] Early childhood exposure to the negative consequences of inequality (eg, violence, crime, child maltreatment[13,14]) may bias cognitive working models of reciprocity and reinforce the belief that social interactions are ruled by power and domination and neutral or ambiguous social cues should be interpreted as hostile.[18,19] Early-life stress also increases the risk of developing mental health problems, which increase the likelihood of becoming a target of bullying.[3,4] Whatever the underlying causal pathway, the complex social consequences of inequality may influence a child's propensity to use violence or become a target of violence later in adolescence.[16]

Research has not yet examined the developmental associations between early-life income inequality and experiences of bullying in adolescence. This might be because studies on income inequality have typically used cross-sectional designs, small samples of countries or regions, and aggregated data and therefore lack the statistical power needed to control differences in area-level wealth and individual SEP. We investigated the question of temporality using data from an ongoing international survey of adolescents in 40 countries. We tested links to bullying separately in sex-specific groups because previous research[7,8] has found stronger associations between inequality and bullying in female youth than male youth. The goal was to determine whether early-life income inequality is associated with later experiences of bullying.

Methods

Sample

Nationally representative samples of 11-year-old, 13-year-old, and 15-year-old students were surveyed in 6 quadrennial

Key Points

Question Is exposure to income inequality in infancy and early childhood associated with later involvement in bullying among adolescents?

Findings This survey study of adolescents in 40 countries found that growing up in areas of income inequality was associated with being bullied after inequality and wealth in the intervening years were controlled for.

Meaning Socioeconomic inequality in early life may shape developmental processes that put adolescents at risk of being bullied.

cycles of the Health Behavior in School-aged Children (HBSC) study between February 1994 and March 2014 (http://www.hbsc.org).[20] The number of countries involved per cycle ranged from 19 in 1994 to 34 in 2014. A complete list is shown in eTable 1 in the Supplement. The sample represented mostly high-income countries in North America and Europe and included 425 938 males and 448 265 females from 162 country-survey year groups and 29 196 schools. Some countries did not participate in some cycles (Bulgaria and the United States in 2010; Turkey and the United States in 2014). Subnational data from England, Wales, and Scotland were combined and linked to national economic data on the United Kingdom. Samples from the Belgian geographic regions of Flanders and Wallonia were also combined.

The HBSC study used 2-stage sampling to recruit students within a stratified samples of schools that represented the regional, economic, and public-private distribution in each country. Teachers or trained interviewers distributed standardized questionnaires in classroom settings. Member countries obtained ethics clearance to conduct the survey from university-based review boards or equivalent regulatory bodies. Student participation was voluntary. Parents, students, and school administrators gave either active or passive consent, depending on national human participant requirements.

Measures

Bullying

Being bullied and bullying others were measured using a common definition and questions adapted from the Bully-Victim Questionnaire.[21] In 1994 and 1998 surveys, the definition was followed by 2 items: "How often have you been bullied at school this term?" and "How often have you taken part in bullying other students at school this term?" Answers were not at all (coded as 1), once or twice (2), 2 or 3 times per month (3), about once a week (4), and several times a week (5). In the 2002, 2006, 2010, and 2014 surveys, the period shown in these questions was revised to "the past couple of months." We derived a third, combined variable, to represent dual involvement in bullying others and being bullied, according to the lower frequency of its 2 constituent items, being bullied and bullying others.

Socioeconomic Position

An index of material assets in the home was used to measure SEP at the individual level.[22] The index contained 2 items in

1994. The first stated, "Does your family own a car, van, or truck?" Answers were no (coded as 0), yes (1), and yes (2 or more) (2). The second stated, "Do you have your own bedroom for yourself?" Answers were no (0) and yes (1). An additional item were added to the index in 1998: "During the past 12 months, how many times did you travel away on holiday with your family?" (answers were not at all [0], once [1], or twice or more [2]). In 2002, "How many computers does your family own?" was added (with answers [0], 1 [1], and 2 or more [2]), and in 2014, "At home, do you have a dishwasher?" (no [0] and yes [1]) and "How many bathrooms (room with a bath) are in your home?" (none [0], 1 [1], 2 [2], more than 2 [3]). Summary scores on these items were harmonized by calculating country-specific and year-specific ridit scores that represented a weighted proportional rank in SEP relative to the sample distribution, ranging from 0 (lowest) to 1 (highest).[15]

Country Wealth and Income Inequality

We controlled country differences in gross national income per capita (Atlas method; US dollars)[23] for each HBSC survey year. The Standardized World Income Inequality Database provided annual data on posttaxation income inequality.[24] These are estimated Gini indices that have a theoretical range of 0 (perfect equality) to 1 (perfect inequality). We used national Gini indices from 1979 to 2014 to cover all life years of the sample, including in the Eastern European countries in the sample that were once part of Czechoslovakia (the Czech Republic and Slovakia), the Soviet Union (Armenia, Estonia, Latvia, Lithuania, Moldova, Russia, and Ukraine), or Yugoslavia (Croatia and Slovenia).

Derived Variables

We applied Box-Cox transformations to the bullying variables to make their regression residuals less heteroskedastic and meet the assumptions of maximum likelihood estimation.[25] The transformation compares functional forms of the variable, y, to derive an optimal exponent, λ, that yields normally distributed residuals: $y(\lambda) = (y^{\lambda} - 1) / \lambda$. We transformed these variables separately in male and female students, given their different frequency distributions (Table 1) and scaled them up by a factor of 100 to better show their slope coefficients in linear regressions.

Statistical Analysis

Isolating age, period, and cohort effects is typically achieved by using either fixed-effects modeling, which removes data endogeneity by differencing stable group characteristics from dependent and independent variables, or random-effects modeling, which recognizes between-country and within-country-level differences and autocorrelation in group characteristics. We used a hybrid of these approaches that combined fixed-effects and random-effects characteristics.[26] By subtracting country-level means from independent variables and specifying country-year and country levels of variation levels of variation, we were able to pool 6 cross-sectional surveys and model within-country and between-country effects separately.[27] A more complete description of this approach is provided elsewhere.[26,27]

Table 1. Frequency of Bullying by Sex (1994-2014)

Characteristic	No. (%) [95% CI]	
	Male	Female
Being bullied		
None	307 526 (66.0) [65.6-66.3]	343 032 (70.0) [69.6-70.3]
1 or 2 times	95 490 (19.8) [19.7-20.0]	92 013 (18.5) [18.3-18.6]
2 or 3 times per mo	32 395 (6.3) [6.2-6.5]	27 890 (5.2) [5.0-5.3]
Once a week	15 797 (3.3) [3.3-3.4]	13 288 (2.7) [2.6-2.8]
Several times a week	21 748 (4.6) [4.5-4.7]	18 655 (3.7) [3.6-3.8]
Bullying others		
None	282 562 (60.9) [60.5-61.4]	363 108 (74.3) [73.9-74.7]
1 or 2 times	118 196 (24.8) [24.6-25.0]	92 412 (18.4) [18.2-18.7]
2 or 3 times per mo	37 082 (7.1) [6.9-7.3]	22 213 (3.9) [3.8-4.1]
Once a week	15 437 (3.2) [3.1-3.3]	8136 (1.7) [1.6-1.7]
Several times a week	19 477 (4.0) [3.9-4.1]	8710 (1.7) [1.7-1.8]
Both combined		
None	371 630 (80.0) [79.7-80.4]	422 025 (86.4) [86.1-86.7]
1 or 2 times	73 179 (15.1) [14.9-15.3]	55 423 (10.9) [10.7-11.2]
2 or 3 times per mo	15 705 (3.0) [2.9-3.1]	9650 (1.7) [1.6-1.8]
Once a week	4714 (1.0) [1.0-1.1	2853 (0.6) [0.6-0.6]
Several times a week	4072 (0.9) [0.8-0.9]	2091 (0.4) [0.4-0.5]

The model specified 4 levels of variation: individuals (i), schools (j), country/survey years (k), and countries (l). Fixed-effects included age, SEP (X_{ijkl}), and country wealth ($\beta_2 X_{kl}$). The subtraction of income inequality from its mean over time ($Z_{kl} - Z_l$) and the mean itself (Z_l) were also entered. Within-country effects of individual characteristics (γ_{WE}) and fixed, between-country effects of nationality and period (γ_{BE}) were estimated simultaneously. Time, $\beta_O(t)$, represents years since 1994 and was entered as a random effect at the country level. Trends in country wealth and inequality were controlled using interactions by time $\beta_3 X_{kl} t$ and $\gamma_{time}(Z_l t)$, respectively. The model also included mean lifetime income inequality and mean lifetime country wealth. Random components were specified at country (v_1), country/y (μ_{kl}), school (ξ_{jkl}), and individual (τ_{ijkl}) levels:

$$Y_{ijkl} + \beta_O(t) + \beta_1 X_{ijkl} + \beta_2 X_{kl} + \beta_3 X_{kl} t + \gamma_{WE}(Z_{kl} - Z_l) + \gamma_{BE} Z_l$$
$$+ \gamma_{time}(Z_l t) + v_1 + \mu_{kl} + \xi_{jkl} + \tau_{ijkl}$$

We linked individual and country data using students' birth years, survey years, and nationalities. We then tested the hypothesis about lagged associations between income inequality and bullying by subtracting the mean Gini index from birth to age 4 years (and from age 5 years to 9 years) from lifetime mean income inequality and entering these differences to linear regression models. Further analyses tested the unique contributions of income inequality at each year of life in an

Table 2. Descriptive Statistics on Key Variables (1994-2014)

Characteristic	Mean (SD) [Range]	
	Male Individuals	Female Individuals
Age, y	13.56 (1.64) [9.83-18.00]	13.57 (1.64) [9.83-20.00]
Socioeconomic position	0.51 (0.28) [0.00-1.00]	0.49 (0.28) [0.00-1.00]
Survey responses		
Being bullied[a]	13.79 (19.55) [0.00-47.28]	10.13 (15.67) [0.00-37.61]
Bullying others[a]	18.4 (23.54) [0.00-59.00]	6.66 (11.47) [0.00-27.55]
Both experiences[a]	3.62 (7.38) [0.00-18.52]	1.56 (4.03) [0.00-11.55]

[a] Continuous measures of bullying are Box-Cox transformations based on variable-specific and sex-specific residual distributions and are therefore not directly comparable with one another.

attempt to identify a developmental period that was most sensitive to inequality. The prevalence estimates and descriptive statistics were derived from intercept-only logistic and linear regressions, respectively. Goodness of fit was reported using Akaike information criterion and the Bayesian information criterion.[28] Tests of statistical significance are based on 2-tailed *P* values or 95% CIs, and statistical significance was set at *P* less than .05. Data analysis was completed from March 2018 to January 2019 with Stata version 14 (StataCorp).

Results

Table 1 shows the frequency distribution of being bullied, bullying others, and both experiences combined. **Table 2** presents descriptive statistics on age (mean [SD]: male participants, 13.56 [1.64] years; female participants, 13.57 [1.64]), SEP (mean [SD]: male participants, 0.51 [0.28]; female participants, 0.49 [0.28]), and bullying.

From 1994 to 2014, gross national income per capita ranged from $4570 (Ukraine; 2002) to $65 970 (Norway; 2014), and the Gini index of income inequality ranged from 0.210 (Denmark; 2002) to 0.416 (Macedonia; 2014). Across all life years, from 1979 to 2014, income inequality ranged from 0.164 (Slovenia; 1987) to 0.452 (Turkey; 1995) and increased from a mean (SD) of 0.26 (0.06) in 1979 to 0.31 (0.05) in 2014 (eFigure in the Supplement).

The regression analysis is summarized in **Table 3**. Detailed results are provided in eTables 2, 3, and 4 in the Supplement. The analysis of being bullied found positive associations with lifetime income inequality (ie, mean Gini index from birth to the year of the survey) in both sex-specific groups (male participants: linear regression coefficient, 57.16 [95% CI, 38.33-75.99]; female participants: linear regression coefficient, 61.68 [95% CI, 45.67-77.70]). The slope coefficients correspond to the theoretical range of the Gini index, from 0 to 1. The observed range in inequality was narrower (0.16-0.45) and corresponded to approximately 1.3 SDs in being bullied in boys and 1.8 SDs in girls. Consistent with other research on school bullying, the analysis of being bullied and bullying others is mutually controlled, given their moderate correlation (*r* = 0.30;

P < .001). The results show that with lifetime income inequality controlled, inequality from birth to age 4 years was associated with a higher rate of being bullied in boys (linear regression coefficient, 18.26 [95% CI, 11.04-25.47]) and girls (linear regression coefficient, 15.67 [95% CI, 10.02-21.33]; model 2) and inequality from ages 5 to 9 years was associated with being bullied in girls only (linear regression coefficient, −13.16 [95% CI, −21.15 to −5.16]; model 3).

Income inequality did not show a robust association with bullying others. As shown in Table 3 and eTable 3 in the Supplement, inequality was not associated with bullying others in boys and was negatively associated with bullying others in girls (linear regression coefficient, −17.10 [95% CI, −28.37 to −5.83]), after differences in being bullied were controlled.

With respect to both outcomes combined, a positive association was found with lifetime income inequality in boys (linear regression coefficient, 14.86 [95% CI, 6.37-23.36]) but not girls. With lifetime inequality controlled, inequality exposure from birth to age 4 years was associated with more bullying combined with being bullied in both sex-specific groups (male participants: linear regression coefficient, 5.55 [95% CI, 2.67-8.44]; female participants: linear regression coefficient, 2.45 [95% CI, 0.93-3.97]), while exposure from age 5 to 9 years was associated with less (male participants: linear regression coefficient, −4.10 [95% CI, −8.16 to −0.05]; female participants: linear regression coefficient, −5.04 [95% CI, −7.16 to −2.87]).

Detailed regression results in eTables 2, 3, and 4 in the Supplement reveal that younger adolescents were bullied more (male participants: −1.19 [95% CI, −1.26 to −1.14]; female participants: −0.77 [95% CI, −0.82 to −0.71]) and experienced more combined bullying and being bullied (male participants: −0.07 [95% CI, −0.10 to −0.04]; female participants: −0.02 [95% CI, −0.04 to 0.00]), whereas older adolescents bullied others more (male participants: 1.32 [95% CI, 1.24-1.41]; female participants: 0.46 [95% CI, 0.41-0.50]). Socioeconomic position was negatively associated with bullying others (male participants: −2.13 [95% CI, −2.33 to −1.93]; female participants: −1.80 [95% CI, −1.95 to −1.64]) and combined bullying and being bullied (male participants: −0.21 [95% CI, −0.28 to −0.13]; female participants: −0.10 [95% CI, −0.14 to −0.06]) but positively associated with bullying others (male participants: 0.30 [95% CI, 0.30-0.30]; female participants: 0.19 [95% CI, 0.18-0.19]). Higher national wealth (log of per capita income) was associated with being bullied (male participants: 2.40 [95% CI, 0.63-4.16]; female participants: 3.71 [95% CI, 2.21-5.21]) and bullying others (male participants: 2.63 [95% CI, 0.45-4.81]; female participants: 2.89 [95% CI, 1.81-3.95]).

Further analyses tested the unique contribution of each year of income inequality exposure to subsequent bullying. As in the main analysis, we controlled for lifetime income inequality, and being bullied and bullying others were mutually controlled. The results summarized in the **Figure** indicate that inequality in the first 4 years of life was uniquely associated with being bullied and the combined outcome of bullying and being bullied in adolescence in both boys and girls. However, no clear pattern was found in the association between early-life income inequality and bullying others.

Table 3. Associations Between Early-Life Income Inequality and Bullying in Adolescence[a]

| | Linear Regression Coefficients (95% CI) | | | | | |
| | Male Participants | | | Female Participants | | |
Variables	Model 1[b]	Model 2[c]	Model 3[c]	Model 1[b]	Model 2[c]	Model 3[c]
Being bullied						
Lifetime (age 0-10 y)	57.16 (38.33-75.99)	51.42 (32.59-70.25)	57.12 (38.31-75.92)	61.68 (45.67-77.70)	56.04 (40.03-72.06)	61.78 (45.75-77.80)
0-4 y	NA	18.26 (11.04-25.47)	NA	NA	15.67 (10.02-21.33)	NA
5-9 y	NA	NA	−11.40 (−21.57 to −1.70)	NA	NA	−13.16 (−21.15 to −5.16)
Bullying others						
Lifetime (age 0-10 y)	7.08 (−16.99 to 31.14)	5.81 (−18.37 to 29.99)	7.05 (−17.02 to 31.12)	−17.10 (−28.37 to −5.83)	−16.80 (−28.12 to −5.48)	−17.17 (−28.47 to −5.86)
0-4 y	NA	4.09 (−4.57 to 12.75)	NA	NA	−0.93 (−5.05 to 3.18)	NA
5-9 y	NA	NA	0.62 (−11.61 to 12.86)	NA	NA	−4.39 (−10.21 to 1.43)
Both combined						
Lifetime (age 0-10 y)	14.86 (6.37-23.36)	12.49 (3.95-21.03)	14.82 (6.31-23.32)	2.49 (−2.00 to 6.97)	1.52 (−3.01 to 6.04)	2.35 (−2.16 to 6.85)
0-4 y	NA	5.55 (2.67-8.44)	NA	NA	2.45 (0.93-3.97)	NA
5-9 y	NA	NA	−4.10 (−8.16 to −0.05)	NA	NA	−5.04 (−7.16 to −2.87)

Abbreviation: NA, not applicable.

[a] All models were tested using weighted 4-level regressions and controlled differences in age, socioeconomic position, time (years post-1994), time-by-inequality interactions, log gross national income per capita, and time-by-log gross national income per capita, and covariation at the school, country/year, and country levels. Being bullied and bullying others are mutually controlled.

[b] Model 1 shows the association between lifetime income inequality (ie, to birth to when bullying was assessed).

[c] Models 2 and 3 contain model 1 variables plus inequality from 0 to 4 years and 5 to 9 years, respectively. Detailed regression results are shown in eTables 2, 3, and 4 in the Supplement.

Figure. Association Between Bullying in Adolescence and Early-Life Income Inequality, From Birth to 10 Years of Age
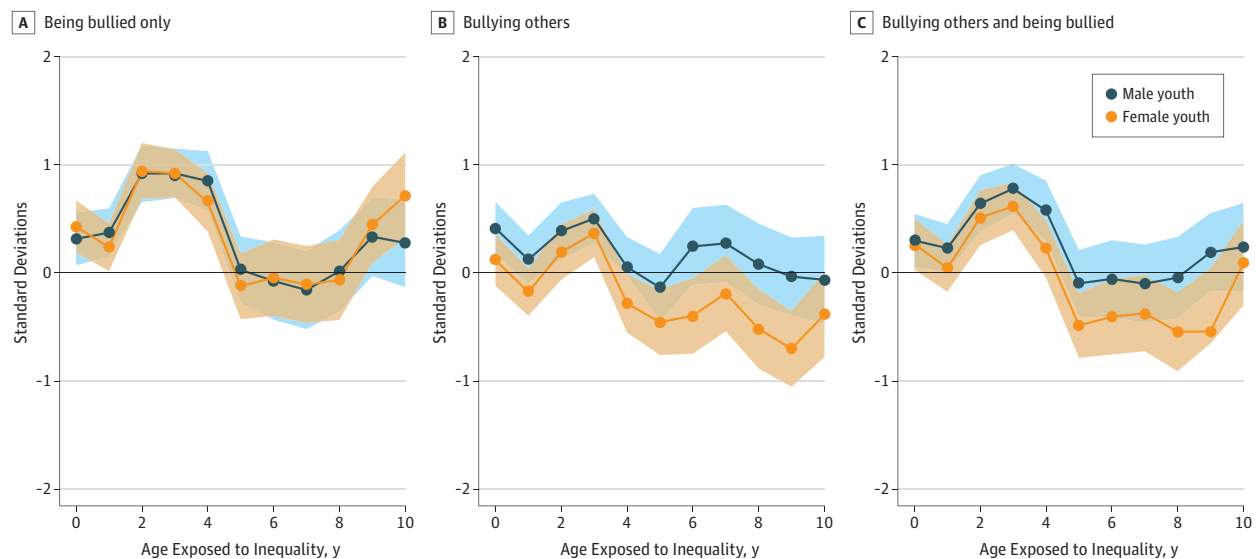
A, Being bullied; B, bullying others; C, both combined. The regression coefficients at each age are adjusted for family affluence, country wealth, and income inequality at the time bullying was measured. Being bullied (A) and bullying others (B) are mutually controlled.

Discussion

This study used a retrospective panel design to explore early-life exposures to income inequality in association with bully-ing in adolescence. Inequality during the first 4 years of life was associated with being bullied in adolescence and dual involvement in being bullied and bullying others. These associations held up to numerous statistical controls, including individual SEP and area-level wealth. No association was found

between early-life income inequality and the perpetration of bullying. This result was unexpected but might reflect a lower accuracy of self-reported perpetrating bullying vs being bullied, as was indicated in validity studies of the Olweus Bully-Victim Questionnaire.[29,30] One such study that compared self-reports and peer reports of bullying found better concurrent validity in self-reported maltreatment (r = 0.42) than in self-reported perpetration (r = 0.12).[31]

Overall, the findings demonstrated the antecedent-consequence conditions between income inequality and violence and supported the hypothesis that early-life income inequality influences developmental trajectories in ways that is associated with later involvement in bullying (as targets in particular). To our knowledge, this is the first evidence of an association between early-life inequality and adolescent bullying. It lends temporal evidence to the cross-sectional associations reported previously[7-9] and has implications for violence prevention and public health research.

First, given the early developmental stage when the most consequential exposures occurred (birth to age 4 years), it appears that the association is largely mediated by family contextual factors and not school contexts. We can only speculate which specific mechanisms are involved. Other studies on income inequality suggest that parent-child attachment styles, maternal mental health, maternal care, or child neglect and maltreatment play a role.[14] A study by Eckenrode and colleagues[13] found a positive association between county-level income inequality in the United States and child maltreatment after controlling differences in area-level child poverty. Another US study found that state-level income inequality correlated with preterm births (r = 0.39), low birth weight (r = 0.40), very low birth weight (r = 0.47), and infant mortality (r = 0.11).[32] These and other studies that link income inequality to poor health in adults and diminished social resources that support health[14,31] suggest that adolescents that grew up in areas of greater inequality experienced poorer care and more adversity and stress in early-life—long before they developed an awareness of social class. Further analysis carried out in more diverse cultural settings might help identify these adversities and examine their cumulative associations with socioemotional development and maltreatment.

Second, the results indicate that the association between income inequality and being bullied is mostly established before age 5 years and therefore not fully explained by primary or secondary school experiences or violence prevention policy in schools. Although schools remain an effective

venue to mitigate the association through violence prevention and health promotion, such efforts do not account for the associations found in this study. Children in areas of high income inequality should be a focus of bullying prevention efforts, beginning in preschool and primary school. In contrast, focusing on individual and area-level poverty seems less likely to guide targeted interventions, given that these factors are not closely associated with adolescents' involvement in bullying.[7,33]

Strengths of this study include its large sample size, 35 years of panel data, and hybrid multilevel analysis of between-country and within-country effects that facilitated a more powerful analysis of early-life income inequality than could have been achieved using a time-invariant cross-sectional design or a context-invariant longitudinal design.[32]

Limitations

There are also limitations in the study. First, it did not contain longitudinal individual-level data nor school-level contextual data on social processes that might explain associations between inequality and bullying. Second, using nationality and age to determine income inequality exposures did not account for migration within or between countries or regional differences in wealth and inequality. Third, the self-report assessments of bullying were brief, undifferentiated in terms of bullying type (eg, physical, relational, and via internet and text message) and uncorroborated by peers, parents, or teachers. Fourth, there may have been nonresponse bias owing to school absence, given that exact response rates in the HSBC study were unavailable.

Conclusions

Child welfare advocates have championed the importance of tackling the social determinants of youth violence early in the life course.[34,35] This study finds that being bullied in adolescence is associated with early-life exposure to income inequality, which might be a proxy of psychological stress and adversity that alters important developmental processes in infancy and early childhood.[15] Furthermore, although the study found that income inequality is associated with later violence, more robust surveillance efforts and further research are needed to understand the psychosocial and physiological mechanisms that explain why children that grow up in more economically unequal settings are at greater risk.

REFERENCES

1. Olweus D. School bullying: development and some important challenges. *Annu Rev Clin Psychol*. 2013;9:751-780. doi:10.1146/annurev-clinpsy-050212-185516

2. Brunstein Klomek A, Marrocco F, Kleinman M, Schonfeld IS, Gould MS. Bullying, depression, and suicidality in adolescents. *J Am Acad Child Adolesc Psychiatry*. 2007;46(1):40-49. doi:10.1097/01.chi.0000242237.84925.18

3. Luk JW, Wang J, Simons-Morton BG. Bullying victimization and substance use among U.S. adolescents: mediation by depression. *Prev Sci*. 2010;11(4):355-359. doi:10.1007/s11121-010-0179-0

4. Wolke D, Copeland WE, Angold A, Costello EJ. Impact of bullying in childhood on adult health, wealth, crime, and social outcomes. *Psychol Sci*. 2013;24(10):1958-1970. doi:10.1177/0956797613481608

5. Sourander A, Jensen P, Rönning JA, et al. What is the early adulthood outcome of boys who bully or are bullied in childhood? the Finnish "From a Boy to a Man" study. *Pediatrics*. 2007;120(2):397-404. doi:10.1542/peds.2006-2704

6. Ttofi MM, Farrington DP. Effectiveness of school-based programs to reduce bullying: a systematic and meta-analytic review. *J Exp Criminol*. 2011;7(1):27-56. doi:10.1007/s11292-010-9109-1

7. Elgar FJ, Craig W, Boyce W, Morgan A, Vella-Zarb R. Income inequality and school bullying: multilevel study of adolescents in 37 countries. *J Adolesc Health*.

2009;45(4):351-359. doi:10.1016/j.jadohealth.2009.04.004

8. Elgar FJ, Pickett KE, Pickett W, et al. School bullying, homicide and income inequality: a cross-national pooled time series analysis. *Int J Public Health*. 2013;58(2):237-245. doi:10.1007/s00038-012-0380-y

9. Due P, Merlo J, Harel-Fisch Y, et al. Socioeconomic inequality in exposure to bullying during adolescence: a comparative, cross-sectional, multilevel study in 35 countries. *Am J Public Health*. 2009;99(5):907-914. doi:10.2105/AJPH.2008.139303

10. Choe J. Income inequality and crime in the United States. *Econ Lett*. 2008;101:31-33. doi:10.1016/j.econlet.2008.03.025

11. Elgar FJ, Aitken N. Income inequality, trust and homicide in 33 countries. *Eur J Public Health*. 2011;21(2):241-246. doi:10.1093/eurpub/ckq068

12. Kawachi I, Kennedy BP, Wilkinson RG. Crime: social disorganization and relative deprivation. *Soc Sci Med*. 1999;48(6):719-731. doi:10.1016/S0277-9536(98)00400-6

13. Eckenrode J, Smith EG, McCarthy ME, Dineen M. Income inequality and child maltreatment in the United States. *Pediatrics*. 2014;133(3):454-461. doi:10.1542/peds.2013-1707

14. Wilkinson RG, Pickett KE. *The Inside Level: How More Equal Societies Reduce Stress, Restore Sanity and Improve Everyone's Well-being*. London, England: Penguin; 2018.

15. Elgar FJ, Pförtner TK, Moor I, De Clercq B, Stevens GW, Currie C. Socioeconomic inequalities in adolescent health 2002-2010: a time-series analysis of 34 countries participating in the Health Behaviour in School-aged Children study. *Lancet*. 2015;385(9982):2088-2095. doi:10.1016/S0140-6736(14)61460-4

16. Downey G, Khouri H, Feldman SI. Early interpersonal trauma and later adjustment: the mediational role of rejection sensitivity. In: Cicchetti D, Toth SL, eds. *Rochester Symposium on Developmental Psychology, Vol. 8: Developmental Perspectives on Trauma, Theory, Research, and Intervention*. Rochester, NY: University of Rochester Press; 1997.

17. Arsenio WF, Gold J. The effects of social injustice and inequality on children's moral judgments and behavior: towards a theoretical model. *Cogn Dev*. 2006;21:388-400. doi:10.1016/j.cogdev.2006.06.005

18. Dodge KA, Rabiner DL. Returning to roots: on social information processing and moral development. *Child Dev*. 2004;75(4):1003-1008. doi:10.1111/j.1467-8624.2004.00721.x

19. Colder CR, Mott J, Levy S, Flay B. The relation of perceived neighborhood danger to childhood aggression: a test of mediating mechanisms. *Am J Community Psychol*. 2000;28(1):83-103. doi:10.1023/A:1005194413796

20. Inchley J, Currie D, Young T, et al. Growing up unequal: gender and socioeconomic differences in young people's health and well-being: Health Behaviour in School-Aged Children (HBSC) study: international report from the 2013/14 Survey, Health Policy for Children and Adolescents (No. 7). http://www.euro.who.int/__data/assets/pdf_file/

0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf. Published 2016. Accessed April 5, 2019.

21. Solberg ME, Olweus D. Prevalence estimation of school bullying with the Olweus Bully/Victim Questionnaire. *Aggress Behav*. 2003;29(3):239-268. doi:10.1002/ab.10047

22. Currie C, Molcho M, Boyce W, Holstein B, Torsheim T, Richter M. Researching health inequalities in adolescents: the development of the Health Behaviour in School-Aged Children (HBSC) family affluence scale. *Soc Sci Med*. 2008;66(6):1429-1436. doi:10.1016/j.socscimed.2007.11.024

23. World Bank. GNI per capita, Atlas method (current US$). https://data.worldbank.org/indicator/NY.GNP.PCAP.CD. Published 2017. Accessed June 28, 2018.

24. Solt F; Harvard Dataverse. The Standardized World Income Inequality Database, version 20.0. https://dataverse.harvard.edu/dataset.xhtml?persistentId=hdl:1902.1/11992. Published 2018. Accessed June 28, 2018.

25. Box GEP, Cox DR. An analysis of transformations. *J R Stat Soc B*. 1964;26:211-252.

26. Fairbrother M. Two multilevel modeling techniques for analyzing comparative longitudinal survey datasets. *Political Science Research and Methods*. 2013;2(1):119-140. doi:10.1017/psrm.2013.24

27. Elgar FJ, Gariépy G, Torsheim T, Currie C. Early-life income inequality and adolescent health and well-being. *Soc Sci Med*. 2017;174:197-208. doi:10.1016/j.socscimed.2016.10.014

28. Burnham KP, Anderson DR. *Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach*. 2nd ed. New York, NY: Springer; 2002.

29. Lee T, Cornell D. Concurrent validity of the Olweus Bully/Victim Questionnaire. *J Sch Violence*. 2010;9:56-73. doi:10.1080/15388220903185613

30. Hartung CM, Little CS, Allen EK, Page MC. A psychometric comparison of two self-report measures of bullying and victimization: differences by sex and grade. *School Ment Health*. 2011;3:44-57. doi:10.1007/s12310-010-9046-1

31. Kondo N, Sembajwe G, Kawachi I, van Dam RM, Subramanian SV, Yamagata Z. Income inequality, mortality, and self rated health: meta-analysis of multilevel studies. *BMJ*. 2009;339:b4471. doi:10.1136/bmj.b4471

32. Olson ME, Diekema D, Elliott BA, Renier CM. Impact of income and income inequality on infant health outcomes in the United States. *Pediatrics*. 2010;126(6):1165-1173. doi:10.1542/peds.2009-3378

33. Tippett N, Wolke D. Socioeconomic status and bullying: a meta-analysis. *Am J Public Health*. 2014;104(6):e48-e59. doi:10.2105/AJPH.2014.301960

34. Patton GC, Sawyer SM, Santelli JS, et al. Our future: a Lancet commission on adolescent health and wellbeing. *Lancet*. 2016;387(10036):2423-2478. doi:10.1016/S0140-6736(16)00579-1

35. Richardson D, Hiu CF. Developing a global indicator on bullying of school-aged children: working paper No. 2018-22. https://www.unicef-irc.org/publications/pdf/WP%202018-11.pdf. Published 2018. Accessed April 9, 2019.