Two determinants of bullying behavior among adolescents in 40 countries: physical fighting and national homicide rates

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Objectives: Adolescent bullying may result from a combination of traits, such as delinquency, and sociocultural influences, such as a culture of violence. This study examined whether physical fighting and national homicide rates were associated with adolescent bullying using a multinational sample. **Methods:** Data were sourced from the 2017/2018 Health Behaviour in School-Aged Children study and linked to the 2018 World Health Organization national homicide rates. After we excluded incomplete survey responses ($n = 21,695$) and six countries for which data on adolescent bullying behavior or alcohol use were unavailable, we obtained a final sample involving 179,097 adolescents from 40 countries/regions. Data on bullying behaviors and physical fighting were dichotomized (0 = *never*, 1 = *at least once*) for ease of interpretation. Multilevel logistic regressions were also conducted. **Results:** Bullying prevalence varied significantly across countries (6.62%–51.70%). The null model revealed country-level differences in adolescent bullying behaviors (intraclass correlation coefficient = 0.11). The random intercept model indicated that adolescents who reported physical fighting had a higher likelihood of engaging in bullying behaviors (adjusted odds ratio [AOR] = 2.96, 95% confidence interval [CI] = 2.88–3.04). Living in countries with higher homicide rates was associated with an increased likelihood of engaging in bullying behaviors (AOR = 1.22, 95% CI = 1.12–1.34). **Conclusions:** Physical fighting and national homicide rates are risk factors for adolescent bullying. These findings highlight the requirement for intervention programs targeting both individual behaviors and broader social contexts to prevent bullying and promote safer environments. (*Taiwan J Public Health*. 2024;*43(6)*:587-606)

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INTRODUCTIONS

Bullying and school violence among adolescents are critical social concerns among researchers, policymakers, and the general public. For example, the United Nations' 2030 Sustainable Development Goals (SDGs) emphasize addressing bullying and ensuring safe educational environments for children

worldwide. SDG 16 advocates for peaceful, inclusive societies in Target 16.2, which calls for "ending all forms of violence against children" [1]. According to the 2020 Global Status Report on Preventing Violence Against Children, authored jointly by the WHO, the United Nations International Children's Emergency Fund (UNICEF), and the United Nations Educational, Scientific, and Cultural Organization (UNESCO), one in three students aged between 11 and 15 years had experienced bullying in the previous month. Specifically, 35% of boys were affected, as were 30% of girls [2]. These statistics indicate that more than 200 million adolescents globally have experienced school violence or bullying [3].

Studies have indicated that bullying severely affects adolescents' physical, emotional, and social well-being [4,5]. Adolescents who bully others often experience physical symptoms, such as sleep disturbances, fatigue, skin problems, or poor appetite [5-7]. Mentally, those who bully others face heightened risks of suicidal ideation, substance abuse, and personality disturbances [5,8,9]. Socially, bullying is correlated with poor school adjustment and externalizing behaviors [5,10]. Bullying also implicates SDG 3, which advocates promoting healthy lives and well-being for all ages, and SDG 4, which prioritizes inclusive, equitable, and high-quality education [1]. Because of the global scope and harmful consequences of adolescent bullying, identifying its determinants using transnational data is crucial.

Adolescent bullying is a form of violent behavior that typically occurs in school settings and involves unwanted aggression. The three defining features of bullying are (1) intentionality, (2) repetition, and (3) a power imbalance between the individuals who bully and those who are bullied [11,12]. Bullying occurs when individuals deliberately and repeatedly harm others, exploiting power dynamics to create unfair situations in which those who are bullied are harmed and struggle to defend themselves. The primary forms of bullying comprise physical violence (e.g., punching, kicking), verbal abuse (e.g., name-calling, threats), and psychological aggression (e.g., social exclusion, emotional abuse) [13]. Bullying involves two primary roles—the bully and the bullied—with some individuals assuming both roles as situations change [11,14]. This study focused on bullies because understanding these individuals is critical to preventing bullying and reducing the risk of severe antisocial behaviors in later life stages [15].

Bronfenbrenner's ecological model suggests that behavior is a product of interactions between personal traits and social contexts [16]. Hence, individual characteristics and social environments substantially influence adolescent behavior. Adolescence is marked by physical and neurological development, and the conditions and interactions shaping young individuals' growth during this period have been thoroughly explored in the literature [17]. Studies on adolescent bullying have primarily focused on individual factors, such as socioeconomic status and behavioral traits, that may mitigate or exacerbate the effects of school violence [18-20]. However, research exploring environmental influences on adolescent bullying behavior is lacking. The current study explored individual characteristics and environmental influences to address this gap.

Physical fighting is a form of violence and aggression, with global data indicating that one in three young people has engaged in such behavior [2]. Self-control theory has identified low self-control as a critical psychological trait linked to deviant behaviors [21]. Specifically, adolescents with low levels of self-control are more likely to exhibit impulsive and aggressive behaviors, including physical fighting and bullying [22]. Problem behavior theory (PBT) also posits that individuals who engage in one problem behavior are more likely to engage in others [23]. In the context of adolescent bullying, one meta-

analysis identified externalizing behaviors, characterized by aggressive, defiant, or poorly controlled actions, as the strongest predictor of engaging in bullying behavior [24]. Because bullying often coincides with other problems with aggressive conduct, children experiencing such problems may also engage in bullying behavior [15,25]. These findings suggest a positive association between physical fighting and bullying behavior.

Culture of violence theory posits that violence may be pervasive in certain social settings, legitimized by cultural norms that render it socially acceptable [26]. Cultural violence refers to those aspects of a social environment that normalize violence or are viewed as sanctioning violent acts. The norms in such environments may promote or tolerate the use of violence to resolve conflicts or respond to specific situations. Adolescents in these settings are more likely to internalize aggression as a cultural norm.

Social cognitive theory suggests that behavior is a product of interactions among individuals, their environment, and their prior actions [27]. Adolescents learn behaviors by observing their social context, and cognitive processes, such as the formation of their thoughts, beliefs, and attitudes, shape how they perceive and respond to their environment and regulate their behavior [27,28]. This framework suggests that adolescents are more likely to engage in bullying behavior if they perceive such behavior as acceptable within their social context.

The concept of "social toxicity" proposed by Garbarino suggests that harmful social environments, particularly for vulnerable groups such as young people, can impede development. Much as physical toxins such as dichlorodiphenyltrichloroethane damage the natural environment, social factors such as poverty, racism, and violence can damage the psychological health and development of adolescents [29]. UNICEF has underscored the importance of addressing pernicious social

norms in violence-prevention efforts, noting that in some cultures, violence is viewed as an acceptable conflict resolution method [30]. These perspectives highlight the role of violent social environments in influencing adolescents' propensity to engage in bullying behavior.

A country's history of perpetrating or experiencing violence substantially influences the aggressive behaviors of its young people. The homicide rate, a measure of intentional acts of violence, is a key indicator of violent behavior that enables standardized comparisons of violence across societies and countries [31,32]. Higher national homicide rates may reflect socially toxic environments, which adversely affect adolescent mental health and contribute to aggressive behaviors. Numerous studies have linked community violence to adolescent aggression. For example, the results of one meta-analysis identified negative community factors, such as violence and crime rates, as predictors of bullying behavior [24]. Additional studies have demonstrated that community violence predicts various behavioral problems, particularly aggression, among young people [33,34]. Despite the evidence from these studies, no study to date has examined how national-level violence influences adolescent bullying behavior.

The 2017/2018 Health Behaviour in School-aged Children (HBSC) study provided critical insights into adolescent bullying behavior across multiple European countries, offering a comprehensive perspective on this social problem [35]. The prevalence of bullying behavior may vary along cultural, linguistic, and geographical lines. For example, in Eastern Europe, where Balto-Slavic cultures are predominant, historical conflicts may have heightened societal tensions. Additionally, boys in these regions may exhibit aggressive behaviors as expressions of masculinity, influencing bullying patterns [36]. The current study examined variations in school violence across diverse societal contexts using the data from the HBSC matched with national

homicide rates compiled by the World Health Organization (WHO).

Research objectives

Research has extensively examined the factors at the individual level that influence adolescent bullying behavior. Nevertheless, theoretical perspectives have highlighted the influence of social contexts on this behavior. Specifically, studies have identified associations between bullying behavior and structural factors, such as national wealth and gender inequality [37,38]. Greater national wealth is associated with greater resources and support and with lower levels of adolescent violence [37]. By contrast, societal gender inequality, which is characterized by entrenched power imbalances, exacerbates bullying behaviors [38].

The role of national-level violence in shaping violent social norms remains underexplored. Bullying behavior prevalence varies across surveys and contexts, necessitating transnational research to address these differences [39-42]. Such comparative studies can enhance the global understanding of adolescent bullying and make intervention strategies more generalizable [41-43].

This study used representative transnational data and consistent bullying behavior measurements to investigate the effects of national-level violence. Specifically, the present study (1) examined transnational differences in bullying behavior on the basis of language and region and (2) determined whether the incidence of physical fighting and national homicide rates were associated with adolescent bullying behaviors.

MATERIALS AND METHODS

Data sources

The data were sourced from the 2017/2018 HBSC study, a multinational, school-based study conducted every 4 years since 1982 by the WHO Regional Office for Europe [35]. This cross-sectional study investigated health behaviors among adolescents aged 11, 13, and 15 years across diverse cultural contexts. The study recruited approximately 240,000 adolescents from 46 countries or regions in Europe, Central Asia, and North America using two-stage cluster sampling with school classes or entire schools as primary units. Data were collected using a standardized self-reported questionnaire to ensure cross-country comparability. Participants were informed that their participation was voluntary and that their responses would remain anonymous, and ethical approval for the study was obtained in each country before its commencement.

To integrate individual- and country-level data, this study linked the HBSC data to three country-level variables: national homicide rates, gross domestic product (GDP) per capita, and the Gender Gap Index (GGI, a measure of gender inequality in a society). Data on these variables were sourced from the WHO, the World Bank data bank, and the World Economic Forum (WEF). We excluded data from 6 countries lacking WHO homicide rates or complete data from surveys on bullying or alcohol use, leaving data from 40 HBSC countries or regions for analysis. The final sample comprised 17 countries from Western Europe, 21 from Eastern Europe, 1 from Central Asia, and 1 from North America. Hence, the analytic sample primarily consisted of European countries, with Kazakhstan being the sole representative from Central Asia. We also excluded incomplete responses for any individual-level variables to obtain a final sample representing 179,097 adolescents from 40 countries or regions (see Figure 1 for the sample flow diagram).

Measures

1. Dependent variables (individual-level)

Bullying behavior. Bullying involvement was measured using the Revised Olweus
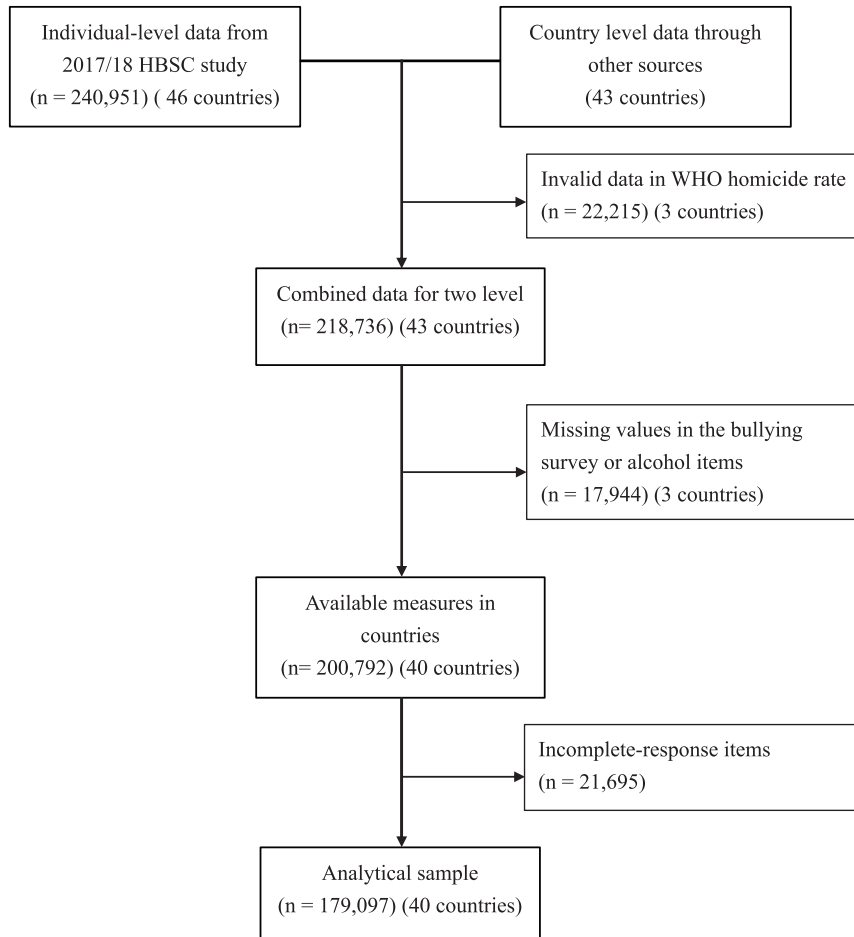
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┌─────────────────────────────┐        ┌─────────────────────────────┐
│  Individual-level data from │        │  Country level data through │
│   2017/18 HBSC study        │────────│      other sources          │
│ (n = 240,951) ( 46 countries)│       │      (43 countries)         │
└─────────────────────────────┘        └─────────────────────────────┘

                                        ┌─────────────────────────────┐
                                        │ Invalid data in WHO homicide rate│
                                        │  (n = 22,215) (3 countries) │
                                        └─────────────────────────────┘

              ┌─────────────────────────────┐
              │  Combined data for two level│
              │  (n= 218,736) (43 countries)│
              └─────────────────────────────┘

                                        ┌─────────────────────────────┐
                                        │ Missing values in the bullying│
                                        │  survey or alcohol items    │
                                        │  (n = 17,944) (3 countries) │
                                        └─────────────────────────────┘

              ┌─────────────────────────────┐
              │    Available measures in    │
              │         countries           │
              │ (n= 200,792) (40 countries) │
              └─────────────────────────────┘

                                        ┌─────────────────────────────┐
                                        │ Incomplete-response items   │
                                        │   (n = 21,695)              │
                                        └─────────────────────────────┘

              ┌─────────────────────────────┐
              │      Analytical sample      │
              │ (n = 179,097) (40 countries)│
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Figure 1. Sample flow ($n_{individual}$ = 179,097; $n_{country}$ = 40)

Bullying Questionnaire. Participants were asked, "How often have you engaged in bullying another person at school in the past couple of months?" [35]. Responses were recorded on a 5-point scale: *1 = "I haven't bullied another person at school in the past couple of months," 2 = "once or twice," 3 = "two or three times a month," 4 = "approximately once a week," and 5 = "several times a week."* For analysis, the responses were recoded as 0 (*never*) or 1 (*at least once*) because of the skewed distribution of the raw data and the small sample sizes for high-frequency bullying. This approach is consistent with that of studies demonstrating that even

one or two bullying incidents can considerably adversely affect adolescents [44,45].

2. Independent variables (individual-level)

Physical fighting. Physical fighting was assessed by asking participants, "During the past 12 months, how many times were you in a physical fight?" Response options were "*none*," "*once*," "*twice*," "*three times*," and "*four times or more*." Responses were dichotomized as 0 (*never*) and 1 (*at least once*) on the basis of approaches widely adopted in violence-prevention studies to address the skewed distribution of the raw data and enable comparisons among individuals who have engaged in such behavior [46,47].

3. Independent variables (country-level)

Homicide rate. Homicide rates were obtained from the 2018 Global Health Observatory of the WHO, which defines homicide as the intentional killing of a human being. Homicide thus includes infanticide but excludes acts of recklessness or negligence. Homicide rates were calculated per 100,000 people [48].

4. Control variables (individual-level)

This study assessed two key types of individual-level control variables: sociodemographics (sex, age, and material deprivation) and risky behaviors (drinking and smoking). These factors are strongly associated with bullying behavior [13,18-20]. Sex was categorized as male or female (reference group). Participants were segmented into three age groups: 11-, 13-, and 15-year-olds, representing early puberty, ongoing physical and emotional changes, and midadolescence, when critical life and career choices must be made [49].

Material deprivation was assessed using the Family Affluence Scale (FAS), a six-item measure evaluating family car ownership, the possession of one's own bedroom, the number of computers owned, the number and type of bathrooms available, the availability of dishwashers, and the ability to spend family holidays away from home [35,50]. Each item was reverse-scored and summed to create a score ranging from 0 to 13, with higher scores indicating greater deprivation. The FAS score was standardized for each country for comparison.

Drinking was assessed with the question: "On how many days (if any) have you drunk alcohol?" Smoking was assessed with the question: "On how many days (if any) have you smoked cigarettes?" Responses for both were recoded as 0 (*never*) and 1 (*ever*).

5. Control variables (country-level)

This study included two country-level control variables: GDP per capita and the GGI. GDP per capita, measured in current international dollars, represents a country's wealth and is calculated by dividing total GDP by a country's midyear population. Data were obtained from the World Bank data bank [51]. The 2018 WEF report measured the GGI by evaluating differences between women and men across the domains of health, education, the economy, and politics. Scores range from 0 (*complete inequality*) to 1 (*complete equality*) [52].

Statistical analysis

This study investigated the association between individual- and country-level violence and adolescent bullying behavior. Mixed-effects multilevel logistic regression models were employed to account for the hierarchically clustered data structure, in which students (level 1) were nested within countries (level 2). First, the null model (Model 1) was established to calculate the intraclass correlation coefficient (ICC), which measures the proportion of outcome variance attributable to differences between countries and determines whether multilevel regression is necessary. Two-level random intercept models were then fitted. Model 2 included only individual-level characteristics, and Model 3 incorporated country-level variables (homicide rate, GDP per capita, and GGI). The models were based on the equation:

$$Y_{ij} = (\gamma_{00} + \gamma_{01}\text{Homicide Rate}_j + \gamma_{02}\text{GDP per capita}_j + \gamma_{03}\text{GGI}_j) + \beta_{ij}X_{ij} + e_{ij} + u_{0j}$$

where Y_{ij} is the bullying behavior of the *ith* student in the *jth* country, γ_{00} represents the overall intercept of bullying behavior across all countries, γ_s are the effects of country-level variables on bullying behavior (e.g., γ_{01} represents the effect of national homicide rates on bullying behavior), β_{ij} are the coefficients for individual-level variables, X_{ij} are the individual-level variables (e.g., physical fighting), e_{ij} refers to individual-level deviations, and u_{0j} is the random effect for the *jth* country.

The Akaike information criterion (AIC) and Bayesian information criterion (BIC) were reported for each model to assess fit, with lower values indicating greater fit. The likelihood ratio test was used to compare the goodness of fit of the models, with statistical significance indicating superior fit. Additionally, we conducted a sensitivity analysis to assess the frequency of bullying behavior, with possible values being 0 (*never or once*) or 1 (*twice or more*) to account for the often repeated nature of bullying. Moreover, Belgium (French) and Belgium (Flemish) were consolidated into a single entity (Belgium) during analysis for consistency with other country indicators. All analyses were conducted using STATA version 16.0, with statistical significance set at $p = .05$. Microsoft Excel was used to map the distribution of country-level bullying prevalence on a global scale.

RESULTS

Descriptive analysis

Descriptive statistics for individual- and country-level variables are presented in Table 1. Among the 179,097 students, approximately 21% reported engaging in bullying behavior, and nearly 35% reported involvement in physical fighting. The sample comprised 48.54% boys and 51.46% girls, with the following age distribution: 11 years old (32.47%), 13 years old (34.75%), and 15 years old (32.78%). The mean FAS score was −0.003 (SD = 1.00). Risky behaviors were reported by a smaller portion of adolescents, with 18.91% drinking alcohol and 6.98% smoking cigarettes.

Summaries for country-level variables for the 40 countries or regions are also presented in Table 1. The mean homicide rate was 1.90 (SD = 1.80), with a range from 0.51 to 8.44, with

Table 1.   Descriptive statistics for all variables

Variables	% or mean (SD)
Individual level	(n = 179,097)
Bullying behavior	
At least once	20.56%
Never	79.44%
Physical fighting	
At least once	34.98%
Never	65.02%
Sex (male)	48.54%
Age group	
11 years	32.47%
13 years	34.75%
15 years	32.78%
Material deprivation	- 0.003 (1.00)
Drinking	
Ever	18.91%
Never	81.09%
Smoking	
Ever	6.98%
Never	93.02%
Country level	(n = 40)
Homicide rate	1.90 (1.80)
GDP per capita	40,078.24 (18,838.97)
GGI	0.74 (0.04)

Note: GGI= Gender gap index; GDP= Gross domestic product

higher rates observed in Eastern Europe (Figure 2). The mean GDP per capita was 40,078.24 (SD = 18,838.97), with Luxembourg as the wealthiest country (116,965.59) and Ukraine as the least wealthy (12,631.66) (Figure 3). The mean GGI across the 40 countries was 0.74 (SD = 0.04); most GGI values were close to 1, indicating relative gender equality (Figure 4).

Figure 5 illustrates the percentages of adolescents who engaged in bullying behavior in each country. Bullying behavior was more prevalent in Eastern Europe than in Western and Northern Europe. At the national level, the rates for adolescent bullying behavior were highest in Latvia (51.70%) and lowest in Iceland (6.62%).

We conducted a two-sample t-test to compare bullying rates between Eastern and Western Europe, uncovering a significant difference between these regions ($t(38) = 6.54$, $p < .05$). Specifically, the mean bullying rate in Eastern Europe (M = 0.289, SD = 0.096) was significantly higher than that in Western Europe (M = 0.135, SD = 0.043). The mean difference of 0.153 (95% CI: 0.106–0.201) indicated a substantially higher prevalence of bullying behavior in Eastern Europe.

In addition to regional comparisons, the effect of language families on bullying prevalence was also examined. The results of an analysis of variance indicated a significant effect of language families ($F(4, 35) = 4.13$, $p < .05$). Specifically, the results of post hoc analyses revealed that adolescents in the Germanic regions exhibited significantly lower bullying behavior rates than those in the Balto-
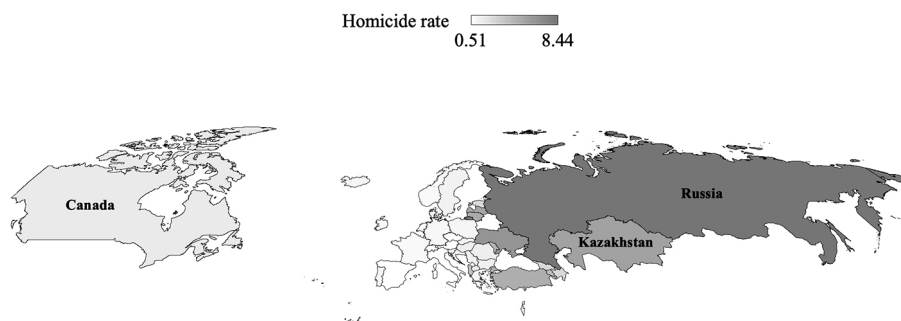

Figure 2. Distribution of homicide rates across 40 countries. The data were retrieved from the 2018 World Health Organization.
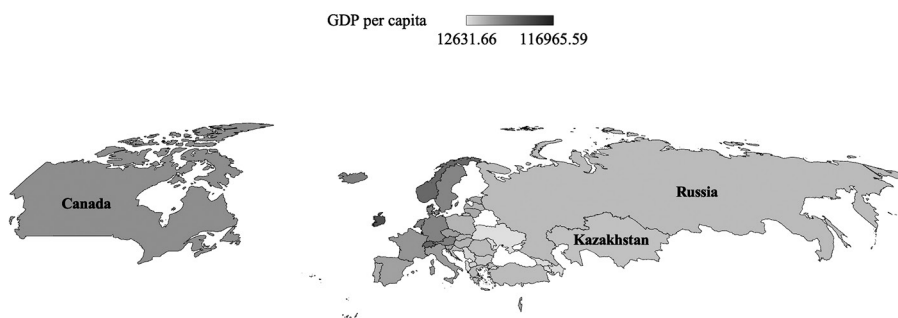

Figure 3. Distribution of GDP per capita across 40 countries. The data were retrieved from the data bank of the World Bank.
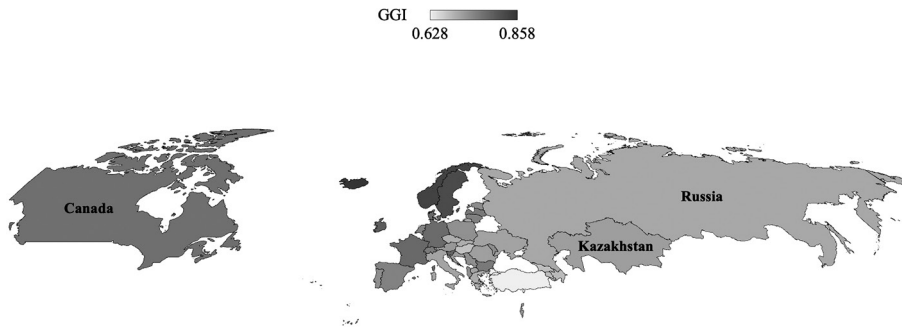
GGI
0.628   0.858

Figure 4. Distribution of Gender Gap Index (GGI) across 40 countries. The data were retrieved from the World Economic Forum.
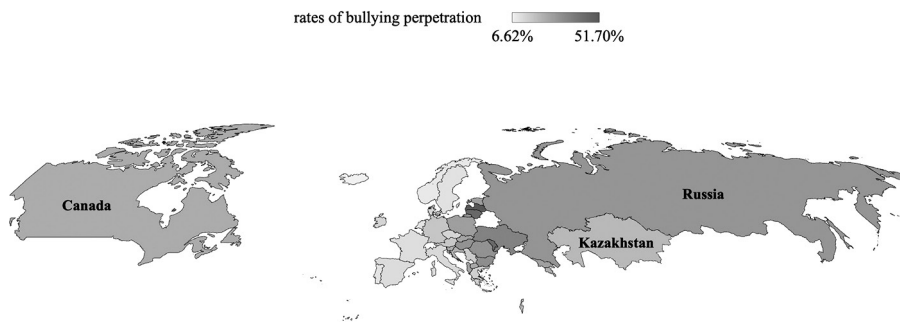
rates of bullying perpetration
6.62%   51.70%

Figure 5. Rates of bullying behavior among adolescents for each country. The data were collected through the 2017/18 Health Behaviour in School-aged Children (HBSC) study.

Slavic regions (mean difference = −0.152, p < .05).

Associations between bullying behavior and physical fighting by country

The results of a logistic regression for the association between bullying behavior and physical fighting in each country are presented as odds ratios (ORs) in Figure 6. Across all countries, adolescents who had participated in physical fights had higher odds of engaging in bullying behavior, with the highest OR observed in Israel (OR = 9.12, 95% CI = 8.06–10.31) and the lowest observed in Iceland (OR = 1.45, 95% CI = 1.18–1.77).

Multilevel logistic regression analysis

Table 2 presents the results of the multilevel logistic regression models (Models 1 to 3) for adolescent bullying behavior across countries. In the first step, the null model (Model 1) was constructed without control variables, and the findings revealed statistically significant country-level variance in bullying behavior (ICC = 0.11). Specifically, the ICC indicates that 11% of the variation in adolescent bullying behavior is attributable to differences among countries. On the basis of suggestions in the literature [53], we conducted a multilevel analysis using the two subsequent bilevel models. In Model 2, all individual-level
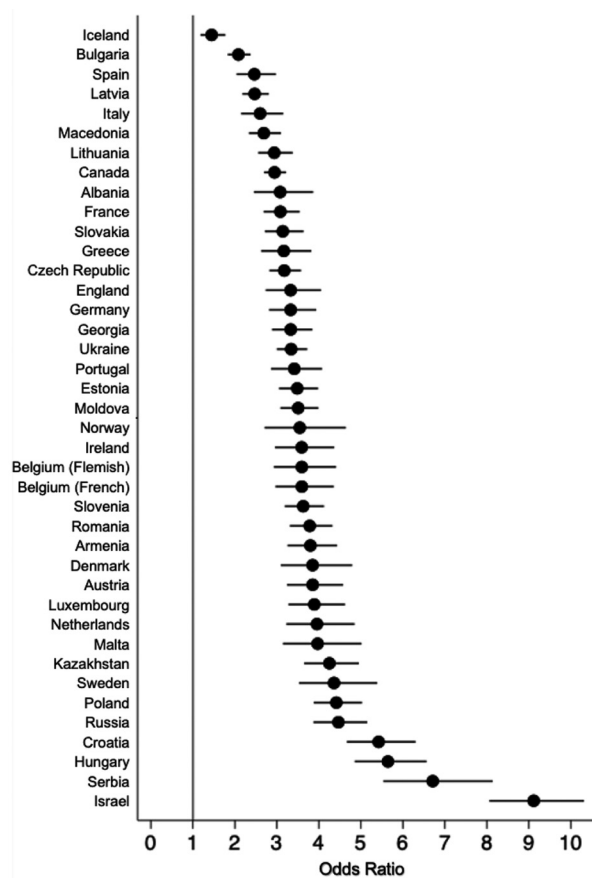
Figure 6.　Logistic regressions in adolescent bullying behavior by physical fighting

variables (sex, age, material deprivation, drinking, smoking, and physical fighting) were incorporated. All level-1 variables were significantly associated with bullying behavior, with the exception of material deprivation. Specifically, adolescents who had reported engaging in physical fighting behaviors were more likely to engage in bullying behavior (adjusted OR (AOR) = 2.96, 95% CI = 2.88–3.04). Additionally, boys were more likely to engage in such behavior than girls (AOR = 1.35, 95% CI = 1.31–1.38). Those who had consumed alcohol or smoked were also likely to report engaging in bullying behavior (AOR = 1.57, 95% CI = 1.51–1.62; AOR = 1.72, 95% CI = 1.64–1.80). By contrast, adolescents aged 13

exhibited an increased likelihood of engaging in bullying behavior compared with those who were 11 years old (AOR = 1.16, 95% CI = 1.12–1.19). However, adolescents aged 15 exhibited a decreased risk of engaging in bullying behavior compared with those 11 years old (AOR = 0.94, 95% CI = 0.90–0.97). The AIC and BIC values were notably lower in Model 2 than Model 1, indicating improved model fit. To account for country-level predictors, we established Model 3 to examine the effects of social contexts (e.g., country homicide rate) on adolescent bullying behavior. The results of the regression for Model 3 indicated that living in countries with higher homicide rates was associated with a greater likelihood of engaging in bullying

Table 2. Multilevel regressions of bullying behavior among adolescents (n $_{individual}$ = 179,097; n $_{country}$ = 40)

Variable	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)
Individual level			
Physical fighting		2.96[*] (2.88-3.04)	2.96[*] (2.88-3.04)
Sex (male)		1.35[*] (1.31-1.38)	1.35[*] (1.31-1.38)
Age group			
11 years (ref.)		1.00 (1.00-1.00)	1.00 (1.00-1.00)
13 years		1.16[*] (1.12-1.19)	1.16[*] (1.12-1.19)
15 years		0.94[*] (0.90-0.97)	0.94[*] (0.90-0.97)
Deprivation		1.00 (0.99-1.02)	1.00 (0.99-1.02)
Drinking		1.57[*] (1.51-1.62)	1.57[*] (1.51-1.62)
Smoking		1.72[*] (1.64-1.80)	1.72[*] (1.64-1.80)
Country level			
Homicide rate			1.22[*] (1.12-1.34)
GDP per capita			1.00 (1.00-1.00)
GGI			0.12 (0.00-6.20)
ICC	0.11	0.12	0.07
AIC	170,802.5	158,601.5	158,580.8
BIC	170,822.7	158,692.4	158,701.2

Note: [*]p< .05

1. Model 1: null model; Model 2: individual-level predictors were included; Model 3: country-level predictors were included.

2. GGI= Gender gap index; GDP= Gross domestic product; ICC= Intraclass correlation coefficient; AIC= Akaike information criterion (lower values better); BIC= Bayesian information criterion (lower values better).

behavior (AOR = 1.22, 95% CI = 1.12–1.34). No associations with bullying behavior were observed for GDP per capita and the GGI. Nevertheless, after adjusting for country-level characteristics, the results for the associations of all individual-level variables with bullying behavior remained consistent. For example, adolescents who engaged in physical fighting were 2.96 times more likely to bully others than those who had not participated in physical fights. Furthermore, the decline in the ICC to 7% in Model 3 suggests that the observed variations were due to country-level factors. Notably, the results from Model 3 exhibited the lowest AIC value, indicating superior predictive performance. Moreover, the BIC value did not decline from Model 2 to Model 3. Nonetheless, the likelihood ratio test verified that all models were statistically significant, suggesting that all models fit the data well.

Sensitivity analysis

We also performed several sensitivity analyses to verify the robustness of our findings. First, we used alternate thresholds for bullying behavior, categorizing responses as 0 (*never or once*) or 1 (*twice or more*). We discovered that the results were similar to those of the primary analyses, indicating that both physical fighting and national homicide rates were associated with an increased likelihood of engaging in bullying behavior (AOR = 2.96, 95% CI = 2.88–3.04; AOR = 1.23, 95% CI = 1.12–1.35; Table S1). Furthermore, in our secondary analysis, Belgium (French) and Belgium (Flemish) in the HBSC study were combined into one country (Belgium). Therefore, only 39 countries remained in this sensitivity analysis. The results were consistent with those for the full sample (see Table S2). For example, individuals involved in physical

fighting were 2.96 times more likely to engage in bullying behavior (AOR = 2.96, 95% CI = 2.88–3.03) when bullying behavior was dichotomized as "*never*" or "*at least once*." Furthermore, higher national homicide rates were associated with an increased likelihood of bullying behavior (AOR = 1.22, 95% CI = 1.11–1.34).

To address the potential influence of data excluded on the basis of missing information, we conducted a sensitivity analysis to compare the excluded sample to the analytical sample across sociodemographic characteristics, risky behaviors, and country-level indicators. The results revealed no statistically significant differences between these groups, indicating that our findings were robust and that the exclusion of missing data was unlikely to have biased our results.

To ensure the robustness of our findings, we also conducted a sensitivity analysis by incorporating the region variable into the model, which was initially excluded to isolate the effect of country-level homicide rates and mitigate potential collinearity with other country-level variables. The results of this sensitivity analysis indicated that including the region variable did not significantly alter the primary findings. This result indicates that the associations between national homicide rates and physical fighting and bullying behavior remained consistent, verifying the robustness of our findings. Additionally, we observed that living in Western Europe was less strongly associated with engaging in bullying behavior than living in Eastern Europe (AOR = 0.45, 95% CI = 0.31–0.66).

DISCUSSIONS

Although considerable research has explored adolescent bullying behavior, studies examining the association between societal factors and bullying behavior are lacking. Additionally, few studies have explored global trends that may influence this association.

The present study employed HBSC data that directly examined the association of national- and individual-level factors with adolescent bullying behavior, filling a critical gap. Our findings are especially critical because the most prevalent form of school violence is bullying and physical fights [54].

Our findings reveal that adolescents who reported engaging in physical fights have a greater likelihood of engaging in bullying behavior. This finding is consistent with those of other studies indicating that adolescents who exhibit conduct problems or externalizing behaviors, such as aggression, are prone to bullying behavior [15,25]. Additionally, PBT [23] posits that multiple problem behaviors often interact simultaneously. Consistent with the hypothesis of PBT, one study observed that exhibiting low levels of self-control, a key factor influencing deviant behaviors such as physical fighting and bullying, was significantly associated with an increased likelihood of engaging in bullying behavior [21]. Because both bullying behavior and physical fighting are violent behaviors, they share psychological causes such as impulsiveness, aggression, and antisocial tendencies [24]. Such traits may contribute to the development of violent behaviors [55].

Approximately 20% of the adolescents whose data were analyzed in the present study reported having recently bullied others. This study identified significant transnational differences in bullying behavior prevalence, ranging from 6.62% in Iceland to 51.70% in Latvia. Specifically, bullying was more prevalent in Eastern Europe and Central Asia than in Western Europe, consistent with the findings of Craig et al. [40]. Moreover, the Balto-Slavic regions in Eastern Europe reported higher rates of bullying than the Germanic regions in Western and Northern Europe. These discrepancies likely result from differences in social contexts and cultural norms, underscoring the value of transnational methodologies in studying bullying [40-

43]. Western Europe's early recognition of school bullying—driven by research in Scandinavia [56]—and its implementation of national antibullying programs contribute to lower rates of bullying behavior. By contrast, Eastern European countries often lack such programs [40]. For example, Longobardi et al. reported greater levels of school violence in Albania, where violence is culturally accepted as a disciplinary tool, than in Italy, which has strong legislative and educational protections for children [57]. Additionally, the complex histories of Eastern European and Central Asian countries, which are marked by recent wars, revolutions, and political upheaval, may render the educational environments in these nations violent and insecure, contributing to higher bullying rates. These findings underscore the role of country-level determinants in adolescent bullying behaviors, demonstrating the value of considering ecological perspectives in studies of violent behaviors [16,56].

Our findings indicate that national homicide rates were positively associated with adolescent bullying behavior. Specifically, adolescents in countries with higher homicide rates were more likely to engage in bullying behavior. Culture of violence theory posits that cultural norms considerably influence bullying behavior [26]. Adolescents raised in violent environments may view bullying as acceptable, a suggestion consistent with the tenets of social cognitive theory [27]. Several studies have linked adolescent exposure to community violence (e.g., high crime rates) [24,33,34] and entertainment violence (e.g., video games, movies, television, and websites) [13,58] with an increased likelihood of engaging in bullying behavior. Studies have demonstrated that exposure to violence can desensitize individuals to aggression, leading them to perceive bullying as an acceptable form of conduct [59,60]. In countries with high homicide rates, prevalent violence may serve as a model that unconsciously influences young people's actions, such as bullying behavior.

Adolescents in areas with high crime rates may engage in bullying as a means of establishing control or achieving their objectives within uncertain and threatening environments [61]. Additionally, those exposed to violence may be at risk of experiencing anxiety or depression, which can lead to behavioral problems [29,62].

Although this study focused on European countries, similar findings have been reported in other regions, such as Africa and South America. For example, one study in Africa suggested an association between observing violent behaviors and engaging in bullying [63]. Similarly, Brazilian adolescents from violent communities were more likely to engage in bullying behaviors [64]. Additionally, Gimenez et al. discovered that high homicide rates in school districts were correlated with increased levels of peer violence, such as bullying, in Costa Rica [65]. Research involving other regions, such as Asia and Africa, has also demonstrated a significant association between physical fighting and bullying [37]. Our findings are thus consistent with the findings of the literature on bullying.

Studies have highlighted age as a key factor in adolescent bullying behaviors [18,66]. For example, López-Castro et al. identified age-related differences in bullying behavior across cultural contexts [66]. The results of our analysis also revealed significant age-related patterns. Specifically, adolescents involved in physical fights exhibited greater bullying tendencies at 11, 13, and 15 years old, with AORs of 3.45 (95% CI = 3.28–3.62) for 11-year-olds, 2.86 (95% CI = 2.73–2.98) for 13-year-olds, and 2.66 (95% CI = 2.54–2.79) for 15-year-olds. Additionally, adolescents in countries with higher homicide rates also exhibited greater levels of bullying behaviors across all age groups, with AORs of 1.21 (95% CI = 1.10–1.34), 1.21 (95% CI = 1.09–1.34), and 1.23 (95% CI = 1.12–1.36) for 11-, 13-, and 15-year-olds, respectively. These findings are consistent with our primary results, verifying that both individual violent behavior

and violent environments influence adolescent bullying behavior.

The Convention on the Rights of the Child advocates protecting children from all forms of violence [67]. Additionally, a UNESCO report emphasized that secure, violence-free learning environments are an urgent global necessity [54]. Policy and public health strategies based on these documents should address sociocultural factors at the individual and societal levels. Because of the strong association between violent behaviors and bullying, prevention programs should target bullying and other aggressive behaviors and provide comprehensive violence-prevention strategies. Moreover, strengthening law enforcement and criminal justice systems is essential to establishing trust, cohesion, and confidence in social institutions and is a prerequisite to reducing homicide rates [68, 69]. Changing social norms that condone violence is critical and requires educational campaigns and programs promoting nonviolence. The United Nations Office on Drugs and Crime's crime prevention framework provides a holistic approach to reducing violent crime and creating safer environments by addressing root causes, such as inequality, and investing in education, society, and economic development [70].

Intervention programs must treat violence as a multifaceted problem and encourage collaboration among governments, law enforcement, schools, and families. Sustained investment in social programs, public health initiatives, and community development is also essential. Effective antibullying programs must consider the social contexts shaping violent norms among adolescents and adopt a multisystemic approach that integrates individual behaviors and environmental factors.

Strengths and limitations

This study has several strengths. First, we utilized data from the HBSC study, which provided a large, representative sample of school-aged children across multiple countries with consistent measurements, enabling transnational comparisons [39-42,56]. Additionally, the use of standard survey methods to measure bullying behavior enhanced the reliability and validity of the findings. Moreover, we employed a multilevel approach, accounting for individual- and country-level factors to examine the multiple factors underlying bullying behavior. Notably, this is the first study in our review of the literature to explore the association between national homicide rates and adolescent bullying behavior, highlighting the complex interaction between societal factors and individual behaviors.

This study also has some limitations. First, bullying behavior was assessed using a single-item measure, which may not fully capture the complexity of this phenomenon. Although the Revised Olweus Bullying Questionnaire is a reliable instrument [71], bullying involves physical, verbal, and emotional aggression [11,13], which were not distinguished in the dataset. Only physical bullying was measured; no information was provided on other forms of bullying behavior.

Second, reliance on self-reported data from the HBSC study may introduce recall and underreporting biases. Although self-reports are widely used in bullying research, concerns regarding their validity and reliability persist [71]. Third, the sample was primarily drawn from European regions, limiting the generalizability of our findings to other contexts, particularly low- and middle-income countries. Fourth, the HBSC study predominantly focused on high-income countries [37]. Future research should examine more diverse adolescent populations.

Another limitation is the exclusion of samples because of missing data on key variables. However, the results of sensitivity analyses suggested the presence of minimal bias due to this exclusion. Finally, causation could not be established because this study used a

cross-sectional design. Nevertheless, the use of 2016 country-level data in additional analyses revealed consistent results, indicating that physical fighting and violent surroundings were associated with engaging in bullying behavior. This consistency suggests that cultural changes exerted limited influence on these associations due to the glacial pace at which cultures evolve. Nonetheless, further studies with longitudinal and experimental designs are required to validate our findings.

Conclusions

This study demonstrates that approximately 20% of the European adolescents surveyed in the HBSC study had engaged in recent bullying behaviors, with higher rates reported in Eastern European countries. Our findings indicate that engaging in physical fighting and living in countries with higher homicide rates are significant predictors of adolescent bullying behavior. These results highlight the importance of examining bullying through a transnational and global lens. This study also provides valuable insights to guide future research and policy interventions targeting adolescent bullying. Addressing bullying comprehensively and systematically within an ecological framework is essential to fostering safer, more inclusive environments for adolescents. Such efforts can reduce societal violence and support progress toward achieving the SDGs.

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APPENDIX

Table S1. Multilevel regressions of bullying behavior among adolescents (n $_{individual}$ = 179,097; n $_{country}$ = 40)

Variable	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)
Individual level			
Physical fighting		2.97[*] (2.85-3.11)	2.96[*] (2.88-3.04)
Sex (male)		1.41[*] (1.35-1.47)	1.41[*] (1.35-1.47)
Age group			
11 years (ref.)		1.00 (1.00-1.00)	1.00 (1.00-1.00)
13 years		1.08[*] (1.03-1.14)	1.08[*] (1.03-1.14)
15 years		0.94[*] (0.89-0.99)	0.94[*] (0.89-0.99)
Deprivation		1.03[*] (1.01-1.05)	1.03[*] (1.01-1.05)
Drinking		1.60[*] (1.52-1.68)	1.60[*] (1.52-1.68)
Smoking		1.97[*] (1.85-2.10)	1.98[*] (1.86-2.10)
Country level			
Homicide rate			1.23[*] (1.12-1.35)
GDP per capita			1.00[*] (1.00-1.00)
GGI			0.04 (0.00-2.51)
ICC	0.14	0.15	0.07
AIC	78,625.81	73,150.79	73,123.20
BIC	78,646.00	73,241.65	73,244.35

Note: [*]p< .05
1. Bullying behavior coded as 0 (*never or once*) and 1 (*twice or more*).
2. Model 1: null model; Model 2: individual-level predictors were included; Model 3: country-level predictors were included.
3. GGI= Gender gap index; GDP= Gross domestic product; ICC= Intraclass correlation coefficient; AIC= Akaike information criterion (lower values better); BIC= Bayesian information criterion (lower values better).

Table S2. Multilevel regressions of bullying behavior among adolescents (n $_{individual}$ = 179,097; n $_{country}$ = 39)

Variable	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)
Individual level			
Physical fighting		2.96[*] (2.88-3.04)	2.96[*] (2.88-3.03)
Sex (male)		1.35[*] (1.31-1.38)	1.35[*] (1.31-1.38)
Age group			
11 years (ref.)		1.00 (1.00-1.00)	1.00 (1.00-1.00)
13 years		1.16[*] (1.12-1.19)	1.16[*] (1.12-1.19)
15 years		0.94[*] (0.90-0.97)	0.94[*] (0.90-0.97)
Deprivation		1.00 (0.99-1.02)	1.00 (0.99-1.02)
Drinking		1.57[*] (1.51-1.62)	1.57[*] (1.51-1.62)
Smoking		1.72[*] (1.64-1.80)	1.72[*] (1.64-1.80)
Country level			
Homicide rate			1.22[*] (1.11-1.34)
GDP per capita			1.00 (1.00-1.00)
GGI			0.10 (0.00-5.43)
ICC	0.11	0.12	0.07
AIC	170,797.5	158,596.9	158,576.7
BIC	170,817.7	158,687.8	158,697.9

Note: [*]p< .05
1. Bullying behavior coded as 0 (*never*) and 1 (*at least once*).
2. Model 1: null model; Model 2: individual-level predictors were included; Model 3: country-level predictors were included.
3. GGI= Gender gap index; GDP= Gross domestic product; ICC= Intraclass correlation coefficient; AIC= Akaike information criterion (lower values better); BIC= Bayesian information criterion (lower values better).

探討40個國家中青少年霸凌行為的兩項決定因素：肢體衝突與國家兇殺率的影響

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目標：霸凌可能源於個人特徵（如犯罪）與社會（如暴力文化）之間影響。本研究旨以跨國視角探討探討個人肢體衝突、國家兇殺率與青少年霸凌行為之關聯。**方法：**納入2017/18學齡兒童健康行為調查（HBSC），並整併2018世界衛生組織（WHO）兇殺率資料。排除缺少霸凌或飲酒調查且未記錄在WHO兇殺率國家（n = 6），及未完整回覆變項資料之青少年（n = 21, 695）後，分析樣本來自40個國家或地區約180,000名青少年（n = 179,097）。霸凌行為與肢體衝突以二分法分類（0 = 無；1 = 至少一次以上），採用多層次羅吉斯回歸進行分析。**結果：**各國霸凌盛行率差異顯著（6.62% - 51.70%）。空模型顯示，青少年霸凌行為存在國家差異（ICC = 0.11）。隨機截距模型發現，霸凌行為常見於有肢體衝突之青少年（AOR = 2.96, 95% CI = 2.88-3.04），且居住在兇殺率較高的國家也會增加霸凌行為風險（AOR = 1.22, 95% CI = 1.12-1.34）。**結論：**個人肢體衝突與國家兇殺率皆會影響青少年霸凌行為，針對個人和社會背景之預防措施對防止霸凌行為和創造更安全、具包容性環境非常重要。（台灣衛誌 2024；**43(6)**：587-606）

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