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Original article

Social Media Use and Cyber-Bullying: A Cross-National Analysis of Young People in 42 Countries

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 A B S T R A C T

Purpose: Social media use (SMU) has become an intrinsic part of adolescent life. Negative consequences of SMU for adolescent health could include exposures to online forms of aggression. We explored age, gender, and cross-national differences in adolescents' engagement in SMU, then relationships between SMU and victimization and the perpetration of cyber-bullying.

Methods: We used data on young people aged 11–15 years (weighted $n = 180,919$ in 42 countries) who participated in the 2017–2018 *Health Behaviour in School-aged Children Study* to describe engagement in the three types of SMU (intense, problematic, and talking with strangers online) by age and gender and then in the perpetration and victimization of cyber-bullying. Relationships between SMU and cyber-bullying outcomes were estimated using Poisson regression (weighted $n = 166,647$ from 42 countries).

Results: Variations in SMU and cyber-bullying follow developmental and gender-based patterns across countries. In pooled analyses, engagement in SMU related to cyber-bullying victimization (adjusted relative risks = 1.14 [95% confidence interval (CI): 1.10–1.19] to 1.48 [95% CI: 1.42–1.55]) and perpetration (adjusted relative risk = 1.31 [95% CI: 1.26–1.36] to 1.84 [95% CI: 1.74–1.95]). These associations were stronger for cyber-perpetration versus cyber-victimization and for girls versus boys. Problematic SMU was most strongly and consistently associated with cyber-bullying,

 IMPLICATIONS AND CONTRIBUTION

This 2017–2018 study of 181 thousand adolescents from 42 countries examines social media use during adolescence, and intense use, problematic use, and frequent online contact with strangers each are each independently associated with cyber-bullying. The universality of such associations is explored, and high-risk groups for cyber-perpetration and cyber-victimization are identified.

Conflicts of interest: The authors declare they have no conflicts of interest.

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both for victimization and perpetration. Stratified analyses showed that SMU related to cyber-victimization in 19%–45% of countries and to cyber-perpetration in 38%–86% of countries.

Conclusions: Accessibility to social media and its pervasive use has led to new opportunities for online aggression. The time adolescents spend on social media, engage in problematic use, and talk to strangers online each relate to cyber-bullying and merit public health intervention. Problematic use of social media poses the strongest and most consistent risk.

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Social media use (SMU) has become a normal part of the lives of young people [1]. Its benefits include the ability to communicate with friends, quickly access information and gain new knowledge, and stay in touch with adult mentors including parents, family members, and teachers [2]. However, emerging problems associated with SMU include frequent or intense use, which may detract from opportunities to participate in other constructive activities, such as extracurricular and community events [3]. A recent international study concluded that although statistically significant, the effects of exposure to digital technology on adolescent well-being are modest and, in the authors' opinions, "insufficient to invoke the need for policy change" [4]. In contrast, others have argued that "problematic SMU" (indicated by symptoms of addiction to social media) puts adolescents at risk for problems because it facilitates potential risky online interaction with strangers with harmful intentions [5] and contributes to addictive behaviors [6], social withdrawal [7], and impaired social functioning [6].

Intense and problematic SMU exposes adolescents to online aggression, including cyber-bullying [6,8–11]. Contemporary social theories provide frameworks to understand these links. *First*, more frequent and intense SMU expose adolescents to aggressive behavior, including the perpetration of cyber-bullying [12]. *Second*, Problem Behavior Theory [13,14] posits that certain risk behaviors are covaried, organized, and clustered, and specific profiles of risk underlie vulnerability. Repeated exposure to online aggression can make the behavior seem more acceptable through role modeling and reinforcement [8–11]. Witnessing the social rewards of aggression or cyber-bullying, such as increased social status, also reinforces the behavior [15,16], as young people become motivated to conform to group norms in their social environment [15]. In addition, the lack of face-to-face cues associated with SMU hides the negative consequences of online aggression or cyber-bullying. Consequently, without this critical feedback, the aggressive behavior may be more likely to recur [16,17]. Furthermore, repeated exposure to online aggression or bullying may result in the "disinhibition effect" [16,17]. That is, these aggressive behaviors may become normalized to youth over time. Such effects are likely to increase the likelihood of engaging in cyber-bullying or being cyber-victimized. In addition, those who use electronic communications excessively may be differentially vulnerable children, who experience psychosocial problems such as loneliness and social anxiety. These vulnerable children feel positive about being online but may lack the social resources and skills to prevent being cyber-victimized at the moment when it is happening [18]. Thus, frequent and problematic SMU may increase the likelihood of witnessing and emulating aggressive online behaviors, both as a perpetrator and as a victim.

Cross-sectional analyses have shown that both intense and problematic SMU relate to increased cyber-bullying and cyber-victimization in adolescents [19–25]. Longitudinal research supports the implied temporality of these links [26,27]. Although the opportunity to interact with strangers in online environments also may play an etiological role [17], few studies have examined this as a potential risk factor for online aggressive behaviors.

In light of this background, through a school-based survey of adolescents in 42 countries and regions [28], we investigated age, gender, and cross-national differences in adolescents' engagement in SMU, then relationships between SMU and victimization and the perpetration of cyber-bullying. We hypothesized that three SMU variables—frequent use, problematic (characterized by addictive-like behaviors), and involvement with strangers—would represent a continuum of exposures with varying harms in terms of online aggression. We examined their unique associations with cyber-bullying and cyber-victimization while simultaneously adjusting for the effects of salient covariates, including mutual control for each indicator of SMU. Our aim was to provide foundational information that supports policies that support adolescent health in a contemporary, digital world.

Methods

Study population and procedures

The 2017–2018 Health Behaviour in School-aged Children (HBSC) survey was conducted in 47 countries and regions throughout Europe and Canada in the 2017–2018 academic year. National research teams surveyed nationally representative samples of 11-, 13-, and 15-year-old children according to a common research protocol [28]. Questionnaires were translated to suit the language of the participating countries following a standardized protocol that included translation, back-translation into English, then centralized verification. Sampling procedures involved the selection of classes within schools with variations in sampling criteria suited to country-level circumstances. Some countries oversampled subpopulations (e.g., by geography and ethnicity), and standardized weights were created to ensure representativeness.

Our analysis of SMU and cyber-bullying/victimization used data from 42 countries and regions (shown in Figures 1 and 2). According to World Bank Classifications [29], these represented 31 "high-income" and 11 "low- and middle-income" countries. Of the original 47, three countries did not collect information on SMU, and two others did not submit data by the time of our analysis. Each country team obtained approval to conduct the

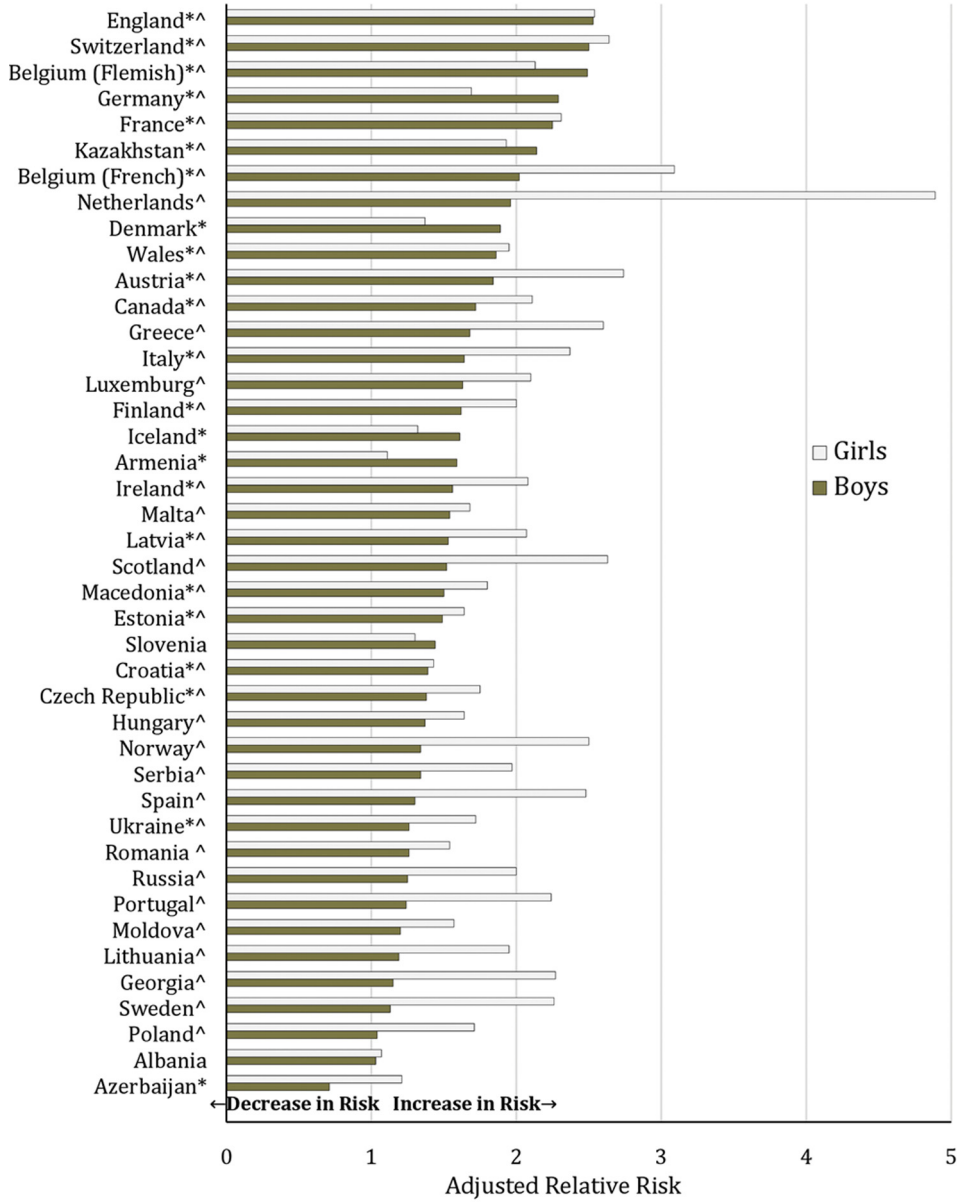


Figure 1. Adjusted relative risks by country for problematic social media use and perpetration of cyber-bullying. Note that * and ^ indicate statistical significance, based on a 95% confidence interval, for boys and girls, respectively.

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survey from the ethics review board or equivalent regulatory body associated with the institution conducting each respective national survey. Participation was voluntary, and consent (explicit or implicit) was sought from school administrators, parents, and adolescents as per national human subject requirements.

We used data on 180,919 adolescents in 42 countries in our prevalence estimation (Table 1). We tested associations between variables using a subsample of 166,979 adolescents (weighted n = 166,647) from the 42 countries that had complete data on cyber-bullying, SMU, age, gender, and socioeconomic class.

Measures

Cyber-bullying. Using an item modified from the validated Olweus bullying scale [16], participants indicated how often that they had been victimized by cyber-bullying in the past couple of months: that is, sent mean instant messages, email, or text messages; wall postings; created a website making fun of someone; posted unflattering or inappropriate pictures online without permission or shared them with others? Because of the low prevalence of cyber-bullying and based on international precedent, its five ordinal response categories were dichotomized into a binary outcome (never vs. at least once in the past couple of

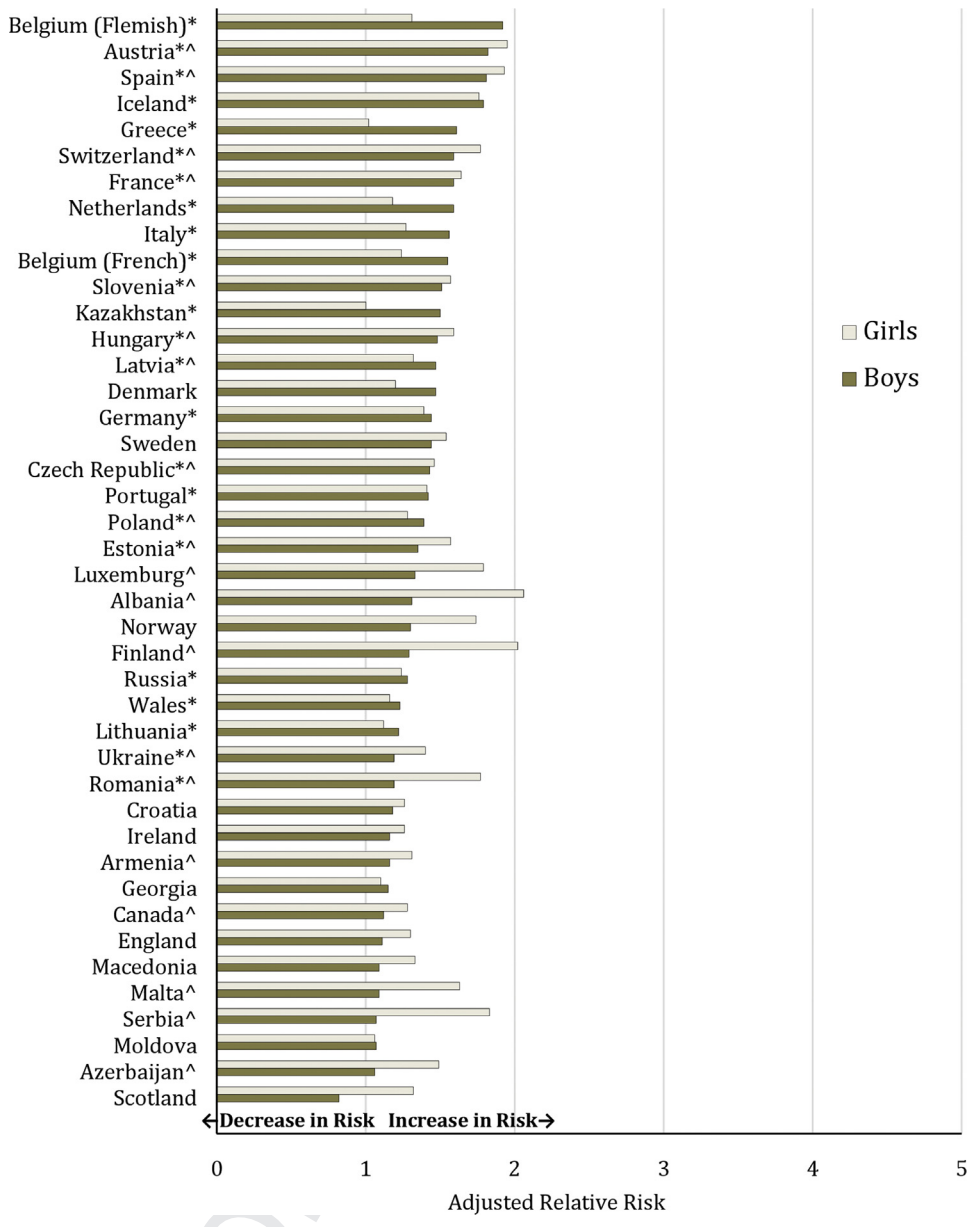


Figure 2. Adjusted relative risks by country for intense social media use and perpetration of cyber-bullying. Note that * and ^ indicate statistical significance, based on a 95% confidence interval, for boys and girls, respectively.

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months) [30]. A second question asked, using a similar stem and response categories, how often they had taken part in the perpetration of cyber-bullying. Response options were similarly categorized in a binary fashion [30].

Frequent or intense SMU. A 4-item adapted scale from the EU Kids Online Survey was used to measure SMU [31]. Respondents were asked how often they have online contact with the following people: *close friend(s)*, *friends from a larger friend group*, *friends that you got to know through the internet but didn't know before*, and *other people than friends* (e.g., *parents, brothers/sisters, classmates, and teachers*). For each of these four items, answer categories ranged from 1 (*never/almost never*) to 5 (*almost all the time throughout the day*), and a *do not know/doesn't apply* option.

Intense SMU was defined as having online contact almost all the time throughout the day on at least one of the four items.

Problematic SMU. The Social Media Disorder Scale ($\alpha = .89$) [32] measured problematic SMU in 9 dichotomous (yes/no) items that describe addiction-like symptoms: preoccupation with social media, dissatisfaction about a lack of time for its use, feeling bad when not using it, trying but failing to spend less time using it, neglecting other duties in order to use it, regular arguments over it, lying to parents or friends about its use, using it to escape from negative feelings, and having a serious conflict with family over SMU. Endorsement of 6–9 items indicated problematic SMU, as per the cut point recommended by the originators of the scale.

Table 1
Description of international study sample, HBSC study, 2018

Descriptor	
Number of countries reporting, n	42
Total participants, n	180,919
By country, n	
Median	3,715
Minimum	1,446 (Albania)
Maximum	11,155 (Wales)
By gender, n (%)	
Boys	86,981 (48.1)
Girls	93,938 (51.9)
By age group, n (%)	
11 years	56,219 (31.1)
13 years	62,661 (34.6)
15 years	62,039 (34.3)

All values are weighted.

HBSC = Health Behaviour in School-aged Children.

Frequent online contact with strangers. We measured frequent online contact with strangers using the response of “almost all the time throughout the day” to an item describing the frequency of online contact with friends that you got to know through the internet but did not know before. [31].

Other variables. The HBSC questionnaire also collected data on self-identified gender (boy, girl, and in some countries “neither term describes me”), age group (11, 13, and 15 years), socioeconomic class (a 6-item measure of material assets in the home including number of vehicles, bedroom sharing, computer ownership, bathrooms at home, dishwashers at home, and family vacations), [33] family support (a 4-item scale describing the degree of help, emotional support, communication, and assistance in decision-making perceived to be experienced in families), and peer support (a 4-item scale describing the degree of help from friends, ability to count on them, communication of happy and sad feelings, and communication of problems with friends) [34].

Statistical analysis

We analyzed the data in SAS 9.4 (SAS Institute, Cary, NC, 2016). Descriptive analyses characterized the international sample, restricted to participants with complete data for age, gender, and the cyber-bullying, and SMU variables. We then estimated the prevalence of cyber-bullying (*victimization* and *perpetration*) and then the three types of SMU (*intense*, *problematic*, and *online contact with strangers*) by age and gender. For each country, we calculated the prevalence per 100 children and then summarized these estimates in a pooled analysis using minimum, median, and maximum values.

In the pooled international sample, we then used Poisson regression analyses to model cyber-bullying (*victimization* then *perpetration*) as dependent variables with each of the three indicators of SMU as independent variables. We analyzed data on boys and girls separately and restricted our analyses to records with complete data on cyber-bullying, SMU, and all covariates under consideration. Based on a priori consideration of confounding, age, family affluence, peer support, and family support were forced into every adjusted model. Models with *victimization* as the dependent variable controlled for *perpetration*, and vice versa. Models examining *intense SMU* were adjusted for *problematic SMU* and vice versa, whereas *frequent online contact with*

strangers was adjusted for *problematic SMU*. In addition, because *frequent online contact with strangers* was one of four items that also contributed to the intense SMU scale, we performed a sensitivity analysis that examined the effects of *intense SMU*, with and without inclusion of the *online contact with strangers* item. All models accounted for the clustered nature of the sampling scheme via inclusion of school, then country identifiers as random effects. Beta coefficients and standard errors were used to generate crude and adjusted estimates of relative risk (RR) and associated 95% confidence intervals (CIs).

Following this step, we reran each of the adjusted regression models at the country level. The numbers of countries where we identified statistically significant ($p < .05$) effects indicated the consistency of any observed risks or protections across countries. We also described these effects across the countries graphically to illustrate the size of effects and their level of consistency, irrespective of statistical significance.

Given the large sample sizes involved, the pooled analysis was 90% powered to detect an adjusted RR of 1.06–1.18 in boys and girls ($\alpha = .05$, two sided) for each of the relationships under study. Detectable effects varied but were generally larger (>1.20) in the country-specific analyses.

Results

Cyber-bullying

The prevalence of reported victimization by cyber-bullying and perpetration of cyber-bullying varied by country, gender, and age group (Table 2). Median estimates of both victimization and perpetration were generally low and, in the pooled analysis, remained fairly consistent by age group for victimization by cyber-bullying in boys ($p = .22$) but not girls ($p = .02$), but increased with age for perpetration (boys: $p = .01$; girls: $p = .02$). The median prevalence of victimization reported by girls was higher than boys, especially at age 13 years ($p = .02$). Conversely, the median prevalence of perpetration reported by boys was higher than girls in all age groups (all comparisons, $p < .01$). Country-specific estimates for both victimization and perpetration are provided in Supplementary Table 1.

Social media use

Based on median estimates, intense SMU positively related to age, especially among girls ($p < .01$; Table 3). Girls were less likely than boys to engage in problematic SMU at age 11 years, but more likely at ages 13 and 15 years. Frequent online contact with strangers increased with age and was more prevalent among boys versus girls. In general, among girls, the prevalence of problematic SMU was higher than the prevalence of frequent contacts with strangers. Among boys, the prevalence of frequent contact with strangers was higher than the prevalence of problematic SMU.

SMU and cyber-bullying

Table 4 presents the regression analysis of cyber-bullying victimization and perpetration using the pooled sample. For *cyber-victimization*, bivariate models showed modest to strong relationships (adjusted RRs: 1.14 [95% CI: 1.10–1.19] to 1.48 [95% CI: 1.42–1.55]) between each of the three indicators of SMU and being victimized by cyber-bullying. Adjusted models showed

Table 2

Reported victimization by and perpetration of cyber-bullying in 42 countries, HBSC study, 2018

	Prevalence per 100 children Within countries by age group and gender								
	11 years			13 years			15 years		
	Minimum	Median	Maximum	Minimum	Median	Maximum	Minimum	Median	Maximum
Boys									
Victimization by cyber-bullying	4.0	12.5	27.5	2.2	11.9	24.3	3.2	11.3	28.5
Perpetration of cyber-bullying	1.8	7.6	26.7	3.1	10.3	28.8	3.6	11.8	31.4
Girls									
Victimization by cyber-bullying	3.8	12.7	24.5	6.4	13.9	27.8	5.3	12.7	20.9
Perpetration of cyber-bullying	.7	6.1	14.0	2.5	7.2	19.1	1.6	7.5	19.4

All values are weighted.

HBSC = Health Behaviour in School-aged Children.

that the observed effects for each of the three indicators were partially explained by known confounders, as the magnitude of the RRs decreased after adjustment. However, the relation between each indicator of SMU and cyber-victimization held up to these added controls. The consistency of such effects across countries is shown in the number of countries reporting statistically significant increases in relative risk. There was significant variation between countries in the significance of the association between intense use and cyber-victimization (there were eight countries with a significant association for boys and 25 for girls). Problematic SMU was most strongly and consistently related to cyber-victimization. The association was significant in 20 countries for boys and in 29 countries for girls. Cyber-victimization related to frequent contact with strangers in 10 countries for boys and 19 countries for girls.

For perpetration of cyber-bullying bivariate models showed stronger effects (adjusted RR: 1.31 [95% CI: 1.26–1.36] to 1.84 [95% CI: 1.74–1.95]) between each of the three indicators of SMU and being a perpetrator when compared with the relative risks for victimization. Adjustment for confounders attenuated the overall relative risks, but the effects remained strong and statistically significant in boys and girls. Again, there was variation across countries. We observed a statistically significant higher risk for perpetration when reporting intense (24 and 20 countries for boys and girls, respectively) and problematic SMU (22 and 36 countries, boys and girls, respectively). We found significant associations with perpetration and frequent talking to strangers in only 16 countries for boys but 28 countries for girls (Figures 1 and 2).

Table 3

Reported engagement in sentinel indicators of electronic media communication within countries, HBSC study, 2018

	Prevalence per 100 children Within countries by age group and gender								
	11 years			13 years			15 years		
	Minimum	Median	Maximum	Minimum	Median	Maximum	Minimum	Median	Maximum
Boys									
Intense use of social media	14.1	28.9	47.3	17.1	32.4	48.9	18.0	36.8	52.3
Problematic social media use	1.2	5.8	25.3	2.9	6.4	17.8	2.1	6.1	17.5
Frequent social media contact with strangers	1.2	6.0	14.3	2.4	7.5	12.7	2.7	8.5	13.0
Girls									
Intense use of social media	12.5	29.3	48.5	16.9	41.8	60.3	21.1	45.6	64.4
Problematic social media use	1.1	4.7	14.5	3.6	8.4	20.1	3.9	8.8	18.7
Frequent social media contact with strangers	.6	3.4	7.7	2.7	6.2	11.6	2.2	6.2	13.7

All values are weighted. For Slovenia, only 15-year-olds included for problematic social media user.

HBSC = Health Behaviour in School-aged Children.

Finally, the sensitivity analysis used to examine the effects of intense SMU on the perpetration then victimization by cyber-bullying outcomes, with and without inclusion of the *frequent online contact with strangers* item as part of the intense SMU measure is presented in [Supplementary Table 2](#). The findings were very similar for models that did and did not include the *contact with strangers* item.

Discussion

The proliferation of SMU among adolescents over the past decade has led to concerns about its negative consequences for adolescent health and well-being [1,5–7]. Our study explored relationships between three types of SMU (intense and problematic SMU and frequency of contact with strangers) and involvement in cyber-bullying and cyber-victimization and the consistency of these relationships across gender and age groups and diverse geopolitical contexts. We note three main findings. First, we observed more consistent relationships across countries for each of the three types of SMU with perpetration of cyber-bullying compared with cyber-victimization. Second, we observed these relationships in more countries for girls than boys, for both cyber-bullying and cyber-victimization. Third, for both boys and girls, problematic media use related to cyber-bullying and cyber-victimization in the most countries and estimates indicated the presence of modest to strong effects that merit public health intervention.

Consistent with an “exposure perspective” [35], our findings suggest that SMU exposes young people to risks for involvement

Table 4

Bivariate and adjusted relative risk estimates for victimization by and perpetration of cyber-bullying associated with three indicators of social media use in 42 countries, HBSC study, 2018 (weighted n= 166,647 [79,486 boys and 87,161 girls] from 41 countries included in the overall analyses)

	Victimization by cyber-bullying						Perpetration of cyber-bullying									
	Overall prevalence		Overall relative risk			No. countries reporting ^a			Overall prevalence		Overall relative risk			No. countries reporting ^a		
	n (% yes)	RR (95% CI)	Bivariate		Adjusted RR ^b	>1	1	<1	n (% yes)	RR (95% CI)	Bivariate		Adjusted RR ^b	>1	1	<1
			RR (95% CI)	RR (95% CI)							RR (95% CI)	RR (95% CI)				
Boys																
Intense use																
No	54,287 (10.7)	1.00 (ref)	1.00 (ref)		8	34	0	54,287 (9.5)	1.00 (ref)	1.00 (ref)		24	18	0		
Yes	25,199 (13.9)	1.29 (1.24–1.35)	1.14 (1.10–1.19)					25,199 (14.2)	1.48 (1.42–1.54)	1.31 (1.26–1.36)						
Problematic use																
No	74,424 (11.0)	1.00 (ref)	1.00 (ref)		20	22	0	74,424 (10.2)	1.00 (ref)	1.00 (ref)		22	19	1		
Yes	5,062 (23.2)	2.12 (2.00–2.24)	1.35 (1.28–1.42)					5,062 (23.2)	2.25 (2.12–2.39)	1.44 (1.37–1.52)						
Frequent contact with strangers																
No	73,848 (11.2)	1.00 (ref)	1.00 (ref)		10	32	0	73,848 (10.4)	1.00 (ref)	1.00 (ref)		16	26	0		
Yes	5,638 (18.6)	1.64 (1.55–1.75)	1.22 (1.16–1.29)					5,638 (19.0)	1.79 (1.69–1.91)	1.34 (1.27–1.41)						
Girls																
Intense use																
No	53,628 (11.9)	1.00 (ref)	1.00 (ref)		25	17	0	53,628 (5.6)	1.00 (ref)	1.00 (ref)		20	22	0		
Yes	33,533 (17.2)	1.44 (1.39–1.49)	1.30 (1.25–1.34)					33,533 (9.9)	1.72 (1.63–1.80)	1.39 (1.32–1.45)						
Problematic use																
No	80,211 (12.6)	1.00 (ref)	1.00 (ref)		29	13	0	80,211 (6.2)	1.00 (ref)	1.00 (ref)		36	6	0		
Yes	6,950 (28.9)	2.26 (2.16–2.37)	1.48 (1.42–1.55)					6,950 (19.6)	3.10 (2.92–3.28)	1.84 (1.74–1.95)						
Frequent contact with strangers																
No	82,323 (13.2)	1.00 (ref)	1.00 (ref)		19	23	0	82,323 (6.8)	1.00 (ref)	1.00 (ref)		28	14	0		
Yes	4,839 (26.3)	1.96 (1.85–2.07)	1.39 (1.31–1.47)					4,839 (16.0)	2.30 (2.14–2.48)	1.40 (1.30–1.50)						

All analyses are weighted.

Armenia is excluded from the overall pooled analysis because of missing data but included in country-specific analyses adjusting for all covariates except family affluence.

CI = confidence interval; HBSC = Health Behaviour in School-aged Children; ref = reference; RR = relative risk.

^a Based on CIs that do or do not overlap 1.00.

^b Adjusted for age, county-specific socioeconomic class, family support, and peer support and for clustering at the country and school level. RR estimates for victimization by cyber-bullying are adjusted for perpetration of cyber-bullying and vice versa. RR estimates for intense user are adjusted for problematic use and vice versa. RRs for frequent contact with strangers are adjusted for problematic use.

in cyber-bullying and to more aggressive online behaviors, particularly for boys. Time spent online, especially if SMU is frequent and/or problematic, replaces opportunities to engage in constructive and protective in-person social activities that promote socioemotional and moral development [3]. From a theoretical perspective, aggressive tendencies may develop in young people who grow up in environments that “reinforce aggression, provide aggressive models, frustrate and victimize them, and teach them that aggression is acceptable and successful” (p. 47) [36]. Intense and problematic SMU may expose adolescents to peers and social norms that validate and reinforce different forms of aggression, including cyber-bullying. Associations between intense and problematic SMU and cyber-bullying may be exacerbated by cognitive, emotional, and associated social vulnerabilities because SMU provides a safe and anonymous way of expressing frustrations, which could translate into online aggression among vulnerable youth [37,38].

Exposure theory also explains gender differences in the consistency of findings across countries. We found more cross-country consistency for girls than boys in the associations among problematic use and frequent contact with strangers and cyber-bullying. Because girls spend more time online and report more problematic use, they have greater exposure to aggressive role models, potentially reinforcing a potential to engage in cyber-bullying. Similarly, for girls, intense and problematic use related to cyber-victimization in most countries but not for boys. Increased exposure and use of social media among girls may result in an increased risk of cyber-victimization [39]. Similarly, the gendered patterns surrounding frequent online contact with strangers become more pronounced as children age and were particularly experienced by boys. This may be attributable to differences in sensation seeking and risk taking, as mediated by hormonal factors and social norms [40], as well as engagement in interactive game playing by boys and older adolescents, which by necessity often involve interaction with strangers [41].

All three of SMU measures independently related to cyber-bullying and cyber-victimization with modest to strong effect sizes. Although these associations varied by country, they highlight the unique contribution of each construct and importance of broad assessments of SMU that include measures of frequency of use, addictive-like behavior, and risky behaviors. Problematic SMU related to cyber-bullying and victimization in many countries. Cross-country variations in associations with cyber-bullying and cyber-victimization also highlight the importance of a socioecological approach in understanding these relationships. Cultural, economic, and social factors, such as Internet access, availability of electronic devices, and social cultural norms about online behavior, underlie these associations. Future research should examine the importance of these contextual differences in explaining cross-national differences found here.

The strengths of our study include large, representative samples and our use of standardized, validated measures that differentiated aspects of SMU and cyber-bullying involvement [31]. The findings are almost certainly generalizable to contemporary populations of young people from high-income countries and may be generalizable beyond such populations, given that access to the internet is common, even in low- and middle-income countries [42].

The limitations of the study include the cross-sectional, self-report nature of the data collection, which limited the potential for causal inferences. Second, self-reports of sensitive behaviors, including perpetration and victimization due to cyber-bullying,

are also subject to bias and misclassification because of the social stigmas associated with their occurrence [43]. Third, HBSC’s reliance on a binary indicator of gender does not reflect the experiences of young people whose identity does not match these binary categories, nor those for whom the sex assigned at birth does not correspond with that identity. In some circles, the HBSC item is best be considered a measure of “sex at birth” rather than gender.

There are theoretical and methodological implications of the findings. First, research will benefit from a socioecological approach to understand variations in association across countries. Exposure theory may not sufficiently describe cross-country variations in the pattern of results. Second, research should also assess multiple aspects of SMU use, given the unique determinants and consequences of its intensity, problematic use, and contact with strangers online. Third, interventions need to consider a sex-/gender-specific approach. Frequency of contact with strangers may represent a risk factor that is particularly important to girls’ involvement in cyber-bullying. The findings also point to the need for further research that examines the interplay of gender and age in SMU use and cyber-bullying. On a more practical level, parents, educators, clinicians, and others who care for children should be aware of these correlates of SMU. Problematic and intense SMU as well as talking with strangers are not innocuous in terms of their potential links to cyber-bullying and require both awareness and evidence-based strategies for prevention.

The developing world of electronic social media technology Q3 and its intensive introduction into the daily lives of adolescents provide new and alternative social settings in which young people engage in relationships. Although social media environments replicate much of what is present in traditional face-to-face activities, these rapidly evolving environments have changed the meaning and manifestation of social connectedness among adolescents. Easy access to social media and its pervasive use have led to new opportunities for cyber-bullying and presents new challenges and opportunities for health policy and practice to protect youth from harm.

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Supplementary Data

Supplementary data related to this article can be found at <http://doi.org/10.1016/j.jadohealth.2020.03.006>.

References

- Livingston JD, Cianfrone M, Korf-Uzan K, Coniglio C. Another time point, a different story: One year effects of a social media intervention on the attitudes of young people towards mental health issues. *Soc Psychiatry Psychiatr Epidemiol* 2014;49:985–90.
- Lenhart A, Smith A, Anderson M, et al. Teens, technology & friendships: Video games, social media and phones play an integral role in how teens meet and interact with friends. Pew Research Center. 2015. Available at: <http://www.pewinternet.org/2015/08/06/teens-technology-and-friendships/>. Accessed August 31, 2019.
- Jiang X, Peterson RD. Beyond participation: The association between school extracurricular activities and involvement in violence across generations of immigration. *J Youth Adolesc* 2012;41:362–78.
- Orben A, Przybylski AK. The association between adolescent well-being and digital technology use. *Nat Hum Behav* 2019;3:173–82.
- Sasson H, Mesch G. Parental mediation, peer norms and risky online behavior among adolescents. *Comput Hum Behav* 2014;33:32–8.
- Qiaolei J, Xiuqin H, Ran T. Examining factors influencing internet addiction and adolescent risk behaviors among excessive internet users. *Health Commun* 2018;33:1434–44.
- Valkenburg PM, Peter J. Online communication among adolescents: An integrated model of its attraction, opportunities, and risks. *J Adolesc Health* 2011;48:121–7.
- Boniell-Nissim M, Sasson H. Bullying victimization and poor relationships with parents as risk factors of problematic internet use in adolescence. *Comput Hum Behav*, 88, 176–183.
- Nixon CL. Current perspectives: The impact of cyberbullying on adolescent health. *Adolesc Health Med Ther* 2014;5:143–58.
- Englander E, Donnerstein E, Kowalski R, et al. Defining cyberbullying. *Pediatrics* 2017;140:S148–51.
- Kowalski RM, Giumetti GW, Schroeder AN, Lattanner MR. Bullying in the digital age: A critical review and meta-analysis of cyberbullying research among youth. *Psychol Bull* 2014;140:1073–137.
- Gottfredson MR, Hirschi T. A general theory of crime. Redford City, CA: Stanford University Press; 1990.
- Jessor R, Jessor SL. Problem behavior and psychosocial development: A longitudinal study of youth. New York: Academic Press; 1977.
- Jessor R. The origins and development of problem behavior theory. New York: Springer; 2016.
- Blakemore SJ, Mills KL. Is adolescence a sensitive period for sociocultural processing? *Annu Rev Psychol* 2014;65:187–207.
- Olweus D. Bullying at school: What we know and what can we do. Oxford: Blackwell publishers; 1993.
- Barlett CP, Gentile DA. Attacking others online: The formation of cyberbullying in late adolescence. *Psychol Popular Media Cult* 2012;1:123–35.
- Prizant-Passal S, Shechner T, Aderka I. Social anxiety and internet use – a meta-analysis: What do we know? What are we missing? *Comput Hum Behav* 2016;62:221–9.
- Erreygers S, Vandebosch H, Vranjes I, et al. The longitudinal association between poor sleep quality and cyberbullying, mediated by anger. *Health Commun* 2019;34:560–6.
- Casas JA, Del Rey R, Ortega-Ruiz R. Bullying and cyberbullying: Convergent and divergent predictor variables. *Comput Hum Behav* 2013;29:580–7.
- Kircaburun K, Jonason PK, Griffiths MD. The dark tetrad traits and problematic social media use: The mediating role of cyberbullying and cyberstalking. *Pers Individ Differ* 2018;135:264–9.
- Rice E, Petering R, Rhoades H, et al. Cyberbullying perpetration and victimization among middle-school students. *Am J Public Health* 2015;105:e66–72.
- Sampasa-Kanyinga H, Hamilton HA. Use of social networking sites and risk of cyberbullying victimization: A population-level study of adolescents. *Cyberpsychol Behav Soc Netw* 2015;18:704–10.
- Machimbarrena J, Calvete E, Fernández-González L, et al. Internet risks: An overview of victimization in cyberbullying, cyber dating abuse, sexting, online grooming and problematic internet use. *Int J Environ Res Public Health* 2018;15:1–15.
- Lee HW, Choi JS, Shin YC, et al. Impulsivity in internet addiction: A comparison with pathological gambling. *Cyberpsychol Behav Soc Netw* 2012;15:373–7.
- Barlett CP, Gentile DA, Chng G, et al. Social media use and cyberbullying perpetration: A longitudinal analysis. *Violence Gend* 2018;5:191–7.
- Gómez-Guadix M, Borrajo E, Almendros C. Risky online behaviors among adolescents: Longitudinal relations among problematic internet use, cyberbullying perpetration, and meeting strangers online. *J Behav Addict* 2016;5:100–7.
- Roberts C, Freeman J, Samdal O, et al. The health behaviour in school-aged children (HBSC) study: Methodological developments and current tensions. *Int J Public Health* 2009;54 Suppl 2:140–50.
- World Bank. World development report 2020: Trading for development in the age of global value chains. Washington, DC: World Bank Publications; 2020.
- Craig W, Harel-Fisch Y, Fogel-Grinvald H, et al. A cross-national profile of bullying and victimization among adolescents in 40 countries. *Int J Public Health* 2009;54 Suppl 2:216–24.
- Mascheroni G, Ólafsson K. Access and use. In: Net children go mobile: Risks and opportunities. 2nd ed. Milano: Educatt; 2014:11–23.
- Van den Eijnden RJJM, Lemmens J, Valkenburg PM. The social media disorder scale: Validity and psychometric properties. *Comput Hum Behav* 2016;61:478–87.
- Currie C, Molcho M, Boyce W, et al. Researching health inequalities in adolescents: The development of the health behaviour in school-aged children (HBSC) family affluence scale. *Soc Sci Med* 2008;66:1429–36.
- Zimet GD, Powell SS, Farley GK, et al. Psychometric characteristics of the multidimensional scale of perceived social support. *J Pers Assess* 1990;55:610–7.
- Brown JD, Bobkowski PS. Older and newer media: Patterns of use and effects on adolescents' health and well-being. *J Res Adolesc* 2011;21:95–113.
- Anderson CA, Carnagey NL. Violent evil and the general aggression model. In: Miller AG, ed. Social psychology of good and evil. New York, NY: Guilford; 2004:168–92.
- Best P, Manktelow R, Taylor B. Online communication, social media and adolescent wellbeing: A systematic narrative review. *Child Youth Serv Rev* 2014;41:27–36.
- Aboujaoude E, Savage MW, Starcevic V, Salame WO. Cyberbullying: Review of an old problem gone viral. *J Adolesc Health* 2015;57:10–8.
- Underwood MK, Ehrenreich SE. The power and the pain of adolescents' digital communication: Cyber victimization and the perils of lurking. *Am Psychol* 2017;72:144–58.
- Vermeersch H, Tsjoen G, Kaufman J, Vincke. The role of testosterone in aggressive and non-aggressive risk taking in adolescent boys. *Horm Behav* 2008;53:463–71.
- Lenhart A, Duggan M, Perrin A, et al. Teens, social media & technology overview 2015: Smartphones facilitates shifts in communication landscape for teens. Pew Research Center. 2015. Available at: https://www.pewresearch.org/wp-content/uploads/sites/9/2015/10/pi_2015-10-01_teens-technology-romance_final.pdf.
- Organisation for Economic Cooperation and Development. OECD broadband portal. Available at: <https://www.oecd.org/sti/broadband/broadband-statistics/>. Accessed July 30, 2019.
- Juvonen J, Graham S. Bullying in schools: The power of bullies and the plight of victims. *Annu Rev Psychol* 2014;65:159–85.