

School-Based Risk Factors Associated with Electronic and At-School Bullying among United States' High School Students

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Abstract

Background: Bullying victimization is associated with serious health risks and consequences for youth, ranging from emotional distress, to substance abuse and suicide. Studies have indicated that school bullying is associated with risky health behaviors associated with violence, including weapon carrying. This study sought to explore trends in the relationships between electronic and at-school bullying and school-related risk behaviors over three distinct time points.

Methods: Using data from the 2011-2015 High School Youth Risk Behavior Surveys (YRBS), logistic regression analyses were conducted to examine trends in the associations between at-school and electronic bullying victimization and risky health behaviors at school.

Results: Being bullied at school or electronically bullied was significantly associated with risky health behaviors at school, including carrying a weapon; being threatened or injured with a weapon on school property; being offered, sold, or given an illegal drug on school property; being in a physical fight at school; or missing school because felt unsafe. Trend analysis was only significant for being bullied at-school and missing school because of feeling unsafe.

Conclusions: Bullying and electronic bullying victimization is consistently associated with risky health behaviors among youth. Recognizing these risks can assist educators, health practitioners, and other adults in prompt intervention and reduction of negative consequences.

Keywords: Cyberbullying; Bullying; Adolescents; Health Risk Behaviors; YRBS

Introduction

Data from the 2015 Youth Risk Behavior Survey [1] suggest that more than 15% of high school youth in the United States (US) have been victims of electronic bullying (also known as cyberbullying and electronic aggression); more than 20% have been victims of traditional bullying. The pervasiveness and potential health consequences associated with bullying victimization make it a public health concern. Increased risks to youth health and wellness related to bullying and cyberbullying have prompted global attention and signified an urgent need to understand the risks and trends associated with these behaviors.

An increasing proportion of school children in the US have experienced shootings and weapon-related incidents on school properties in recent years, with many of those shootings being linked to youth bullying victims [2]. Bullying, in any form, is often not the sole contributing factor to violent incidents on school property, but research studies suggest a relationship between bullying of any type and precarious health behaviors related to violence, such as weapon carrying and physical fights both on and off school grounds [3,4]. Bullying victims who reported skipping school out of fear for their own safety, fighting at school, or being threatened or injured with a weapon at school were significantly more likely to carry weapons to school than non-bullying victims [2]. Youth who are victimized by bullying

may feel vulnerable and seek a means to protect themselves and are more likely to carry weapons in school than outside of school [4], indicating the need for interventions to improve school safety and students' perceptions of their personal safety. Studies have shown that electronic bullying is most likely to occur alongside other types of bullying [5] resulting in electronic bullying-related issues impacting interactions within the school setting.

Electronic bullying is a unique type of bullying and is defined as "willful and repeated harm inflicted through the use of computers, cell phones, and other electronic devices" [6]. Electronic bullying is similar to traditional bullying as electronic bullies exhibit an intent to harm or distress the victim. However, electronic bullying has characteristics that make it distinct from traditional bullying. Electronic bullying provides anonymity to perpetrators, who can hide behind a screen or pseudonym, increasing the victim's fear of an unknown attacker [7]. Electronic bullying is omnipresent; victims describe online electronic bullying as inescapable, stating there is no way to get away from it, even at home, in the car, or through geographical distance [6,8]. Further, the reach of electronic bullying is extensive as social media postings and text messages can be shared to an infinite number of people, across the globe, and in a relatively short amount of time [6].

Earlier studies have identified relationships between electronic victimization, physical, and psychological health risks, including depression and suicidality, alcohol and drug abuse, and risky sexual activity [9-13]. One study found higher depression among electronic bullying victims as compared to traditional bullying victims [13]. This depression may be related to feelings of loneliness and helplessness during the experience and may be worsened by adults' lack of intervention to curtail the electronic bullying, due to lack of skills or knowledge, or preference not to intervene [8]. School personnel may respond similarly, feeling as though their hands are tied because the behavior is not happening at school. Research has found that only one-third of electronic bullying victims reported it to an adult, with teens citing numerous reasons for not reporting the behavior, including a lack of privacy, losing technology privileges, and perceived ineffectiveness of adults in dealing with the problem [14].

Purpose of the Study

The purpose of this study was to explore trends in the relationships between at-school and electronic bullying victimization and school-based risk behaviors among high school students in the US including: carrying a weapon to school, being involved in a physical fight on school property, being threatened or injured with a weapon on school property, being offered, sold, or given illegal drugs on school property, and missing school because they felt unsafe.

Methods

YRBS

Secondary data analysis was conducted using the weighted data from the national Youth Risk Behavior Surveillance (YRBS) survey from 2011-2015, collected by the Centers for Disease Control and Prevention (CDC). Among its purposes, the YRBS, using a three-stage cluster design to obtain a nationally representative sample, aims to assess trends in health-risk behaviors among high school youth attending 180 randomly selected public and private high schools across the US. Detailed information about YRBS data collection methods have been described elsewhere [15,16].

Variables of interest

The dataset used in this paper included three distinct time points of YRBS: 2011, 2013, and 2015. To facilitate the analyses, participants were classified into four mutually exclusive bullying categories: not bullied, bullied at school, bullied electronically, and bullied both at school and electronically. Demographic variables such as sex, race/ethnicity, and grade were used either as stratified variables or as controlling variables. Participants with missing data on the bullying category variable, sex, race/ethnicity, and grade were excluded from the data analysis. American Indian/Alaska Native/Native Hawaiian/Other Pacific Islander were defined as "other".

There are five primary independent variables of interest: 1) carried a weapon on school property in the past 30 days; 2) offered, sold or given an illegal drug on school property in the past 12 months; 3) were in a physical fight on school property in the past 12 months; 4) threatened or injured with a weapon on school property in the past 12 months; and 5) missed school because felt unsafe in the past 30 days. These variables were selected as they pertain to behaviors that occur on school property or relate to school attendance.

Plan of analysis

First, trend analyses were conducted to investigate the prevalence of bullying over time using logistic regression with bullying as the dependent variable. Both linear and quadratic trends were compared by including a linear time variable for a linear trend analysis, and by including both linear and quadratic time variables for the quadratic trend analysis with adjustment for sex, race/ethnicity, and grade; the significant trends were reported. In addition to the overall trend analysis, distinct trend analyses stratified by sex, race/ethnicity, and grade were conducted. In the stratified trend analysis, the variable that was used to stratify was not used to adjust the analysis.

Due to the distinct and consistent differences in types of bullying between sexes reported in the literature, statistical analyses using chi-squared tests were conducted to examine proportional differences between male and female students for each of the bullying categories for each survey year, without adjusting for race/ethnicity and grade.

The prevalence of bullying in relation to certain risk factors was investigated using adjusted logistic regression models by including the risk factor as a predictor; each risk factor was modeled separately. For these data analyses, youth who experienced both types of bullying were excluded from the analyses to avoid overlap that may be more associated with one type of bullying and to focus on the risk factors associated with each type of bullying. Thus, the categories were reduced to three dependent variables: experienced no bullying, cyberbullied only, and bullied only at school. Variables were characterized by a "yes" or "no" response to the following questions: "During the past 12 months, have you ever been bullied on school property?" and "During the past 12 months, have you ever been electronically bullied? (Count being bullied through e-mail, chat rooms, instant messaging, websites, or texting)." Lastly, for significant risk factors, interaction variables were created with survey year to examine the prevalence of bullying as predicted by the factor over time.

Analyses were conducted with Proc SurveyFreq and Proc SurveyLogistic of SAS/STAT software Version 9.4 of the SAS System for Windows (SAS Institute Inc., Cary, NC) using guidance provided by the CDC in Software for Analysis of YRBS Data [17] for weighting.

Results

Prevalence of Bullying over Time

The trend analysis showed that there was a significant linear overall trend in bullying over time (Wald χ^2 for year was $\chi^2(3) = 10.42$, $p = 0.015$). For the stratified trend analyses, there were significant linear trends in bullying over time for sex (female: Wald χ^2 for year was $\chi^2(3) = 11.75$, $p = 0.008$; male: Wald χ^2 for year was $\chi^2(3) = 9.13$, $p = 0.028$), for Hispanic/Latino (Wald χ^2 for year is $\chi^2(3) = 12.51$, $p = 0.006$), for 9th grade (Wald χ^2 for year was $\chi^2(3) = 14.72$, $p = 0.002$), and for 11th grade (Wald χ^2 for year was $\chi^2(3) = 13.23$, $p = 0.004$). There was a significant quadratic trend for Asian students (Wald χ^2 for year and year² were $\chi^2(3) = 11.58$, $p = 0.009$ and $\chi^2(3) = 11.38$, $p = 0.010$, respectively) and for 10th grade students (Wald χ^2 for year and year² were $\chi^2(3) = 10.09$, $p = 0.018$ and $\chi^2(3) = 9.57$, $p = 0.023$, respectively). As for 12th graders, Black/African-American, White, multiple-Hispanic, and multiple-Non Hispanic, and other race/ethnic students, there was no significant trend, either linear or quadratic. Table 1 presents the prevalence rates for each year and the post hoc analyses comparing the 2011 to 2013 and the 2011 and 2015 prevalence rates.

	Bullied at School				Bullied Electronically				Both			
	2011% (95% CI)	2013% (95% CI)	2015% (95% CI)	2011-2015 % Point Change	2011% (95% CI)	2013% (95% CI)	2015% (95% CI)	2011-2015 % Point Change	2011% (95% CI)	2013% (95% CI)	2015% (95% CI)	2011-2015 % Point Change
Total	9.9 (8.9, 10.9)	9.7 (8.9, 10.5)	9.5 (8.3, 10.6)	-0.4	6.2 (5.5, 6.8)	5.5** (5.1, 6.0)	5.0** (4.4, 5.5)	-1.2	7.5 (6.7, 8.2)	7.8 (7.2, 8.3)	8.1 (7.3, 8.8)	0.6
By Gender												
Female	8.9 (7.8, 10.0)	9.5 (8.5, 10.4)	10.1 (8.7, 11.5)	1.2	8.4 (7.5, 9.4)	7.6* (6.9, 8.2)	6.8* (6.0, 7.6)	-1.7	10.2 (9.1, 11.3)	10.8 (9.9, 11.7)	11.5 (10.3, 12.7)	1.3
Male	10.6 (9.3, 11.9)	9.6* (8.6, 10.6)	8.7* (7.4, 10.0)	-1.9	4.5 (3.6, 5.4)	4.1 (3.5, 4.7)	3.6 (2.9, 4.4)	-0.9	5.8 (4.8, 6.7)	5.7 (5.1, 6.3)	5.7 (4.6, 6.8)	-0.1
By Race/Ethnicity												
White	11.4 (10.2, 12.7)	10.8 (9.6, 12.0)	11.4 (9.8, 13.0)	-0.1	6.8 (6.0, 7.6)	5.8 (4.9, 6.7)	6.0 (5.0, 7.0)	-0.8	10.5 (9.1, 12.0)	9.8 (8.7, 10.9)	11.0 (9.5, 12.5)	0.4
Black or African American	6.9 (5.5, 8.4)	7.2 (6.3, 8.1)	7.5 (5.8, 9.1)	0.6	5.0 (3.9, 6.0)	4.2 (3.4, 5.0)	3.5 (2.3, 4.8)	-1.4	3.7 (2.8, 4.6)	4.1 (3.5, 4.7)	4.6 (3.5, 5.6)	0.9
Hispanic/Latino	10.2 (8.3, 12.0)	8.6* (7.3, 9.9)	7.3* (5.5, 9.1)	-2.9	5.5 (4.2, 6.8)	4.1** (3.4, 4.8)	3.1** (2.3, 3.8)	-2.4	5.5 (4.2, 6.8)	5.5 (4.6, 6.4)	5.5 (4.2, 6.8)	0.0
Asian	8.2 (4.5, 11.9)	11.3 (6.8, 15.8)	6.1 (3.7, 8.4)	-2.1	7.8 (3.9, 11.6)	3.0** (1.8, 4.2)	5.7 (2.9, 8.4)	-2.1	6.3 (3.3, 9.3)	9.6 (6.2, 13.1)	8.2 (5.4, 11.0)	1.9
Am Ind/Alaska Nat/ Nat Hawaiian/Other PI	13.8 (9.2, 18.4)	9.7* (7.1, 12.2)	6.6* (3.0, 10.3)	-7.2	7.5 (4.5, 10.6)	5.4 (3.5, 7.3)	3.7 (1.3, 6.2)	-3.8	10.1 (6.9, 13.3)	11.4 (8.6, 14.1)	12.6 (7.7, 17.4)	2.5
Multiple – Hispanic	9.9 (7.8, 12.0)	10.3 (8.3, 12.3)	9.6 (7.7, 11.5)	-0.3	6.5 (5.4, 7.5)	5.5 (4.0, 7.0)	5.3 (3.9, 6.8)	-1.1	7.9 (6.1, 9.8)	8.7 (6.8, 10.7)	8.6 (6.7, 10.5)	0.7
Multiple – Non Hispanic	11.7 (8.8, 14.6)	11.7 (8.7, 14.7)	11.9 (9.2, 14.6)	0.2	10.0 (6.5, 13.4)	6.7 (4.9, 8.6)	6.3 (2.9, 9.7)	-3.6	8.3 (5.4, 11.3)	9.9 (6.9, 12.9)	11.1 (7.5, 14.7)	2.8
By Grade												
9 th Grade	14.6 (12.8, 16.5)	13.2* (11.7, 14.6)	11.8* (9.8, 13.8)	-2.8	4.6 (3.4, 5.8)	4.2 (3.3, 5.0)	3.8 (2.7, 4.8)	-0.8	8.1 (6.8, 9.4)	9.1 (8.1, 10.0)	10.1 (8.7, 11.5)	2.1
10 th Grade	10.6 (9.1, 12.0)	12.0 (9.9, 14.1)	9.8 (7.9, 11.6)	-0.8	6.3 (4.9, 7.7)	4.6* (3.3, 6.0)	5.7 (4.3, 7.1)	-0.6	9.2 (7.2, 11.2)	7.4 (6.1, 8.7)	8.1 (6.5, 9.7)	-1.1
11 th Grade	8.0 (6.6, 9.5)	9.1* (7.9, 10.4)	10.4* (8.6, 12.1)	2.3	7.6 (6.2, 9.0)	6.4 (5.5, 7.4)	5.5 (4.3, 6.7)	-2.1	6.7 (5.3, 8.0)	7.1 (6.0, 8.1)	7.4 (5.9, 9.0)	0.8
12 th Grade	6.5 (5.2, 7.7)	6.4 (5.4, 7.4)	6.4 (4.9, 7.8)	-0.1	6.7 (5.6, 7.8)	5.9* (5.2, 6.7)	5.3* (4.3, 6.2)	-1.5	6.2 (5.0, 7.3)	6.5 (5.6, 7.4)	6.9 (5.6, 8.1)	0.7

Table 1: Prevalence of students who reported being bullied at school, electronically, and both.

p* < 0.05 and *p* < 0.01 indicate statistical significance of change in bullying relative to the year of 2011

Analyses were adjusted for sex, race/ethnicity and grade, except when the analysis was stratified by one of these variables.

Male and Female Proportion Differences by Year

The results of the chi-square tests were reported in table 2. There were significant differences by sex in the proportion of each bullying category by year, except for year 2013 for the bullied at school category.

	Sex				Post Hoc χ^2 Test for Female VS Male by Bullying Type		
	Female		Male		χ^2	DF	pI-value
	Un N*	Col %	Un N*	Col %			
2011							
Not Bullied	4961	68.79%	5376	77.15%	84.62	1	< .0001
Bullied at School	609	9.17%	749	12.21%	28.05	1	< .0001
Bullied Electronically	613	9.15%	314	4.58%	65.42	1	< .0001
Both	755	12.89%	351	6.06%	50.82	1	< .0001
2013							
Not Bullied	4576	68.37%	5603	81.24%	125.03	1	< .0001
Bullied at School	682	10.64%	662	10.23%	0.41	1	.5223
Bullied Electronically	512	7.90%	217	3.27%	48.70	1	< .0001
Both	778	13.10%	353	5.26%	137.89	1	< .0001
2015							
Not Bullied	5383	67.90%	6132	80.32%	293.50	1	< .0001
Bullied at School	734	10.39%	751	10.04%	0.22	1	.6401
Bullied Electronically	534	7.39%	262	3.78%	48.68	1	< .0001
Both	982	14.32%	436	5.86%	61.56	1	< .0001

Table 2: Unadjusted Prevalence of Being Bullied by Year and Sex.

* Un N = Unweighted N

Prevalence of Bullying by Risk Factors

The logistic regression tests, adjusted for sex, race/ethnicity, grade, and survey year for the five primary risk factors of interest revealed that the risk factors were significant predictors of bullying and electronic bullying (Wald χ^2 for carried a weapon was $\chi^2(2) = 25.61$, $p < 0.001$; Wald χ^2 for offered, sold or given an illegal drug was $\chi^2(2) = 197.65$, $p < 0.001$; Wald χ^2 for were in a physical fight was $\chi^2(2) = 117.84$, $p < 0.001$; Wald χ^2 for threatened/injured with a weapon was $\chi^2(2) = 394.28$, $p < 0.001$; Wald χ^2 for missed school because felt unsafe was $\chi^2(2) = 260.14$, $p < 0.001$). The adjusted prevalence and odds ratios with not having been bullied as the reference category were reported in table 3.

Risk Factors	% (95% CI)	AOR (95% CI)
Carried a weapon on school property in the past 30 days		
Bullied at School	37.01 (31.47, 42.55)	1.57 (1.27, 1.95)***
Bullied Electronically	39.48 (33.19, 45.77)	1.68 (1.29, 2.18)***
Offered, sold or given an illegal drug on school property in the past 12 months		
Bullied at School	35.00 (32.11, 37.88)	1.65 (1.49, 1.82)***
Bullied Electronically	43.78 (40.37, 47.18)	2.06 (1.81, 2.35)***
Were in a physical fight on school property in the past 12 months		
Bullied at School	35.24 (31.41, 39.08)	1.76 (1.53, 2.04)***
Bullied Electronically	44.78 (40.32, 49.25)	2.24 (1.88, 2.67)***
Threatened or injured with a weapon on school property in the past 12 months		
Bullied at School	41.22 (37.17, 45.27)	3.29 (2.89, 3.75)***
Bullied Electronically	46.25 (41.58, 50.93)	3.69 (3.05, 4.48)***
Missed school because felt unsafe in the past 30 days		
Bullied at School	44.41 (39.63, 49.18)	3.10 (2.64, 3.63)***
Bullied Electronically	41.25 (36.17, 46.33)	2.88 (2.36, 3.50)***

Table 3: Adjusted Prevalence and Odds Ratios of Being Bullied for Various Risks.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Analyses were adjusted by sex, race/ethnicity, grade, and survey year with not bullied as the reference category.

Prevalence of Bullying over Time for Risk Factors

When the year by risk factor interaction term was added to the logistic regression model, the interaction was only significant for one of the five primary risk factors, which was missed school because felt unsafe (Wald χ^2 for year by missed school interaction term was $\chi^2(2) = 7.05, p = 0.029$). The adjusted prevalence and odd ratios with not having been bullied as the reference categories by year were reported in table 4.

Risk Factors	% (95% CI)	AOR (95% CI)
Missed school because felt unsafe in the past 30 days		
Bullied at School		
Year 2011	36.53 (34.13, 38.93)	1.11 (1.01, 1.22)*
Year 2013	43.16 (35.71, 50.62)	1.37 (1.03, 1.82)*
Year 2015	49.91 (37.49, 62.34)	1.68 (1.05, 2.70)*
Bullied Electronically		
Year 2011	30.55 (27.65, 33.44)	0.93 (0.81, 1.07)
Year 2013	25.24 (17.47, 33.01)	0.80 (0.53, 1.21)
Year 2015	20.41 (9.18, 31.63)	0.69 (0.34, 1.37)

Table 4: Adjusted prevalence and odds ratios of being bullied by year.

* $p < 0.05$

Analyses were adjusted by sex, race/ethnicity and grade with not bullied as the reference category.

Discussion

Findings from our study demonstrated that risky health behaviors contributing to violence on school property were significantly associated with electronic and at-school bullying. Other researchers, including those who used YRBS data, found an association between various risky health behaviors contributing to violence and bullying victimization [2,9,11,18,19]. Our study adds to the literature as it highlights the association between risky health behaviors and electronic bullying among youth.

Overall Trends

Recent studies have indicated a slight downward trend in physical bullying prevalence [14,20]. These findings are supported by the 2013 National Crime Victimization Survey (NCVS) School Crime Supplement report indicating a significant drop in reports of school bullying for over a decade [21]. The National Survey of Children's Exposure to Violence (NatSCEV) and the Boston MetroWest Adolescent Health Survey also reported a decrease in bullying from 2010 - 2012 [14,22].

In our study, electronic bullying trends exhibited a significant decrease from 2011 - 2015 (6.2% - 5.0%). This rate is consistent with the 6.9% overall electronic bullying prevalence noted in the NCVS [20], but the NCVS reported an overall increase in electronic bullying from 2006 - 2012. Inconsistencies in these findings may be explained by the different time periods of study or the different age ranges of participants in the current study (high school only) compared to the NCVS and MetroWest Adolescent Health Surveys, which include middle school students, a population with a noted higher prevalence of bullying and electronic bullying behaviors [23,24]. Furthermore, variations may also be related to differences in defining bullying and electronic bullying. As Patchin [25] explains, studies within and across disciplines do not use a universal definition for bullying and electronic bullying. These variances have the potential to disturb prevalence rates and trends, making it difficult to assess the extent of the problem [25].

Gender: Gender was one of the strongest characteristics of differences in the type of bullying victimization. Traditionally, boys have been more involved with school bullying than girls [11]. We found that bullying among high school boys is trending downward, dropping nearly two points between 2011 and 2015, although there was no significant change for girls.

Electronic bullying research has been inconsistent with reports of gender differences. Some studies reported that boys were more likely to be involved in electronic bullying than girls [26,27], while other studies reported no significant difference among youth males and females [28]. More recent studies, however, found that girls were more likely to be perpetrators and victims of electronic bullying [11,14,21,29,30].

Consistent with the NatSCEV [22], we found that girls were more likely to report being a victim of both, bullying and electronic bullying. Moreover, our study showed that reports of electronic bullying were twice as high in girls, and reports of both types of bullying are nearly two and a half times as high in girls as compared to their male counterparts. Elevated reports of electronic bullying among girls has been noted and may be related to the ability to be indirect and anonymous in the cyber world [12].

Race/Ethnicity: The prevalence of bullying, electronic bullying, and both were statistically different only among specific race/ethnic groups. There was a significant decrease in the prevalence of bullying and electronic bullying among students identifying as Hispanic/Latino and as other race/ethnic groups. These findings cannot be easily attributed to one specific factor but may reflect attitudes associated with the changing population in the US and substantial growth among these populations [31]. A study by the Pew Research Center [32] supported a change in attitude, suggesting that the Millennial generation (born after 1980) is more racially diverse and more racially tolerant than previous generations.

Grade: General bullying literature has indicated that bullying and electronic bullying peak during middle school and then decrease throughout high school [23,33,34]. The NCVS and the MetroWest Adolescent Health Survey [21,22] found similar results with the highest reports of high school physical bullying occurring in 9th grade and dropping during 10th through 12th grades. Findings from our study

also showed rates of physical bullying decreasing from 9th through 12th grades in all but one survey year (in 2015, between 10th and 11th grade). Physical bullying among 12th graders remained steady at approximately 6.5% over time, the lowest rates among high schoolers during the 2011 - 2015 period.

Our study findings point to a significantly decreasing trend in electronic bullying only among 12th graders. The NCVS and MetroWest Adolescent Health Survey [21,22] demonstrated a relatively consistent rate between 9th and 10th grade and a decrease from 10th grade through 12th grade. The increase in electronic bullying between 9th and 10th grades may be attributed to increased access or use of the Internet among older teens [35] or possibly, increased independence and less monitoring from parents. Older adolescents, though likely to spend more time online than younger adolescents, indicate lower online victimization. This may indicate that older adolescents' spend more time engaging in pro-social or academic behaviors online [36].

Risky Behaviors on School Property

High school students who reported having been threatened or injured with a weapon on school property, reported having been in a physical fight on school property, and reported carrying a weapon to school were more likely to have been electronically bullied or bullied at school. Likewise, students who reported having been offered, sold, or given an illegal drug on school property were more likely to have been electronically bullied or bullied than those who had not experienced the risk factors. These findings coincide with previous studies that showed a positive association between traditional bullying and risky school behaviors, including alcohol and substance abuse, smoking tobacco, and suicidality [2,37-41], adding to the literature by demonstrating a significant association between those behaviors and electronic bullying.

Students who missed school because they felt unsafe at school or on the way home from school had greater odds of having been electronically bullied or bullied at school. Various explanations have been proposed regarding the association between bullying victimization and weapon carrying at school and suggest that school bullying victims feel most vulnerable at school, resulting in a greater need for self-protection in that specific environment [4]. Electronic bullying victims may not know the source of the bullying, potentiating a distinct sense of fear related to an invisible attacker [12] who may attack at any place and time. This fear of the unknown may drive a feeling of vulnerability and perceived need for self-protection among victims of electronic bullying.

Limitations

This study utilized data collected from the CDC's 2011, 2013, and 2015 High School Youth Risk Behavior Surveys (YRBS). Because this data was self-reported, and reports of these behaviors were not validated externally, over-reporting and underreporting is possible. Students may be reluctant to report participating in risky behaviors, especially weapon carrying, potentially impacting the findings. The YRBS is administered to youth attending school, thus, these findings are not representative of all high school-aged youth [1]. Based on the examined variables, participants with missing data on the bullying category variables, sex, race/ethnicity, and grade were excluded from analyses, thus affecting the overall sample size. Finally, we used cross-sectional data for our analyses. Therefore, these findings are not causal and the order of events cannot be determined.

Though research with the vulnerable youth population is often challenging in terms of recruitment and human subjects' protections, it is essential that we understand electronic bullying and traditional bullying of adolescents from their unique, first-hand perspective. This perspective may vary across populations of students, including the more than 1.5 million school-aged children who are home-schooled [42]. As such, future research should include home-schooled youth and youth who may otherwise not be enrolled in school for various reasons. Research is also needed to identify causal relationships between bullying behaviors and risky health behaviors to reduce the cause and limit negative outcomes. Additionally, future studies using methods that support confidentiality and promote honest self-reporting will also improve the accuracy of the findings.

Implications

Bullying, in any form, is a serious youth health concern. There is evidence to support mental and physical health consequences associated with bullying and electronic bullying victimization, including suicidality [9,43,44]. Thus, the potential seriousness of the problem cannot be overlooked.

Bullying prevention programs have been in place for decades [45] while electronic bullying prevention programs have been recently developed. However, a 2018 systematic review of electronic (cyberbullying) programs found a lack of programs targeting younger youth (ages 6 - 11) and those with special needs [46]. Furthermore, not all schools have bullying programs in place but may label a school bully-free in hopes of curbing bullying behavior [8]. It is not enough to label a school as having a zero-tolerance for bullying if consequences for participating in such behavior are ambiguous or not enforced. Creating a safe, positive school environment where bullying is not tolerated, is essential.

Our study has shown that electronic bullying is trending downward, specifically among girls; likewise, bullying at school is trending downward, especially among boys. These decreased rates of both types of bullying suggest successful efforts on the part of educators, school personnel, law enforcement, and other community members in promoting electronic bullying awareness and prevention. Building on the success of bullying awareness and prevention programs, efforts should continue to focus on decreasing both traditional and electronic bullying, through awareness, prevention, and intervention strategies that address various types of bullying. Additionally, efforts to curb electronic bullying must also address passive-aggressive behaviors that allow perpetrators to be definitively angry and toxic to others, but with an indirect approach that supports disinhibition. The disinhibition that is afforded to users of the Internet may contribute to electronic bullying perpetration, especially among females [47], but prior studies exploring sex and electronic bullying were somewhat inconsistent in identifying gender differences. Males have been shown to be more likely to be involved in physical bullying [11,48] and this has held true over time. Regardless, in identifying strategies for reducing bullying behaviors of any type, it may be helpful to consider the differences between male and female youth regarding the type of aggression and potential factors driving the perpetration.

Considering that a high proportion of students do not report being victimized by bullying [49], it becomes imperative for adults to recognize changes in behavior, inquire about concerns of bullying and electronic bullying, and address concerns in a timely manner. Research has shown that adolescents perceive that nothing can be done to curtail bullying, especially electronic bullying [49]. Further research is needed to identify effective adult responses to reports of bullying and electronic bullying, as well as interventions that do not punish or dismiss victims, so that youth are encouraged to report bullying victimization.

This study demonstrates that bullying and electronic bullying victimization are associated with risky health behaviors among youth, including those that occur at school. Recognizing these risks can assist educators, health practitioners, and other adults in better prevention and management of traditional and electronic bullying victimization and may reduce negative health outcomes.

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