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Exposure to Violence in the School Setting and Suicidal Ideation and Attempts Among United States High School Students: 2003-2013 CDC Youth Risk Behavior Survey.

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Exposure to Violence in the School Setting and Suicidal Ideation and Attempts Among United States High School Students: 2003-2013 CDC Youth Risk Behavior Survey.

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An abstract of
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Abstract

Exposure to Violence in the School Setting and Suicidal Ideation and Attempts Among United States High School Students: 2003-2013 CDC Youth Risk Behavior Survey.

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BACKGROUND: Suicide is a serious public health problem that affects millions of individuals worldwide. Suicide and suicidal behaviors are complex phenomena that arise from numerous risk factors. Current research has examined the impact of violence exposure on mental health and behavior, but little research has focused specifically on the impact of violence experienced in the school setting and suicidal behaviors among adolescents.

METHODS: This study utilized data from the CDC Youth Risk Behavior Survey combined dataset that contained data from the YRBS surveys conducted from 1991-2013. Using this data analysis was conducted to assess the association between suicidal behavior and violence within the school setting from 2003-2013. From this data, logistic regression analysis was utilized to estimate the association between suicidal behavior (considered suicide, made a suicide plan, and attempted suicide) and violence within the school setting (having been in a physical fight on school property, having been threatened or injured at school with a weapon, and having been bullied on school property). Logistic regression was used to assess the crude and adjusted associations between each school violence exposure variable and each suicidal behavior. Adjusted models also tested whether there was interaction between the school violence exposures and any of the covariates of interest. Trend analysis was also conducted on this National data over the time period of 2003-2013. All analyses were weighted to account for the complex survey design.

RESULTS: Overall, 15.8 % of students reported having considered suicide, 13% of students reported having made a suicide plan, and 7.6% of students reported having attempted suicide within the past 12 month. After controlling for potential confounders, a significant association was found between school violence exposure (having been in a physical fight on school property, having been threatened or injured at school with a weapon, and having been bullied on school property), and students who considered suicide, made a suicide plan, and attempted suicide. However, the association between exposure to school violence and suicidal ideation and attempts varied by age, race/ethnicity, and feelings of sadness or hopelessness.

CONCLUSIONS: This study identified a significant association between exposure to violence within the school setting and considering suicide, making a suicide plan, and attempting suicide among students in grades 9-12. These findings are essential in developing suicide prevention efforts within the school systems. Follow-up studies are needed to better understand the association, and direction of causality between school violence and suicide behaviors among this population.

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Introduction

Epidemiology of Suicide

Suicide is a serious public health problem that affects millions of individuals worldwide [2]. Suicide places a heavy burden on the population in terms of the emotional suffering that families and communities experience, as well as the economic costs associated with medical care and lost productivity [3]. In 2013, suicide was the 10th leading cause of death in the United States, with 41,149 suicides reported (12.6 per 100,000) accounting for 113 suicides each day [4]. Suicide dramatically affects the lives of families, friends and communities; causing survivors to experience a range of complex grief reactions including: guilt, anger, abandonment, denial, helplessness, and shock. It is estimated that between 6 and 32 survivors exist for each suicide completion [5]. Additionally, suicide results in an estimated \$51 billion in combined medical and work loss costs. [4] Not only is suicide a major public health problem within the United States, but also affects millions of individuals globally. In 2012, suicide accounted for 1.4% of all deaths worldwide, making it the 15th leading cause of death in the world. Furthermore, an estimated 804,000 suicide deaths occurred worldwide in 2012, representing an annual global age-standardized suicide rate of 11.4 per 100,000 population [2].

Young people are among those most affected by suicide. Worldwide, suicide is now the second leading cause of death for individuals between the ages of 15 and 29, and is the third leading cause of death among individuals aged 10-14 years. However, actual deaths from suicide are only a part of the problem. For each individual who dies as a result of suicide, many individuals survive attempts made to take their own life. In 2013, among United States students in grades 9-12, 17.0% of students seriously considered attempting

suicide in the previous 12 months, 13.6% of students made a plan about how they would attempt suicide in the previous 12 months, and 8.0% of students attempted suicide one or more times in the previous 12 months [4].

Unfortunately, current statistics on suicide among all ages may greatly underestimate the actual incidence of suicide, suicide attempts, and suicidal ideation. Barriers associated with current data collection methods, as well as within the community, make it difficult to fully understand the burden of suicide. The current knowledge on suicide attempts and deliberate self-harm among young individuals is primarily based on hospital and survey data [6]. There is evidence to suggest that, on average, only 25% of those carrying out suicidal acts make contact with a hospital. Furthermore, the likelihood that young individuals seek professional help for mental health problems is low [6]. Jorm and colleagues found that in the case of a mental health problem, only a small proportion of adolescents (aged 12–17 years) would seek help from a general practitioner or mental health specialist, whereas half would turn to their family for help [7]. Additionally, the sensitive nature and stigmatization of suicide, as well as the illegality in some countries [8], may also contribute to underreporting and a reluctance to engage in help seeking behaviors.

Suicide and Violence

Suicide, suicide attempts, and suicidal ideation are complex phenomena that have been found to be associated with a combination of individual, relational, community, and societal risk factors. Individual risk factors alone include: previous suicide attempts, mental disorders, harmful use of alcohol, financial loss, chronic pain, and a family history of suicide [2]. For example, a prior suicide attempt is the single most potent risk factor for youth suicide in both case–control and prospective studies, elevating the risk of a subsequent suicide completion by 10 to 60 fold [9]. Other key relational, community, and societal factors

include: family history of child maltreatment, access to lethal methods, difficulties in accessing health care, stigma, culture or religious beliefs, discrimination, disaster, sense of isolation, abuse, and violence [2].

Many adolescents are regularly exposed to high levels of violence at home, at school, and in their neighborhoods [10]. Exposure to high levels of violence and victimization have been consistently related to posttraumatic stress disorder symptoms and other mental health problems such as increased levels of anger, anxiety, and depression [10]. According to Hinduja and Patchin, youth who are bullied, or who bully others are at an increased risk for suicidal thoughts, attempts, and completed suicides [11]. Kaltiala-Heino et al., conducted a study in which 16,410 Finnish students aged 14-16 years completed a survey focused on adolescent health. Among boys who were frequently bullied, 4% had severe suicidal ideation (compared to 1% for boys who were not bullied). Among girls who were frequently bullied, 8% exhibited signs of severe suicidal ideation (compared to 1% for girls who were not bullied). Of those who bullied others 8% of boys and 8% of girls displayed severe suicidal ideation (compared to 1% for both boys and girls who reported no involvement in bullying)[12]. More recently the nature of adolescent victimization has evolved due to the rise in the use of technology, which has led to an increase in cyber bullying. Cyber bullying, defined as “willful and repeated harm inflicted through the use of computers, cell phones, and other electronic devices,” has also been shown to increase the risk of suicide and suicidal behaviors [11]. Approximately 15–35% of students have been victims of cyber bullying while about 10–20% of students admit to cyber bullying others [11]. In addition to bullying, research has also indicated a greater likelihood of depression and suicide attempts among victims of violence between intimate partners [13]. Furthermore, a study conducted by Sigfusdottir concluded that exposure to family conflict and violence and to sexual abuse

increases the likelihood of both depressed mood and anger as well suicidal ideations and suicidal attempts among adolescent females and males [14]. Ongoing research has also linked exposure to community violence with disruptions in children's overall well-being [15].

Suicide and Violence Experienced in the School Setting

Research has examined the impact of violence exposure on mental health and behavior, but little research has focused specifically on the impact of violence experienced in the school setting and suicidal behaviors among adolescents. School violence may include incidents of bullying, threats, weapon carrying, homicide, spree shootings, and fatalities [16]. Exposure to violence within the school setting remains a significant problem. Recent statistics indicate that from July 1, 2011 through June 30th, 2012, there were 45 school-associated violent deaths in the United States among student, staff, and non-student individuals (26 homicides, 14 suicides, and 5 legal intervention deaths); accounting for 15 homicides, and 5 suicides among youth aged 5-18 years[17] . Since June 2012, there have been additional school-associated violent deaths, including the Sandy Hook Elementary School shooting on December 14, 2012, in Newtown, Connecticut which resulted in 20 child homicides, 6 adult homicides, and 1 adult suicide [17]. Furthermore, according to the Youth Risk Behavior Survey, 7 % of students in grades 9-12 reported being threatened or injured with a weapon such as a gun, knife, or club on school property, and 8 % reported being in a fight on school property in 2013 [17]. In 2013, 19.6% of high school students reported being bullied on school property [18]. Additionally, in 2013, among students aged 12–18 years, there were approximately 1,420,900 nonfatal victimizations at school, which included 454,900 theft victimizations and 966,000 violent victimizations (simple assault and serious violent victimization) [17]. From 1992-2003, the total victimization rates among

students aged 12–18 years has generally declined both at and away from school. However in 2013, the rate of violent victimization in schools (37 per 1,000 students) was more than twice the rate of violent victimization away from school (15 per 1,000 students)[17].

Exposure to violence within the school setting, both as a witness and as a victim, can have adverse health outcomes on adolescents. Research has shown that nearly 90% of elementary, and high school students report having witnessed someone else being threatened at school, and one in four reported having seen someone else being beaten up at school [10]. A representative sample of 2,002 students aged 12 to 16 years in the United Kingdom were surveyed using a questionnaire that included measures of bullying at school, substance abuse, and mental health risk. Compared to students not involved in bullying, results from this study suggest that students who observe bullying are also at risk for certain outcomes including increased alcohol consumption, depression, anxiety, and thoughts of ending life [19]. A study conducted by Flannery et al., explored exposure to violence among 5,969 students in both elementary (grades 3-8), and high schools (grades 9-12). The Flannery study concluded that male and female students, regardless of the type of school, who experienced high levels of exposure to violence (threats, beatings, or slapping/ hitting/ punching) at school were more likely to report experiencing clinically significant levels of trauma symptoms, including: anxiety, depression, posttraumatic stress, dissociation, anger, and sexual concerns [16]. Furthermore, evidence has shown an association between bullying within the school setting and suicide and suicidal behaviors. In one study, eight percent of children reported school violence or bullying had affected their lives to the point that they attempted suicide, ran away, or refused to go to school [20].

Despite recent declines, violence still exists at high rates in our schools, and we still know little about the specific impact of exposure to violence in schools on adolescent mental health and suicidal behavior. In order to increase school safety, and improve the overall health among the adolescent population, it is crucial to better understand the association between school violence and suicide attempts and suicidal ideation. This study will explore the association between violence within the school setting and suicidal behaviors through the use of the national Youth Risk Behavior Survey (YRBS). Specifically, this analysis will evaluate the relationship between being threatened or injured with a weapon at school, being in a fight on school property, and being bullied on school property in the past 12 months and the following suicidal behaviors: 1) considered attempting suicide; 2) made a suicide plan; 3) and attempted suicide. We hypothesize that school violence is associated with an increase in suicidal behaviors among 9th - 12th grade students in the United States. In conducting this analysis, we hope to add to the current body of epidemiologic literature on the effects school violence and suicidal behaviors within the school setting in the United States, and provide additional research findings to better target prevention in this vulnerable population.

Methods

Data Source

The data for these analyses were obtained from the CDC National Youth Risk Behavior Surveys (YRBS). The YRBS was developed in 1990 to monitor health risk behaviors that significantly contribute to the leading causes of death, disability, and social problems among youth and adults in the United States [21]. The YRBS is an anonymous survey that is administered every other year to students in grades 9 -12 in public and private

schools in the United States. The National YRBS uses a three-stage cluster sample design to produce a representative sample of students in grades 9-12. The data are weighted to adjust for nonresponse and oversampling of non-Hispanic Black and Hispanic students [22].

This study utilized the YRBS combined dataset that contains data from the YRBS surveys conducted from 1991-2013 for the United States. The variables in this combined dataset have been standardized across survey years [22]. This study specifically covers the 10-year time frame of 2003-2013. These data are publically available and can be retrieved from the CDC's Youth Risk Behavior Surveillance System (YRBSS) website. Prior to data retrieval and analysis, Emory University's Institutional Review Board (IRB) committee reviewed an application for this study and determined that it did not meet the criteria of human subjects research and thus did not require IRB review.

Classification of Variables

Outcome Variables

Suicidal behaviors, the outcome of interest, is classified within the combined YRBS dataset as three separate variables: considered suicide (Q27), made a suicide plan (Q28), and attempted suicide (Q29). Information was collected on the variables "considered suicide" and "made a suicide plan" through answering "Yes" or "No" to the following questions: Q27) During the past 12 months, did you ever seriously consider attempting suicide?; and Q28) During the past 12 months, did you make a plan about how you would attempt suicide? Information on the attempted suicide variable was collected through answering question 29), During the past 12 months, how many times did you actually attempt suicide? : A. 0 times, B. 1 time, C. 2 or 3 times, D. 4 or 5 times, E. 6 or more times. A dichotomous

variable was created from the categorical variable, suicide attempt, which indicates whether a student attempted suicide 1 or more times in the past 12 months.

Exposure Variables

Violence within the school setting was measured using three separate questions: (Q17): During the past 12 months, how many times has someone threatened or injured you with a weapon such as a gun, knife, or club on school property?; (Q20) During the past 12 months, how many times were you in a physical fight on school property?; (Q24): During the past 12 months, have you ever been bullied on school property? (“Yes” or “No”). Dichotomous variables were created for Q17 and Q20 to indicate whether students had been threatened on school property 1 or more times in the past 12 months, and whether students had been bullied on school property 1 or more times within the past 12 months.

Covariates

Four covariates were considered in this study. These variables included: age, sex, race/ethnicity, and feelings of sadness or hopelessness. YRBS reports the respondent’s age using a 7 level categorical variable: 12 years or younger; 13 years old; 14 years old; 15 years old; 16 years old; 17 years old; and 18 years and older. Due to the inclusion of few students aged 13 years and younger (N=239), the age categorical variable was reformatted as a 5 level categorical variable: 5= 14 years old (reference, n= 9,862), 4= 15 years old (n= 22,272), 3= 16 years old (n= 22,845), 2= 17 years old (n= 20,985), 1= 18 years old or older (n=12,029). The variable *sex* was collected as a 2 level variable (1 = male (n=43,204), 2 = female (n=45,128)), and *grade* was collected as a 4 level variable (1 = 9th Grade (n=25,017), 2 = 10th Grade (n=22,894), 3 = 11th Grade (n=20,749) 4 = 12th Grade (n=19,367); no changes were

made to these classifications. Using two questions from the YRBS survey: Are you Hispanic or Latino?; and What is your race? (Select one or more responses.), YRBS created a 7 level categorical variable to categorize race and ethnicity (race7). This variable classifies race/ethnicity into the following categories: 1 = American Indian/Alaska Native (n=758), 2 = Asian (n=2,882), 3 = Black or African American (n=12,544), 4 = Hispanic/Latino (n=15,724), 5 = Native Hawaiian/Other Pacific Islander (n=747), 6 = White (n=51,526), 7 = Multiple Races, Non-Hispanic (n=2,994). Lastly, feelings of sadness or hopelessness have been shown to increase the risk of suicidal behaviors, and may also be associated with exposure to violence in the school setting. As such, it is important to consider this variable as a potential confounder in our analyses. The YRBS captures data on the occurrence of these feelings through answering “Yes” or “No” to Question 26 (Q26): During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?; no changes were made to this classification.

Statistical Analysis

The YRBS combined dataset was downloaded from the CDC’s YRBSS website [23]. Data were compiled and formatted using CDC-provided SAS codes. All analysis was completed using SAS v9.4. Analyses were weighted using SAS’s survey procedures in order to account for the complex survey design.

Descriptive and Bivariate Analyses

Univariate analyses were conducted to describe the characteristics of the population under study. We also conducted bivariate analyses of the distributions of suicidal behaviors by covariates of interest and school violence exposures. Chi-square tests for homogeneity

were used to determine whether the distribution of the suicidal behaviors differed with respect to the covariates of interest. Logistic regression models were used to assess the crude relationship between each suicidal behavior and each exposure variable, as well as the crude relationship between each suicidal behavior and the covariates of interest (age, sex, race/ethnicity, grade, and sadness/hopelessness). These models yielded crude odds ratios (ORs), 95% confidence intervals (CIs), and Wald Chi-square test p-values.

Multivariate Analysis

Logistic regression analysis was utilized to estimate the association between suicidal behavior (considered suicide, made a suicide plan, and attempted suicide) and violence within the school setting (having been in a physical fight on school property, having been threatened or injured at school with a weapon, and having been bullied on school property). Although the covariate grade was considered in the crude analysis, it was not considered in the adjusted analysis, due to its collinearity with age. The decision to keep the age variable in favor of the student's grade was made after finding that the age covariate had fewer missing values in comparison to the grade covariate.

Multivariate logistic models considered all possible two-way interactions between each exposure and the covariate of interest (age, sex, race/ethnicity, and feelings of sadness or hopelessness). The initial model contained all main effects and interaction terms. A backwards elimination approach was conducted on the interaction terms, with an alpha level of 0.05. All non-significant interaction terms were dropped, resulting in the fully adjusted model.

Trend Analysis

Trend analysis was conducted to determine whether there were changes in the proportion of individuals engaging in suicidal behaviors and/or reporting experiencing violence in the school setting over the study period. Linear trends using logistic regression models controlling for age, sex, race/ethnicity, and sadness or hopelessness ($p < 0.05$) were used to determine whether the relationship between suicidal ideations and attempts and violence in the school setting changed during the study period. The YRBS survey did not begin to collect data on bullying at school until 2009, thus data for this particular exposure was unavailable 2003-2008. Logistic models were used to evaluate two-way interactions between each exposure and the year variable, for each suicidal behavior outcome. Odds ratios for each year were obtained for all models that displayed significant interaction between the exposure variable and year.

Results

Descriptive Analysis

From 2003 – 2013, an estimated 15.8% of YRBS respondents reported considered suicide, 13% of students made a suicide plan, and 7.6% of students attempted suicide. Frequency distributions of the exposure variables and covariates of interest are shown in Table 1. Weighted distributions are displayed for the overall study population and by the three suicidal behavior outcomes of interest.

Among the overall student population, the largest number of students were 16 years old (26%), followed by 15 year olds (25.3%), 17 year olds (23.8%), 18+ year olds (13.7%), and 14 year olds (11.2%). The majority of students were in the 9th grade (28.4%), and the least number of students were in 12 grade (22%). The distribution of males and females were

fairly even, with 51.1% being male, and 48.1% being female. When evaluating the race/ethnicity of the student population, the majority of the students were classified as White/Non-Hispanic (59.1%). The second largest race/ethnicity category was Hispanic/Latino students (18%); followed by Black or African American students (14.4%), Multiple Races, Non-Hispanic students (3.4%), Asian students (3.3%), American Indian/Alaska Native students (0.9%), and Native Hawaiian/Other Pacific Islander students (0.9%). The majority of students (71.7%) reported *not* feeling sad or hopeless within the past 12 months. The most common experience of violence in the school setting within the last 12 months was bullying (19.9%), followed by having been in a physical fight (11.7%), and having been threatened or injured with a weapon (7.8%).

Table 1 also displays distribution of the school violence exposure variables and the covariates of interest by the three suicidal behavior outcome variables of interest. The Chi-square p-values testing the significance of the crude association between each suicidal behavior and each of the three school violence exposure variables were all statistically significant at an alpha level of 0.05. This indicates that there is a difference in the distribution of exposure to each type of school violence among students who experienced each suicide behavior and those who did not. The Chi-square p-values testing the significance of the crude association between each suicidal behavior and each covariate of interest were also statistically significant at an alpha level of 0.05; indicating differences in the distributions of these covariates among students who experienced suicide behaviors in comparison to those who did not.

Unadjusted Analysis

Bivariate analyses were performed to assess the crude associations between

student characteristics and each outcome of interest: considered suicide, suicide planning, and suicide attempt (Table 2). Compared to students aged 18 and older, the odds of considering suicide and suicide planning were greatest among students aged 15 and 16 years: considered suicide (15 yr old: cOR =1.2, 95% CI= 1.13-1.32 and 16 yr old: cOR = 1.2, 95% CI=1.13-1.32), and suicide planning (15 yr old: cOR =1.3, 95% CI= 1.14-1.37 and 16 yr old: cOR = 1.3, 95% CI= 1.17-1.4). The only exception was noted for the association between age and attempting suicide in which the odds were greater among students aged 14 (cOR = 1.4, 95% CI= 1.23-1.60), 15(cOR = 1.4, 95% CI= 1.23-1.58), and 16 (cOR = 1.4 , 95% CI= 1.26 -1.6) year olds in comparison to students aged 18 years and older. The odds of considering suicide, and suicide planning were similar among all grades. When comparing the 9th, 10th, and 11th grade students to the 12th grade students, the odds of considering suicide and planning suicide ranged from 1.1-1.2. The only difference occurred among the students who attempted suicide. When assessing the association between grade and attempting suicide, the odds of attempting suicide were highest among 9th grade students (cOR = 1.7, 95% CI= 1.52, 1.84), in comparison to 12th grade students. These findings were followed by 10th grade students (cOR 1.5, 95% CI (1.39, 1.69), and 11th grade students (cOR=1.2, 95% CI=1.12, 1.38) respectively. Compared to males, female students had higher odds of experiencing all three suicidal behaviors: considering suicide cOR=1.9, 95% CI =(1.8-2.02); suicide planning cOR=1.6, 95% CI=(1.48-1.67); and attempting suicide (cOR=2.0, 95% CI= (1.82-2.17). Compared to non-Hispanic white students, non-Hispanic students of Multiple Races had the highest odds of considering suicide (cOR = 1.7, 95% CI= 1.46-1.90). Native Hawaiian/Other Pacific Islanders (cOR = 1.7, 95% CI= 1.28-2.13), and students of Multiple Races/Non-Hispanic (cOR = 1.7, 95% CI= 1.44-2.0) had the highest odds of making a suicide plan, in comparison to Non-Hispanic White students.

While American Indian/Alaska Native high school students were more likely to report having attempted suicide (cOR = 2.6, 95% CI=2.13-3.22) than non-Hispanic white students. Lastly, the odds of considering suicide, suicide planning, and attempting suicide were higher among individuals who reported feeling sad or hopeless almost every day for two weeks or more, in the last 12 months, in comparison to those who reported not having these feelings: with crude odds ratios and 95% confidence intervals of 11.6 (10.45, 12.94); 10.6 (10.04-11.29); 8 (7.14-8.95), respectively.

In the crude analyses, all three school violence exposures were statistically significantly associated with each suicidal behavior. The strongest of these was among students who reported being threatened or injured at school with a weapon, who had 3.2 higher odds of considering suicide (95% CI=3.01, 3.43), 3.7 higher odds of making a suicide plan (95% CI = 3.49, 4.01), and 5.4 higher odds of attempting suicide (95% CI =4.97, 5.92), in comparison to students who were not threatened or injured at school with a weapon.

Multivariate Analysis

Separate models evaluated the association between each outcome of interest (considered suicide, made a suicide plan, and attempted suicide) and each school violence exposure variable (having been in a physical fight on school property, having been threatened or injured at school with a weapon, and having been bullied on school property) during the last 12 months. The results for each of these models are described below. All fully adjusted models controlled for age, race/ethnicity, sex, and feelings of sadness/hopelessness.

Considered Suicide

When assessing the association between having been in a fight on school property and considering suicide and controlling for age and sex (Table 3a), there was a significant

interaction between race/ethnicity and having been in a fight on school property, and feelings of sadness or hopelessness and having been in a fight on school property. The effect of having been in a fight on school property on considering suicide differed by both race/ethnicity and feelings of sadness or hopelessness. There was a statistically significant association between having been in a fight on school property and considering suicide for all groups except American Indian/Native Alaska Native students (regardless of feelings of hopelessness), and Native Hawaiian/Other Pacific Islander Students who reported having feelings of sadness or hopelessness. Among the groups with a statistically significant association between having been in a fight on school property and considering suicide, the magnitude of the association differed by race and feelings of sadness or hopelessness. The strongest associations were observed among Asian students. Among Asian students who reported *not* experiencing feelings of sadness or hopelessness, the odds of considering suicide among those who reported having been in a fight on school property were 3.1 (95% CI: 1.97, 4.79) times the odds of considering suicide among students who were *not* in a fight on school property. Among Asian students who reported experiencing feelings of sadness or hopelessness, the odds of considering suicide for those who reported having been in a fight on school property were 2.6 (95% CI: 1.7, 3.98) times the odds of considering suicide among students who were *not* in a fight on school property. Non-Hispanic White students displayed similar associations to Asian students. White students who reported *not* experiencing feelings of sadness or hopelessness had 2.5 (95% CI: 2.13, 2.97) times the odds of considering suicide among those who reported having been in a fight on school property in comparison to those who were *not* in a fight on school property. Among White students who reported experiencing feelings of sadness or hopelessness, the odds of having been in a fight on school property were 2.1 (95% CI: 1.87, 2.41) times higher than the odds among those who

were *not* in a fight on school property. The odds ratios for Black or African American Students, Hispanic/Latino Students, Native Hawaiian/Other Pacific Islander students, and students of multiple races/Non-Hispanic were remarkably similar. For each of these racial/ethnic groups, the odds ratio for the association between having been in a fight on school property and considering suicide for students *not* experiencing feelings of sadness or hopelessness was 1.9, while the odds ratio for the association between having been in a fight on school property and considering suicide for students who reported experiencing feelings of sadness or hopelessness was 1.6. However, the 95% confidence intervals for these groups did vary – likely due to variations in sample sizes across these groups. The estimates were most precise for Hispanic/Latino students, while they were the least precise among Native Hawaiian/Other Pacific Islander students.

When evaluating the association between considering suicide and having been threatened or injured at school with a weapon and controlling for age, sex and race/ethnicity, a significant interaction was present between having been threatened or injured at school with a weapon, and having feelings of sadness or hopelessness (Table 3a). The odds ratio for the association between having been threatened or injured at school with a weapon and having considered suicide was greater among students who did *not* report feelings of sadness or hopelessness in comparison to those who *did* report experiencing these feelings. Among students who felt sad or hopeless, the odds for considering suicide among students who were threatened or injured at school with a weapon were 2.1 (95% CI: 1.96, 2.33) times the odds of considering suicide in students who were not threatened at school. In comparison, among students who did *not* feel sad or hopeless, the odds of considering suicide among students who were threatened or injured at school with a weapon were 2.8

(95% CI: 2.42, 3.23) times the odds of considering suicide in students who were not threatened or injured at school with a weapon.

When assessing the association between considering suicide and having been bullied on school property and controlling for age and sex, a significant interaction was present between having been bullied on school property and race and having been bullied on school property and having feelings of sadness or hopelessness. Statistically significant associations between considering suicide and having been bullied at school were present for all stratum except the following: American Indian/Alaska Native students who reported feelings of sadness or hopelessness, Asian students (regardless of whether they felt sad or hopeless), and Native Hawaiian/Other Pacific Islander students who reported feelings of sadness or hopelessness. For all other groups, the odds of considering suicide among students who were bullied on school property were higher than for students who were not bullied on school property. The strongest association was noted among Black or African American students: among Black or African American students who reported having feelings of sadness or hopelessness, the odds of considering suicide among students who reported having been bullied on school property were 2.2 (95% CI: 1.65, 2.80) times the odds among students who were not bullied on school property. Among Black or African American students who reported *not* having feelings of sadness or hopelessness, the odds of considering suicide among students who were bullied on school property were 2.8 (95% CI: 2.06, 3.88) times the odds among students who were not bullied on school property.

Made a Suicide Plan

In multivariate analyses of the association between having been in a fight on school property and making a suicide plan, there was no interaction between having been in a fight

at school and any of the covariates of interest. After adjusting for age, sex, race, and having feelings of sadness or hopelessness, students who reported having been in a fight on school property within the past 12 months had 2.0 (95% CI 1.82-2.15) times the odds of making a suicide plan, compared to students who reported that they were not in a fight on school property (Table 3b).

The findings for the exposures of having been threatened or injured at school with a weapon and having been bullied on school property were very similar when examined with respect to their association with making a suicide plan. Both of these violence exposures had statistically significant interaction with feelings of sadness or hopelessness. Students who reported exposure to both types of violence were more likely to report having made a suicide plan, regardless of whether they had felt sad or hopeless; however, the magnitude of these associations was higher for those students who reported that they had *not* felt sad or hopeless.

Specifically, among students who reported experiencing feelings of sadness or hopelessness, the odds of making a suicide plan for students who were threatened or injured at school with a weapon were 2.5 (95% CI: 2.25, 2.70) times the odds of making suicide plan for students who were not threatened or injured at school with a weapon. Conversely, among students who did *not* report experiencing feelings of sadness or hopelessness, the odds of making a suicide plan among students who were threatened or injured at school with a weapon were 3.2 (95% CI: 2.67, 3.76) times the odds of making a suicide plan for students who were not threatened or injured at school with a weapon.

Likewise, among students who reported experiencing feelings of sadness or hopelessness, the odds of making a suicide plan among students who were bullied on school property were 2.0 (95% CI: 1.81, 2.17) times the odds of making a suicide plan for students

who were not bullied on school property. Among students who did *not* report having feelings of sadness or hopelessness, the odds of making a suicide plan among students who were bullied on school property were 2.7 (95% CI: 2.31, 3.17) times the odds of making a suicide plan for students that were not bullied on school property.

Attempted Suicide

When evaluating the association between suicide attempt and having been in a fight on school property within the past 12 months and adjusting for sex, race and hopelessness (Table 3c), a significant interaction was found between having been in a fight on school property and age. The association between having been in a fight on school property and reporting having attempted suicide differed by age group. Specifically, among 14 year old students, the odds of attempting suicide among students who reported having been in a fight on school property were 3.0 (95% CI 2.32-4.0) times the odds of attempting suicide for students who did not report being in a fight on school property within the last 12 months. While, among students aged 18 years and older, the odds of attempting suicide among students who were in a fight on school property were 4.0 (95% CI: 3.11, 5.19) times the odds of attempting suicide for students who were not in a fight on school property.

When evaluating the association between attempting suicide and having been threatened or injured at school with a weapon, a significant interaction was found between having been threatened or injured at school with a weapon and having feelings of sadness or hopelessness. Among students who reported experiencing feelings of sadness or hopelessness, the odds of making a suicide plan for students who were threatened or injured at school with a weapon were 3.3 (95% CI: 2.98, 3.67) times the odds of making suicide plan for students who were not threatened or injured at school with a weapon. On the other

hand, among students who did *not* report experiencing feelings of sadness or hopelessness, the odds of making a suicide plan among students who were threatened or injured at school with a weapon were 6.0 (95% CI: 4.87, 7.32) times the odds of making a suicide plan for students who were not threatened or injured at school with a weapon.

Finally, adjusting for age, sex, race, and hopelessness, students who were bullied on school property had 2.2 times the odds of attempting suicide in comparison to students who were not bullied on school property (95% CI 1.97, 2.43).

Trend Analysis

Results from the analyses of trends in suicidal behaviors and exposure to violence in the school setting from 2003 – 2013 are shown in Table 4. Significant linear changes were detected for having been in a fight on school property within the past 12 months (p -value = <0.001), indicating an overall decrease in students who were in a fight on school property during the study period. Similarly, significant linear change was noted for being threatened or injured at school with a weapon within the past 12 months (p -value = <0.01), demonstrating an overall decrease in students who experienced this type of violence from 2003 - 2013. No significant linear changes were identified for any of the suicidal behaviors during this period.

Additional analyses were conducted to assess whether there was a change in the association between having been exposed to violence within the school setting and experiencing suicidal behaviors, over the time period of 2003-2013 (Table 5). The association between suicidal behaviors and experiencing violence in the school setting was unchanged over time for all variables, except for the association between having been bullied on school property within the past 12 months and considering suicide, and having been threatened or injured at school with a weapon and having attempted suicide. The association

between both of these school violence exposures and suicidal behaviors increased over the study period.

Discussion

Findings

Violence continues to exist at high rates within schools in the United States, and still little is known about the impact that exposure to violence in the school setting can have on our youth. This analysis of the 2003-2013 National Youth Risk Behavior Survey demonstrates a significant association between school violence exposure (having been in a physical fight on school property, having been threatened or injured at school with a weapon, and having been bullied on school property), and considering suicide, making a suicide plan, and attempting suicide.

Overall, students who had considered suicide within the past 12 months, were approximately twice as likely to have been in a fight on school property, threatened or injured at school with a weapon, and bullied on school property. These findings are similar to previous findings reported by Hinduja and Patchinwith, who found that youth who experienced traditional bullying (not including cyber bullying) and victimization, as either an offender or a victim, had more suicidal thoughts than those who had not experienced such forms of peer aggression [11]. We also found that the odds of considering suicide were not only significantly associated with exposure to school violence, but the association also varied significantly for different groups of students. For example, the relationship between considering suicide and exposure to violence in the school setting varied by race/ethnicity, and/or whether students reported experiencing feelings of sadness or hopelessness. The association between having been in a fight on school property and considering suicide was

strongest among Asian and non-Hispanic White students. Furthermore, the association between having been in a fight on school property and considering suicide was strongest among Asian and non-Hispanic White students who reported that they did not have feelings of sadness or hopelessness.

Similar findings were noted among students who reported making a suicide plan. This analysis found that students who made a suicide plan in the past 12 months were more likely to have been, in a fight on school property, threatened or injured at school with a weapon, and bullied on school property. Students who reported having made a suicide plan within the past 12 months were twice as likely to have been in a fight on school property, in comparison to students who did not report having made a suicide plan. Findings also displayed that making a suicide plan was significantly associated with having been threatened or injured at school with a weapon and having been bullied on school property; however these associations varied by self-reported feelings of sadness or hopelessness. There was a statistically significant relationship between these exposures and making a suicide plan for students who *did* and *did not* report having feelings of sadness or hopelessness; however, this relationship was stronger for students who reported that they had *not* felt sad or hopeless in comparison to students who reported having felt sad or hopeless.

As with students who considered suicide and made a suicide plan, students who reported attempting suicide were more likely to have been exposed to school violence. When comparing the findings among students who attempted suicide to students who considered suicide and made a suicide plan, a difference was noted for the association with having been in a fight on school property and attempting suicide. Students who reported having been in a fight on school property had an increased odds of attempting suicide in comparison to those students who reported not having been in a fight on school property. However, the

relationship between having been in a fight at school and attempting suicide varied by age. Findings displayed that the association between having been in a fight on school property and attempting suicide was strongest among students who were aged 18 years and older. These findings were followed by students aged 17 years old, 16 years old, 14 years old, and 15 years old, respectively. Similar to those students who reported having considered suicide and made a suicide plan, the association between having been threatened or injured on school property with a weapon and attempting suicide varied by feelings of sadness or hopelessness.. The association between having been threatened or injured at school with a weapon and attempting suicide was strongest among students who reported *not* experiencing feelings of sadness or hopelessness. Students who reporting *not* experiencing feelings of sadness or hopelessness had approximately twice the odds of attempting suicide, in comparison to students who reported having feelings of sadness or hopelessness.

The findings for the associations between experiencing violence in the school setting and suicidal ideations and attempts were weaker for those students who reported feelings of sadness or hopelessness, compared to those who *did not* report those feelings. Having a history of depression, mental illness, or feeling alone have been shown to be associated with suicide [4]. For this reason, it was anticipated that the relationship between school violence and suicidal behaviors would be *stronger* among those who reported feelings of sadness or hopelessness in comparison to those who did not report these feelings. These findings are likely a result of the strong effect that sadness or hopelessness have on suicidal ideations and attempts. Both prior research and stratified analysis of the effect that feelings of sadness or hopelessness have on suicidal ideation and attempts display an increased prevalence of suicidal ideations and attempts among students reporting that they experienced feelings of sadness or hopelessness. Furthermore, stratified analysis identified that among students who

reported that they experienced feelings of sadness or hopelessness, the prevalence of suicidal ideation and attempts among students exposed to school violence was greater than the prevalence of suicidal ideations and attempts among students who did not report feelings of sadness or hopelessness and were exposed to school violence. The effect that feelings of sadness or hopelessness have on suicidal ideations and attempts may explain these surprising findings within the multivariate analyses. For example, students who report feelings of sadness or hopelessness have a predisposed risk for suicidal ideation, thus exposure to violence in the school setting may have less of an impact when compared to students who do not experience those feelings. In comparison, the students who reported not experiencing feelings of sadness and hopelessness were not subject to this increased risk of suicidal ideation and attempts, thus introducing the school violence exposure variables to this group displayed a stronger association between suicidal ideations and attempts among students exposed to school violence. Additionally, the emotional response of feeling sad or hopeless may also have a mediating effect on the relationship between school violence and suicidal behaviors. In that school violence can cause feelings of sadness or hopelessness among students, which in turn can lead to suicidal ideations and attempts. Therefore, when interpreting the findings of this study, it is important to take into consideration the effect that the variable having felt sadness or hopelessness has on the relationship between school violence and suicidal behaviors. Additionally, we do know that multiple lines of evidence display a strong association between depressive disorder and completed suicide. Therefore, it is likely that students who have successfully completed suicide would fall into this group of students that report feelings of sadness and hopelessness. We are unable to ask students who successfully completed suicide these survey questions, and thus data on suicide completion is unable to be collected within this study. Therefore, lack of data from students who

completed suicide may contribute to the weaker association between exposure to school violence and suicidal ideation and attempts among students who felt sad or hopeless. However, a relatively small number of successful suicides in the adolescent population probably limits potential impact on the observed results.

As previously mentioned, research has examined the impact of violence exposure on mental health and behavior, but little research has focused specifically on the impact of violence experienced in the school setting and suicidal behaviors among adolescents. Flannery et al. stated that adolescents who witness traumatic events of violence such as a school shooting, or who are victims of assault may experience transient mental health symptoms, including depression, increased risk for suicide and drinking problems [16]. Furthermore, Sosin et al., compared adolescents who reported being in a fight to adolescents who never fought, and found that adolescents who reported fighting accounted for 22% of students who attempted suicide [24], however these results were not specific to fighting within the school setting. Not only did this study identify significant associations between school violence and suicidal behaviors, but this study also detected a significant increase in school violence exposure among students who reported having considered suicide and those who reported having attempted suicide over the time period of 2003-2013. We found that the relationship between having been bullied at school and having considered suicide, increased from 2009 – 2013. Although we found that the prevalence of students reporting that they were threatened or injured with a weapon at school decreased during 2003- 2013, the relationship between having been threatened or injured with a weapon at school and having attempted suicide increased during this time period.

Identification of increased associations between certain school violence exposures and suicidal behaviors is extremely important. Within this analysis, the relationship between having been threatened or injured with a weapon on school property and reporting having experienced suicidal behaviors was the most alarming. Among students who reported having been threatened or injured with a weapon at school, the odds of attempting suicide was 3.3-6 times the odds of attempting suicide in comparison to those students who were not threatened or injured with a weapon at school. As previously mentioned, the relationship between having been threatened or injured with a weapon at school and having attempted suicide has also increased from 2003-2013. This information can be utilized when working to develop prevention efforts within the school system. Efforts focused on training school staff to identify threats and intervene before violent behaviors occur, through methods such as threat assessment and conflict resolution, could be beneficial [25].

Furthermore, it was found that differences between the exposure to violence and suicidal behaviors varied among students of different races/ethnicities, ages, and feelings of sadness or hopelessness. Therefore it is important to identify if these findings are useful in the development and implementation of school violence prevention efforts. School systems in the United States have implemented a variety of different programs in efforts to decrease school violence, and establish safe learning environments for students. However, further work is needed to identify the most effective school violence prevention strategies, and whether these should be tailored to specific groups. Currently, the majority of school-based violence prevention programs take one of two forms: universal interventions (all students), or selective interventions (focus on high-risk students) [26]. However, there is no consensus on which intervention types are most effective. It is likely that a combination of both universal and selective prevention strategies would be most effective when working to

decrease violence within the school systems. Universal school based interventions have been shown to be effective, however information on student populations that are at higher risk of school violence, such as students of different races, ages, and feelings of sadness and hopelessness, allows for more effective delivery of prevention methods. For example, school prevention programs can focus on students of specific age and teachers can be educated to be more aware of students who display depressive symptoms in order to intervene at an earlier time point, before violent and/or suicidal behaviors occur.

Strengths and Limitations

There is also much strength associated with utilizing the YRBS for analysis. One key strength of the YRBS is that it utilizes a three-stage cluster sample design, producing a nationally representative sample of 9th through 12th grade students. YRBS yields a large nationally representative sample that is able to produce results that are generalizable to the general U.S. high school student population. Furthermore, the YRBS is an anonymous survey that collects information on health-risks behaviors that may cause death and disability among youth. Since survey responses are not linked to individual students, it is likely that students will be truthful when answering survey questions. Thus, allowing the survey data to accurately portray the prevalence of health risks behaviors among our youth. Accurate portrayal of the prevalence of health risk behaviors is essential in the evaluation and improvement of public health policies and programs.

There are also several limitations that must be recognized when drawing conclusions from this analysis. First, the YRBSS data are comprised entirely of self-reported data, thus introducing biases such as recall bias, and non-response bias. For example, students may have underreported deviant or unfavorable behavior. Thus, the extent to which suicide

behaviors and school violence behaviors were underreporting or over reported cannot be determined. However, several studies have evaluated YRBSS and concluded that the data obtained from this survey is of acceptable and reliable quality ((CDC), 2014 #39).

Secondly, the YRBSS data only apply to youth who attend school, and therefore are not representative of all persons in this age group. In 2013, 7% of student's aged 16-24 years were not enrolled in school and had not earned a high school degree [27]. Furthermore it has been shown that youth who are not enrolled in school are more likely than youth attending school to engage in health risk behaviors ((CDC), 2014 #39). If this analysis were able to capture the youth population that do not attend high school, it is likely that the prevalence of students who were exposed to school violence behaviors would be higher than what was found within this analysis. Due to the significant association that was found between school violence and suicidal ideation and attempts, inclusion of this population would result in the identification of stronger associations between school violence and suicidal ideation and attempts among the youth of our nation if these students are also more likely to engage in suicidal ideation and attempts.

Thirdly, as with all cross-sectional studies, there is no way of determining temporality between the exposures and the outcome. We cannot establish whether the exposure to school violence preceded the suicidal behaviors. Further, given the complicated nature of these experiences and behaviors, it is unknown whether suicidal behaviors are triggered by exposure to school violence, or if suicidal behaviors put an individual at greater risk for engagement in school violence behaviors.

Lastly, there was information that the YRBS was unable to collect that could strengthen this study. First, YRBS is only able to capture data on students who have partaken in suicidal behaviors. Thus, data on suicide completion were not available for this analysis. Understanding factors associated with suicide completion is an important component in developing public health interventions directed towards suicide prevention. Secondly, there are many risk factors for exposure to violence in the school setting. Family risk factors, such as family structure, income, violence within the household, substance abuse in the household, parental involvement, and childrearing attitudes can play a role in the likelihood that a child may become violent, or be a victim of violence [18]. The YRBS did not collect this type of information on students' families, and therefore this study was unable to control for these variables. Taking these variables into account would likely help to better understand the relationship between school violence and suicidal behaviors.

Public Health Implications and Direction for Future Research

Findings from this analysis have the potential to direct public health efforts in decreasing the burden of suicide among US adolescents. Identifying that exposure to violence in the school setting is associated with suicidal behaviors is important in the development of prevention efforts within our school system. For each suicidal behavior, this study identified that the strength of these associations may vary among students of different ages, races, and of hopeless and depressive states. Furthermore, this study recognized that although students report a decline in exposure to some types of violence in the school setting, the relationships between some exposures to school violence and some suicidal behaviors have actually increased over time. Thus, these findings allow for public health efforts to further target prevention efforts within the school system.

Taking measures to decrease violence among our nation's youth, is an important step when working to decrease suicidal ideation and attempts among this population. Findings from this analysis indicate that incorporating prevention efforts that aim to decrease violence within the school system may also assist with decreasing suicidal ideation and attempts among the youth. Research has shown that many prevention approaches can reduce violence within the school system and thus promote a safe positive environment for students. Prevention efforts aimed at decreasing school violence involve multiple prevention strategies at the individual, relationship, and societal level [28]. One current strategy is the implementation of universal school based violence prevention programs. These prevention programs are delivered to all students (in a classroom, school or grade) regardless of their risk level, and have shown to reduce violent behavior among students through delivering programs such as: emotional control, positive social skills, social problem solving, conflict resolution, etc. [29] However it is important to note that programs within these universal violence prevention programs can vary in their level of effectiveness [28]. Furthermore, increasing awareness of school personnel, through education and policy change, can help in the development of skills that can assist in identifying and deescalating conflict, and promoting positive learning environments. Much advancement has been made in the field of youth violence prevention, which has resulted in the implementation of different prevention tools and program within the school system. Consistently providing tools and programs that are similar to this, may assist in decreasing the burden of suicidal ideation and attempts among the youth population.

Additional studies are needed to better understand the relationship between violence within the school setting and suicidal behaviors. Follow-up studies are needed to analyze the direction of causality between school violence and suicidal behaviors among this population.

Future studies should attempt to collect information on suicidal attempts, suicidal ideation, and completed suicide. Future research should also work to capture data that takes into account other risk factors for youth violence. Youth violence risk factors may affect the relationship between school violence and suicidal behavior. Therefore, data that include information on family risk factors such as family structure, income, violence within the household, substance abuse within the household, parental involvement, and childrearing attitudes would be pertinent to include within future analysis.

Conclusions

Suicide is a major public health problem worldwide. Suicide and suicidal behaviors are complex phenomena that arise from numerous risk factors. Thus developing targeted prevention efforts to decrease the prevalence of suicide behaviors is key in decreasing the overall burden of suicide. This study identified a significant association between exposure to violence within the school setting (having been in a school fight on school property, threatened or injured at school with a weapon, and bullied on school property) and considering suicide, making a suicide plan, and attempting suicide among US students in grades 9-12. These findings are essential because they can help to identify and direct public health prevention efforts that can be implemented to assist with decreasing the prevalence of suicidal ideation and attempts among youth. Implementation of programs and tools within the school system that are directed towards increasing awareness, providing education, implementing policy changes, and the development of skills to help decrease violent behaviors within the school system, may help to decrease suicidal ideation and attempts among the youth population. Furthermore, these findings can assist in directing future

research needs to identify causality and reciprocal relationships between school violence and suicide among adolescents.

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Tables

Table 1: Characteristics of US High School Students, National YRBS 2003-2013, by Suicidal Behaviors

Student Characteristics	Overall Characteristics		Considered Suicide		Made Suicide Plan		Attempted Suicide	
	n (%)	n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Overall	N= 88,590							
Covariates								
Age								
14 years old	9,862 (11.2)	1,496(15.4)	8,247(84.6)	1,264 (13.0)	8,467 (87.0)	738 (8.2)	8,228 (91.8)	
15 years old	22,272 (25.3)	3,622(16.5)	18,388(83.5)	2,970 (13.5)	19,008 (86.5)	1,642 (8.2)	18,363 (91.8)	
16 years old	22,845 (26)	3,733 (16.5)	18,957 (83.5)	3,112 (13.7)	19,533 (86.3)	1,721 (8.3)	18,963(91.7)	
17 years old	20,985 (23.8)	3,179(15.3)	17,644(84.7)	2,570 (12.4)	18,212 (87.6)	1,229 (6.5)	17,762 (93.5)	
18 years and older	12,029 (13.7)	1,657 (13.9)	10,262 (86.1)	1,319 (11.1)	10,573 (88.9)	640 (6.0)	10,016 (94.0)	
Grade								
9th Grade	25,017 (28.4)	4,060 (16.4)	20,666 (83.6)	3,303 (13.4)	21,372 (86.6)	1,998 (9.0)	20,197 (91.0)	
10th Grade	22,894 (26)	3,712 (16.4)	18,980 (83.6)	3,134 (13.8)	19,543 (86.2)	1,720 (8.3)	18,990 (91.7)	
11th Grade	20,749 (23.6)	3,246 (15.8)	17,340 (84.2)	2,631 (12.8)	17,915 (87.2)	1,287 (6.9)	17,489 (93.1)	
12th Grade	19,367 (22)	2,694 (14.0)	16,523 (86.0)	2,189 (11.4)	16,974 (88.6)	986 (5.6)	16,669 (94.4)	
Sex								
Female	43,204 (48.9)*	8,602 (20.1)	34,234 (79.9)	6,655 (15.6)	36,126 (84.4)	3,926 (10.0)	35,470 (90.0)	
Male	45,128 (51.1)*	5,184 (11.6)	39,487 (88.4)	4,675 (10.5)	39,897 (89.5)	2,124 (5.3)	38,050 (94.7)	
Race/Ethnicity								
White	51,526 (59.1)	7,842 (15.3)	43,335(84.7)	6,371 (12.5)	44,751 (87.5)	3,000 (6.2)	45,330 (93.8)	
American Indian/Alaska Native	758 (0.9)	168 (22.4)	582 (77.6)	140 (18.8)	605 (81.2)	97 (14.8)	560 (85.2)	
Asian	2,882 (3.3)	471 (16.5)	2,377 (83.5)	433 (15.2)	2,411(84.8)	219 (8.4)	2,395 (91.6)	
Black or African American	12,544 (14.4)	1,615 (13.1)	10,750 (86.9)	1,250 (10.1)	11,076 (89.9)	820 (8.1)	9,295 (91.9)	
Hispanic/Latino	15,724 (18)	2,661 (17.1)	12,887 (82.9)	2,246 (14.5)	13,254 (85.5)	1,381 (10.2)	12,154 (89.8)	
Native Hawaiian/Other Pacific Islander	747 (0.9)	161 (21.9)	576 (78.1)	139 (19.0)	592 (81.0)	92 (14.7)	534 (85.3)	
Multiple Races/Non-Hispanic	2,944 (3.4)	674 (23.2)	2,232 (76.8)	564 (19.5)	2,337 (80.5)	344 (12.8)	2,345(87.2)	
Sad or hopeless for 2 weeks or more within past 12 months								
Yes	24,709 (28.3)*	9,968 (40.5)	14,663 (59.5)	7,699 (31.3)	16,883 (68.7)	4,726 (21.2)	17,615 (78.8)	
No	62,669 (71.7)*	3,755 (6.0)	58,785(94.0)	3,371 (5.4)	59,081 (94.6)	1,283 (2.3)	55,614 (97.7)	
Exposures								
Having been in a physical fight on school property within the past 12 months								
Yes	10,132 (11.7)	2,694 (26.8)	7,365 (73.2)	2,270 (22.6)	7,771 (77.4)	1,639 (18.6)	7,150 (81.4)	
No	76,554 (88.3)	10,844 (14.2)	65,449 (85.8)	8,428 (11.1)	67,785 (88.9)	4,209 (6.0)	65,702 (94.0)	
Having been threatened or injured at school with a weapon within the past 12 months								
Yes	6,911 (7.8)*	2,356 (34.6)	4,447 (65.4)	2,192 (32.4)	4,577 (67.6)	1,555(26.2)	4,391 (73.8)	
No	81,303 (92.2)*	11,448 (14.2)	69,363 (85.8)	9,159 (11.4)	71,522 (88.6)	4,516 (6.1)	69,191(93.9)	
Having been bullied on school property within the past 12 month								
Yes	8,742 (19.9)**	2,647 (30.6)	6,002(69.4)	2,178 (25.2)	6,479 (74.8)	1,264 (15.7)	6,789 (84.3)	
No	35,215 (80.1)**	4,075 (11.6)	30,925 (88.4)	3,196 (9.1)	31,793 (90.9)	1,618 (5.1)	30,039 (94.9)	

* P-value <0.001 for all Chi-square testing, except for the overall values for: sex, sad/hopeless, and threatened at school

** Unable to obtain p-value due to missing values; school bullying data was not collected until 2009

Table 2: Unadjusted Odds Ratios for Associations Between Exposure to Violence in the School Setting and Whether an Individual Considered Suicide, National YRBS 2003-2013

Covariates	Considered Suicide			Made Suicide Plan			Attempted Suicide		
	OR	95% C.I.†	p-value*	OR	95% C.I.†	p-value*	OR	95% C.I.†	p-value*
Age									
14 years old	1.1	(1.02, 1.24)	0.8	1.2	(1.07, 1.34)	0.4841	1.4	(1.23, 1.60)	<.001
15 years old	1.2	(1.13, 1.32)	<.001	1.3	(1.14, 1.37)	0.008	1.4	(1.23, 1.58)	<.001
16 years old	1.2	(1.13, 1.32)	<.001	1.3	(1.17, 1.4)	<.001	1.4	(1.26, 1.6)	<.001
17 years old	1.1	(1.03, 1.21)	0.52	1.1	(1.04, 1.23)	0.192	1.1	(0.97, 1.21)	<.001
18 years and older (reference)	1	---		1	---		1	---	
Grade									
9th Grade	1.2	(1.12, 1.29)	<.0001	1.2	(1.09, 1.32)	<.0001	1.7	(1.52, 1.84)	<.0001
10th Grade	1.2	(1.13, 1.28)	<.0001	1.2	(1.15, 1.35)	<.0001	1.5	(1.39, 1.69)	<.0001
11th Grade	1.1	(1.07, 1.24)	<.0001	1.2	(1.04, 1.25)	<.0001	1.2	(1.12, 1.38)	<.0001
12th Grade	1	---		1	---		1	---	
Sex									
Female	1.9	(1.81, 2.02)	<.001	1.6	(1.48, 1.67)	<.001	2	(1.82, 2.17)	<.001
Male (reference)	1	---		1	---		1	---	
Race/Ethnicity									
White (reference)	1	---		1	---		1	---	
American Indian/Alaska Native [†]	1.6	(1.36, 1.87)	<.001	1.6	1.35, 1.96	0.006	2.6	(2.13, 3.22)	<.001
Asian	1.1	(0.95, 1.27)	0.08	1.3	(1.09, 1.46)	0.88	1.4	(1.11, 1.72)	0.01
Black or African American	0.83	(0.77, 0.9)	<.001	0.79	(0.71, 0.88)	<.001	1.3	(1.2, 1.49)	<.001
Hispanic/Latino	1.1	(1.07, 1.22)	0.03	1.2	(1.06, 1.34)	0.13	1.7	(1.57, 1.87)	0.78
Native Hawaiian/Other Pacific Islander	1.6	(1.24, 1.93)	0.02	1.7	(1.28, 2.13)	0.01	2.6	(1.87, 3.64)	0.005
Multiple Races/Non-Hispanic	1.7	(1.46, 1.90)	<.001	1.7	(1.44, 2.0)	<.001	2.2	(1.88, 2.63)	<.001
Sad or hopeless for 2 weeks or more within the past 12 months									
Yes	10.6	(10.04, 11.29)	<.001	8	(7.14, 8.95)	<.001	11.6	(10.45, 12.94)	<.001
No (reference)	1	---		1	---		1	---	
Exposures									
Having been in a physical fight on school property within the past 12 months									
Yes	2.2	(2.07, 2.35)	<.001	2.4	(2.19, 2.52)	<.001	3.6	(3.28, 3.91)	<.001
No (reference)	1	---		1	---		1	---	
Having been threatened or injured at school with a weapon within the past 12 months									
Yes	3.2	(3.01, 3.43)	<.001	3.7	(3.49, 4.01)	<.001	5.4	(4.97, 5.92)	<.001
No (reference)	1	---		1	---		1	---	
Having been bullied on school property within the past 12 months									
Yes	3.4	(3.10, 3.61)	<.001	3.3	(3.11, 3.60)	<.001	3.5	(3.12, 3.82)	<.001
No (reference)	1	---		1	---		1	---	

† C.I. Confidence interval

* Wald Chi-Square p-value

Table 3a: Adjusted Odds Ratios for Associations Between Exposure to Violence in the School Setting and Whether an Individual Considered Suicide, National YRBS 2003-2013

	Considered Suicide		
	OR	95 % C.I.†	p-value*
Having Been in a Fight on School Property Within the Past 12 Months, by Race/Ethnicity and Hopelessness, Adjusted for Age and Sex			
White, Sad/Hopeless = Yes	2.1	(1.87, 2.41)	<.001
White, Sad/Hopeless = No	2.5	(2.13, 2.97)	<.001
American Indian/Alaska Native, Sad/Hopeless = Yes	1.3	(0.70, 2.28)	0.43
American Indian/Alaska Native, Sad/Hopeless = No	1.5	(0.82, 2.75)	0.19
Asian, Sad/Hopeless = Yes	2.6	(1.7, 3.98)	<.001
Asian, Sad/Hopeless = No	3.1	(1.97, 4.79)	<.001
Black or African American, Sad/Hopeless = Yes	1.6	(1.35, 1.85)	<.001
Black or African American, Sad/Hopeless = No	1.9	(1.55, 2.26)	<.001
Hispanic/Latino, Sad/Hopeless = Yes	1.6	(1.37, 1.81)	<.001
Hispanic/Latino, Sad/Hopeless = No	1.9	(1.57, 2.22)	<.001
Native Hawaiian/Other Pacific Islander, Sad/Hopeless = Yes	1.6	(0.91, 2.95)	0.1
Native Hawaiian/Other Pacific Islander, Sad/Hopeless = No	1.9	(1.05, 3.55)	0.03
Multiple Races/Non-Hispanic, Sad/Hopeless = Yes	1.6	(1.12, 2.36)	0.01
Multiple Races/Non-Hispanic, Sad/Hopeless = No	1.9	(1.33, 2.77)	<.001
Having Been Threatened or Injured at School With a Weapon Within the Past 12 Months, by Hopelessness, Adjusted for Age, Sex, and Race/Ethnicity			
Sad/Hopeless= Yes	2.1	(1.96, 2.33)	<.001
Sad/Hopeless= No	2.8	(2.42, 3.23)	<.001
Having been Bullied on School Property Within the Past 12 Months, by Race/Ethnicity and Hopelessness, Adjusted for Age and Sex			
White, Sad/Hopeless = Yes	2	(1.78, 2.33)	<.001
White, Sad/Hopeless = No	2.7	(2.25, 3.18)	<.001
American Indian/Alaska Native, Sad/Hopeless = Yes	1.7	(0.98, 2.96)	0.056
American Indian/Alaska Native, Sad/Hopeless = No	2.2	(1.27, 3.92)	0.005
Asian, Sad/Hopeless = Yes	0.73	(0.48, 1.09)	0.124
Asian, Sad/Hopeless = No	0.95	(0.61, 1.49)	0.831
Black or African American, Sad/Hopeless = Yes	2.2	(1.65, 2.80)	<.001
Black or African American, Sad/Hopeless = No	2.8	(2.06, 3.88)	<.001
Hispanic/Latino, Sad/Hopeless = Yes	2	(1.65, 2.40)	<.001
Hispanic/Latino, Sad/Hopeless = No	2.6	(2.1, 3.24)	<.001
Native Hawaiian/Other Pacific Islander, Sad/Hopeless = Yes	1.7	(0.87, 3.17)	0.1257
Native Hawaiian/Other Pacific Islander, Sad/Hopeless = No	2.2	(1.13, 4.21)	0.021
Multiple Races/Non-Hispanic, Sad/Hopeless = Yes	1.9	(1.31, 2.79)	<.001
Multiple Races/Non-Hispanic, Sad/Hopeless = No	2.5	(1.72, 3.66)	<.001

† C.I. Confidence interval

* Wald Chi-Square p-value

Table 3b: Adjusted Odds Ratios for Associations Between Exposure to Violence in the School Setting and Whether an Individual Made a Suicide Plan, National YRBS 2003-2013

	Suicide Plan		
	OR	95 % C.I.†	p-value*
Having Been in a Fight on School Property Within the Past 12 Months, Adjusted for Age, Sex, Race/Ethnicity, and Hopelessness			
	2	(1.82, 2.15)	<.001
Having Been Threatened or Injured at School With a Weapon Within the Past 12 months, by Hopelessness, Adjusted for Age, Sex, and Race/Ethnicity			
Sad/Hopeless= Yes	2.5	(2.25, 2.70)	<.001
Sad/Hopeless= No	3.2	(2.67, 3.76)	<.001
Having been Bullied on School Property Within the Past 12 Months, by Hopelessness, Adjusted for Age, Sex, and Race/Ethnicity			
Sad/Hopeless= Yes	2	(1.81, 2.17)	<.001
Sad/Hopeless= No	2.7	(2.31, 3.17)	<.001

† C.I. Confidence interval

* Wald Chi-Square p-value

Table 3c: Adjusted Odds Ratios for Associations Between Exposure to Violence in the School Setting and Whether an Individual Attempted Suicide, National YRBS 2003-2013

	Attempted Suicide		
	OR	95 % C.I.†	p-value*
Having Been in a Fight on School Property Within the Past 12 Months, by Age, Adjusted for Sex, Race/Ethnicity, and Hopelessness			
14 years old	3	(2.32, 4.00)	<.001
15 years old	2.3	(1.90, 2.83)	<.001
16 years old	3.1	(2.61, 3.73)	<.001
17 years old	3.4	(2.77, 4.29)	<.001
18 years and older	4	(3.11, 5.19)	<.001
Having Been Threatened or Injured at School With a Weapon Within the Past 12 months, by Hopelessness, Adjusted for Age, Sex, and Race/Ethnicity			
Sad/Hopeless= Yes	3.3	(2.98, 3.67)	<.001
Sad/Hopeless= No	6	(4.87, 7.32)	<.001
Having been Bullied on School Property Within the Past 12 Months, Adjusted for Age, Sex, Race, and Hopelessness			
	2.19	(1.97, 2.43)	<.001

† C.I. Confidence interval

* Wald Chi-Square p-value

Table 4: National Trends of Suicidal Behaviors and School Violence Risks, National YRBS 2003-2013

Year	2003 (%)	2005 (%)	2007 (%)	2009 (%)	2011 (%)	2013 (%)	Linear Change
Suicidal Behaviors							
Considered Suicide	16.9	16.9	14.5	13.8	15.8	17	No Change, 2003-2013
Made a Suicide Plan	16.5	13	11.2	10.9	12.8	13.6	No Change, 2003-2013
Attempted Suicide	8.5	8.4	6.9	6.3	7.7	8.1	No Change, 2003-2013
Exposure to Violence in the School Setting							
Having Been in a Physical Fight on School Property Within Past 12 Months							
	12.8	13.6	12.4	11.1	12	8.1	Decreased, 2003-2013
Having Been Threatened or Injured at School With a Weapon Within Past 12 Months							
	9.1	7.9	7.8	7.7	7.4	6.9	Decreased, 2003-2013
Having Been Bullied on School Property Within the Past 12 Months							
	*	*	*	19.9	20.1	19.6	No Change, 2009-2013

Linear trend analyses using logistic regression models controlling for sex, race, age, and hopelessness. $p < 0.05$.

* Unable to be reported due to missing values, the YRBS did not collect information in regards to school bullying until 2009.

Table 5: Adjusted Odds Ratios by Year for Associations Between Exposure to Violence in the School Setting and Whether a Student Experienced Suicide Behaviors, National YRBS 2003-2013

Year	2003 (OR)	2005 (OR)	2007 (OR)	2009 (OR)	2011 (OR)	2013 (OR)
Considered Suicide						
Having been Bullied at School Within the Past 12 Months, by Hopelessness, Adjusted for Age, Sex, and Race						
	**	**	**	1.9	2.1	2.5
Attempted Suicide						
Having Been Threatened at School Within the Past 12 months, by Hopelessness, Adjusted for Age, Sex, and Race						
	3.4	3.4	3.4	2.8	4.5	4.3

* $P < 0.001$ for all findings

** Unable to be reported due to missing values, the YRBS did not collect information in regards to school bullying until 2009.

Appendix I: YRBS Questionnaire Characteristics

Characteristics of Selected Study YRBS Questions: National YRBS 2003-2013			
Variable/Variable Label	Question	Response Options	Analysis Description
Outcome Variables			
Q27: Considered suicide 12 mos	During the past 12 months, did you ever seriously consider attempting suicide?	A. Yes B. No	Reformatted variable to consideredsuicide : 1= Yes 2= No (Reference)
Q28: Made suicide plan 12 mos	During the past 12 months, did you make a plan about how you would attempt suicide?	A. Yes B. No	Reformatted variable to suicideplan : 1= Yes 2= No (Reference)
Q29: Attempted suicide 1+ times 12 mos	During the past 12 months, how many times did you actually attempt suicide?	A. 0 times B. 1 time C. 2 or 3 times D. 4 or 5 times E. 6 or more times	Dichotomous variable suicideattempt created: Attempted suicide 1 or more times in the past 12 months. 1= Yes 2= No (reference) <i>"Yes" if B, C, D, or E are selected, otherwise "No"</i>
Compiled Variable: Q27, Q28, Q29	Compilation of the following questions: Q 27: During the past 12 months, did you ever seriously consider attempting suicide? Q28: During the past 12 months, did you make a plan about how you would attempt suicide? Q29: Dichotomous variable: Attempted suicide 1 or more times in the past 12 months?	A. Yes B. No	Dichotomous variable suicidebavior created: Partook in on or more of the three suicidal behaviors in the past 12 months. 1= Yes 2= No (reference) <i>"Yes" if "Yes" is selected for 1 of the following questions: Q27, Q28, Q29; otherwise "No".</i>

Independent Variables			
Q17: Threatened at school 1+ times 12 mos	During the past 12 months, how many times has someone threatened or injured you with a weapon such as a gun, knife, or club on school property?	A. 0 times B. 1 time C. 2 or 3 times D. 4 or 5 times E. 6 or 7 times F. 8 or 9 times G. 10 or 11 times H. 12 or more times	Dichotomous variable SchoolThreat created: Threatened on school property with a weapon 1 or more times in the past 12 months. 1= Yes 2= No (reference) <i>"Yes" if B, C, D, E, F, G, and H are selected; "No" if A is selected.</i>
Q20: Fought school 1+ times 12 mos	During the past 12 months, how many times were you in a physical fight on school property?	A. 0 times B. 1 time C. 2 or 3 times D. 4 or 5 times E. 6 or 7 times F. 8 or 9 times G. 10 or 11 times H. 12 or more times	Dichotomous variable schoolfight created: In a fight on school property 1 or more times in the past 12 months. 1= Yes 2= No (reference) <i>"Yes" if B, C, D, E, F, G, and H are selected; "No" if A is selected.</i>
Q24: Bullied past 12 months	During the past 12 months, have you ever been bullied on school property?	A. Yes B. No	Reformatted variable to schoolbullying : 1= Yes 2= No (Reference)
Covariates			
Q1: Age	How old are you?	A. 12 years or younger B. 13 years old C. 14 years old D. 15 years old E. 16 years old F. 17 years old G. 18 years old or older	Categorical variable created agecat : 1= 14 years old 2= 15 years old 3= 16 years old 4= 17 years old 5= 18 years old or older (reference)
Q3: Grade	In what grade are you in?	A. 9 th grade B. 10 th grade C. 11 th grade	YRBS formatting: 1=9 th grade

		D. 12 th grade	2=10 th grade 3=11 th grade 4=12 th grade (reference)
Q2: Sex	What is your sex?	A. Female B. Male	YRBS Formatting: 1= Female 2= Male (Reference)
Race7	Variable created by YRBSS using the following questions: Are you Hispanic or Latino? What is your race?/how would you describe yourself (Select one or more responses.)	1 = "American Indian/Alaska Native" 2 = "Asian" 3 = "Black or African American" 4 = "Hispanic/Latino" 5 = "Native Hawaiian/Other Pacific Islander" 6 = "White" 7 = "Multiple Races (Non-Hispanic)"	Categorical variable race created: 1 = "American Indian/Alaska Native" 2 = "Asian" 3 = "Black or African American" 4 = "Hispanic/Latino" 5 = "Native Hawaiian/Other Pacific Islander" 6 = "Multiple Races (Non-Hispanic)" 7 = "White"
Q26. Sad 2 wks past 12 mos	During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?	A. Yes B. No	YRBS formatting: 1. Yes 2. No (reference)