# **Title:** Violence victimization and suicide attempts among adolescents aged 12-15 years from thirty-eight low- and middle-income countries

## **Running Title:** Violence victimization and suicide in adolescents

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# ABSTRACT

**Objective:** The association between violence victimization and suicide attempts in a large representative sample of adolescents from low- and middle-income-countries (LMICs) of multiple continents has never been investigated. Therefore, the aim of the present study was to examine the relationship between being a victim of physical attacks (independent variable) and suicide attempts (dependent variable) in a sample of 117,472 students aged 12-15 years [mean (SD) age 13.8 (0.9) years; girls 49.4%] from thirty-eight LMICs in Africa, the Americas, and Asia.

**Methods:** Cross-sectional data from the Global School-based Student Health Survey (GSHS) were analyzed. Self-reported data on past 12-month suicide attempts and exposure to physical attacks were collected. Logistic regression and meta-analysis were conducted.

**Results:** The overall prevalence of suicide attempts and physical attacks were 10.1% and 39.4%, respectively. Overall, the results of the meta-analysis based on country-wise estimates adjusted for potential confounders (i.e., age, sex, food insecurity, alcohol consumption, bullying victimization, anxiety-induced sleep problems, low parental support/involvement, loneliness) showed that physical attacks were associated with a 1.71 (95%CI=1.62-1.81) times higher odds for suicide attempt.

**Conclusions:** In this large sample of adolescents from multiple LMICs, violence victimization was associated with significantly increased odds of suicide attempts. Future longitudinal studies are required to assess causality, and whether addressing exposure to violence can positively impact on adolescent suicide rates.

**Key Words: Suicide, Violence, Adolescents, Low- and middle-income countries, Epidemiology**

# 1. INTRODUCTION

Globally, suicide is the second leading cause of death among adolescents and young adults (aged 15-29 years). 1 Importantly, 79% of all global suicides occur in low- and middle-income countries (LMIC), and, on average, one in ten adolescents attempt suicide by the age of 12–15 years. 1 The most important risk factor for completed suicide in the general population is a previous suicide attempt. 2 Suicide attempts have also been shown to be associated with an increased risk for mental health problems, substance misuse, physical health problems and premature death in adulthood. 3–5 Therefore, identifying behavioral risk factors for suicide attempts is important to inform targeted interventions. Indeed, a recent systematic review on this topic concluded that some evidence suggests that suicide prevention programs targeted for specific subgroups can be effective.6 Moreover, the review provides nine suicide prevention categories that could be utilized including: training on coping skills and self-referral, marketing campaigns, gatekeeper trainings, crisis hotlines, postvention programs that guide a community to appropriately respond to suicide to prevent possible contagion, screening programs to identify and refer individuals in distress, provider training in suicide risk assessment and management, targeted mental health interventions, and social/policy interventions that increase access to care or restrict access to lethal means through policies that create a safe environment (e.g., restricting access to firearms).6

One understudied potential correlate of adolescent suicide attempts is physical violence relating to victimization. Physical violence is defined here as the application of immediate and unlawful physical force. The prevalence of youth violence is high. For example, globally, the fourth leading cause of death in young people is homicide (10–29 years old). 7 Importantly, there are differences in prevalence between countries with the majority of deaths due to homicide occurring in LMICs. 7 Moreover, through violence, many more young people are hospitalized as a consequence of injuries sustained due to violence. It has also been suggested that in addition to death and injuries, mental and/or emotional health problems, disability, and increased health-risk behaviors are key consequences of violence in young people. 8

Exposure to violence through victimization may increase one’s risk of suicidal behavior through several mechanisms including a decline in self-efficacy and mental well-being, and an increase in psychological stress. 9,10 Moreover, the interpersonal-psychological theory of suicidal behavior 11 proposes that an individual will not die by suicide unless s/he has both the desire to die by suicide (perceived burdensomeness and a sense of low belongingness or social alienation) and the ability to do so (developed a fearlessness of pain, injury, and death). The theory purports that the ability to die by suicide is acquired through a process of repeatedly experiencing painful and otherwise provocative events. Such experience may be acquired through victimization from physical violence. 11 Moreover, victimization may lead to feelings of perceived burdensome and a sense of low belonging or social alienation.A previous systematic review with meta-analyses on the association of exposure to violence with risk of suicide and suicide attempts included twenty-nine articles with 143 730 participants. 12 For victims of any interpersonal violence (IPV), odds ratio (OR) of subsequent suicide attempt was 1.99 (95% CI: 1.73–2.28); for child maltreatment, 2.25 (95% CI: 1.85–2.73); for bullying, 2.39 (95% CI: 1.89–3.01); for dating violence, 1.65 (95% CI: 1.40–1.94); and for community violence, 1.48 (95% CI: 1.16–1.87). Young victims of IPV had an OR for suicide death of 10.57 (95% CI: 4.46–25.07). However, this meta-analysis has one important limitation, that is, all included studies were from high-income-countries (HICs). It is important to study the relationship between physical violence and suicide in LMICs owing to differences in social and political contexts. For example, in some LMICs, research suggests that gender and common mental health problems contribute less to suicidal behaviors.13 Moreover, the majority of suicide attempts and exposure to violence occurs in such settings. 1,7 Some limited literature does exist on this relationship in LMICs. One study examined whether being bullied, fighting, and injury, in terms of frequency and nature, were significantly associated with suicidal behavior among adolescents in Western Pacific Island countries. 14 The study found that being bullied, fighting and injury were significantly associated with suicidal ideation and suicide attempts.

**1.1 *Aims of the study***

Although these previous studies have advanced the field, to date, no empirical analysis has investigated the association between violence victimization and suicide attempts in a large representative sample of adolescents from multiple LMICs and global regions, while multi-continental studies are lacking. Therefore, the aim of the present study was to examine the relationship between being a victim of physical attacks (exposure) with suicide attempts (outcome) in a sample of 117,472 students aged 12-15 years from 38 LMICs spanning multiple continents.

# 2. MATERIALS AND METHODS

## 2.1. The survey

Publicly available data from the Global School Health Survey (GSHS) were analyzed. Details on this survey can be found at http://www.who.int/chp/gshs and http://www.cdc.gov/gshs. Briefly, the GSHS was jointly developed by the WHO and the US Centres for Disease Control and Prevention (CDC), and other UN allies. The core aim of this survey was to assess and quantify risk and protective factors of major non-communicable diseases. The survey draws content from the CDC Youth Risk Behavior Survey (YRBS) for which test-retest reliability has been established. 15 The survey used a standardized two-stage probability sampling design for the selection process within each participating country. For the first stage, schools were selected with probability proportional to size sampling. The second stage involved the random selection of classrooms which included students aged 13-15 years within each selected school. All students in the selected classrooms were eligible to participate in the survey regardless of age. Data collection was performed during one regular class period. The questionnaire was translated into the local language in each country and consisted of multiple-choice response options; students recorded their response on computer scannable sheets. All GSHS surveys were approved, in each country, by both a national government administration (most often the Ministry of Health and/or Education) and an institutional review board or ethics committee. Student privacy was protected through anonymous and voluntary participation, and informed consent was obtained as appropriate from the students, parents and/or school officials. Data were weighted for non-response and probability selection.

From all publicly available data, we selected all nationally representative datasets from LMICs (based on the World Bank classification at the time of the survey) that included the variables used in the current analysis. If there were more than two datasets from the same country, we chose the most recent dataset. A total of 38 LMICs were included in the current study. The characteristics of each country or survey are provided in **Table 1**. For the included countries, the survey was conducted between 2009 and 2017.

## 2.2. Variables

### 2.2.1. Suicide attempt

Suicide attempt was assessed by the question “During the past 12 months, how many times did you actually attempt suicide?” and was defined as at least one suicide attempt in the past 12 months.

### 2.2.2. Physical attack

Students were first provided with the following explanation on physical attacks: “A physical attack occurs when one or more people hit or strike someone, or when one or more people hurt another person with a weapon (such as a stick, knife, or gun). It is not a physical attack when two students of about the same strength or power choose to fight each other. Subsequently, they were asked “During the past 12 months, how many times were you physically attacked?” with answer options 0, 1, 2-3, 4-5, 6-7, 8-9, 10-11, and ≥12 times. Physical attack was defined as having been attacked at least once.

### 2.2.3. Control variables

The control variables were selected based on their previously reported associations with both the exposure and outcome, and included age, sex, food insecurity, alcohol consumption, bullying victimization, anxiety-induced sleep problems, low parental support/involvement, and loneliness 14,16–22. Food insecurity was used as a proxy for socioeconomic status as there were no variables on socioeconomic status in the GSHS. Also, anxiety-induced sleep problems were considered a proxy for psychiatric disorders as there were no variables on psychiatric disorders, including depression, in the dataset. Food insecurity was assessed by the question “During the past 30 days, how often did you go hungry because there was not enough food in your home?” Answer options were categorized as ‘never’, ‘rarely/sometimes’, and ‘most of the time/always’. Alcohol consumption was defined as having had one drink containing alcohol for at least one day in the past 30 days. Bullying victimization referred to having been bullied on at least one day in the past 30 days. Anxiety-induced sleep problems was defined as replying ‘most of the time’ or ‘always’ to the question “During the past 12 months, how often have you been so worried about something that you could not sleep at night?” Low parental involvement and support was defined as answering ‘rarely’ or ‘never’ to all of the following three questions: (a) ‘during the past 30 days, how often did your parents or guardians check to see if your homework was done?’; (b) ‘during the past 30 days, how often did your parents or guardians understand your problems and worries?’; and (c) ‘during the past 30 days, how often did your parents or guardians really know what you were doing with your free time?’. 23 Loneliness was defined as having answered ‘most of the time’ or ‘always’ to the question “During the past 12 months, how often have you felt lonely?”

## 2.3. Statistical analysis

Statistical analyses were performed with Stata 14.1 (Stata Corp LP, College station, Texas). The analysis was restricted to those aged 12-15 years as most students were within this age range and the exact age outside of this age range was not provided. Using the overall sample, the prevalence of suicide attempts and number of times physically attacked in the past 12 months were calculated. The frequency of physical attacks was categorized as 0, 1, 2-3, and ≥4 times as the numbers in the extreme categories were small. We conducted logistic regression analysis using country-wise samples to assess the association between physical attacks (exposure) and suicide attempts (outcome) with and without adjustment. The former was adjusted for age, sex, food insecurity, alcohol consumption, bullying victimization, anxiety-induced sleep problems, low parental support/involvement, and loneliness. An overall estimate was obtained by combining the estimates for each country into a meta-analysis with fixed effects. We also calculated the Higgins’s *I*2 which represents the degree of heterogeneity that is not explained by sampling error with a value of <40% often considered as negligible and 40-60% as moderate heterogeneity. 24 All variables were included in the regression analysis as categorical variables with the exception of age (continuous variable). Sampling weights and the clustered sampling design of the surveys were taken into account. Results from the logistic regression analyses are presented as odds ratios (ORs) with 95% confidence intervals (CIs). The level of statistical significance was set at p<0.05.

# 3. Results

A total of 117,472 students aged 12-15 years [mean (SD) age 13.8 (0.9) years; girls 49.4%] were included in the current analysis. The overall prevalence of suicide attempts and physical attacks were 10.1% and 39.4%, respectively, although the prevalence varied widely between countries (Table 1). The prevalence of those who were attacked 1, 2-3, and ≥4 times in the past 12 months were 15.4%, 13.3%, and 10.7%, respectively. There was a linear increase in the prevalence of suicide attempts by increasing number of times physically attacked in the past 12 months although the prevalence was similar between 1 time and 2-3 times (**Figure 1**). The prevalence of suicide attempts was only 7.2% among those without violence victimization but this increased to 18% among those who were exposed 4+ times. **Figure 2** illustrates the country-wise association between physical attack and suicide attempts estimated by univariable logistic regression. There was a positive association (i.e., OR>1) between physical attack and suicide attempts in all countries with this being statistically significant in the majority of countries. Overall, based on the meta-analysis, physical attacks were associated with a 2.55 (95%CI=2.43-2.68) times higher odds for suicide attempt with a moderate level of heterogeneity being observed (*I2*=66.5%). After adjustment for age, sex, food insecurity, alcohol consumption, bullying victimization, anxiety-induced sleep problems, low parental support/involvement, and loneliness, the overall estimate was attenuated to 1.71 (95%CI=1.62-1.81; *I2*=21.0%) (**Figure 2**).

# 4. DISCUSSION

In this large sample of adolescents from thirty-eight LMICs, the present study found that the overall prevalence of suicide attempts and physical attacks were high (10.1% and 39.4%, respectively). There was a positive association (i.e., OR>1) between physical attack and suicide attempts in all countries with this being statistically significant in the majority of countries. Overall, after adjustment for a variety of potential confounders, victims of physical attacks had a 1.71 times higher odds for suicide attempts, while in terms of individual countries, the OR was >2 in seven countries, and >3 in one country.

As mentioned, the prevalence of suicide attempts in the present sample were high (10.1%) compared to statistics reported for young adolescents from HICs. For example, the reported figure for the US was 6.9%. 25 Moreover, rates of reported physical attacks in the present sample (39.4%) were also high when compared to those of samples of young adolescents from HICs. For example, in the US, the corresponding figure was 20.8%. 26 The high rates of these behaviors observed in LMICs demonstrate an urgent need to address such issues.

Taken together, the findings from the present study support the existing literature showing positive associations between violence victimization and suicide attempts in single HICs. 12 Moreover, findings from the present study add to the only LMIC study on this topic 14 by showing that the association exists across most LMICs and regions. Importantly, the overall OR was 1.71, and most countries had ORs which were much higher than one. There were seven countries with OR>2 and one country with OR>3. However, studies using machine learning have produced ORs of 20-30 for suicide attempts 27and have been argued to be of low clinical relevance.28 Such low ORs are likely of low clinical relevance because it means that the majority of people with violence victimization have not attempted suicide (and will not) and many of the people that did attempt suicide (or will go on to) did not experience violence victimization.

Several plausible mechanisms may explain the relationship between physical attacks (i.e., victimization) and suicide attempts among adolescents. First, exposure to violence (victimization or witnessing violence) has been found to be associated with poor overall mental health, 9 which in turn has been shown to be associated with suicidal behavior. 29 Although we had adjusted for anxiety-induced sleep problems, this might not have captured the entire spectrum of mental disorders. Second, victimization has also been shown to be associated with lower levels of self-efficacy 10 and lower levels of emotional self-efficacy have been found to be associated with suicidal behavior. 30 Next, one study found that individuals reporting increased victimization over time during adolescence also reported higher perceived stress levels in emerging adulthood and concluded that violence exposure may disrupt normative adaptation to daily stressors in emerging adulthood. 31 Moreover, higher levels of perceived stress have been found to be associated with suicidal behavior. 32 The relationship between violence victimization and suicide attempts observed in the present study is likely owing to a combination of all the discussed pathways.

The large representative sample across multiple LMICs and regions are clear strengths of this study. However, findings from this study must be interpreted in light of its limitations. First, the study is of a cross-sectional nature and it is not known whether exposure to violence precedes suicide attempts or whether suicide attempts precede exposure to violence. For example, those who have attempted suicide are at an increased risk of developing depression 33 and depression is associated with victimization 34. Future studies of a longitudinal nature are required to shed light on the direction of the association. Second, the study was based on adolescents attending school. Thus, the study results may not be generalizable to adolescents who do not attend school. In particular, the percentage of children attending school varies by country, and therefore, the present data may be more representative for some countries in comparison to others. Third, exposure to violence and suicide attempts were assessed using self-reported measures, and this may have introduced reporting biases (e.g., social desirability bias, recall bias). Finally, from the present analyses one cannot tell whether the results are due to the attempters' ideation or their attempts. To overcome this future work may wish to report the relationship between violence victimization and (1) ideation, (2) attempts, and (3) attempts among ideators.

In conclusion, in this large sample of adolescent from multiple LMICs, violence victimization was associated with a significantly increased risk of suicide attempts. Future studies of longitudinal design are warranted to assess causality, and to assess whether addressing exposure to violence can positively impact on adolescent suicide rates.

**Data availability statement:** Data used for this analysis is available via https://www.who.int/ncds/surveillance/gshs/datasets/en/

**Conflicts of Interest:** None declared

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| Table 1 Sample characteristics and prevalence of suicide attempts and physical attack | | | | | |
| Country | Na | Year | Response | Suicide | Physical |
| rate (%) | attempt (%) | attack (%) |
| Antigua & Barbuda | 1,235 | 2009 | 67 | 12.2 | 39.9 |
| Argentina | 21,528 | 2012 | 71 | 15.9 | 24.9 |
| Bangladesh | 2,753 | 2014 | 91 | 6.9 | 62.5 |
| Belize | 1,600 | 2011 | 88 | 12.0 | 28.0 |
| Benin | 717 | 2016 | 78 | 12.3 | 25.5 |
| Bolivia | 2,804 | 2012 | 88 | 20.1 | 34.8 |
| Costa Rica | 2,265 | 2009 | 72 | 8.0 | 14.0 |
| Dominican Republic | 954 | 2016 | 63 | 16.0 | 24.1 |
| East Timor | 1,631 | 2015 | 79 | 10.0 | 41.1 |
| El Salvador | 1,615 | 2013 | 88 | 12.3 | 18.7 |
| Fiji | 1,537 | 2016 | 79 | 10.3 | 34.5 |
| Ghana | 1,110 | 2012 | 82 | 26.6 | 49.4 |
| Honduras | 1,486 | 2012 | 79 | 17.1 | 20.8 |
| Indonesia | 8,806 | 2015 | 94 | 3.9 | 34.3 |
| Jamaica | 1,061 | 2017 | 60 | 18.7 | 27.0 |
| Kiribati | 1,340 | 2011 | 85 | 30.8 | 10.1 |
| Laos | 1,644 | 2015 | 70 | 5.9 | 19.5 |
| Lebanon | 3,347 | 2017 | 82 | 9.1 | 22.0 |
| Liberia | 541 | 2017 | 71 | 23.9 | 57.4 |
| Malaysia | 16,273 | 2012 | 89 | 7.0 | 29.2 |
| Mauritius | 1,955 | 2017 | 84 | 14.3 | 25.7 |
| Mongolia | 3,707 | 2013 | 88 | 9.5 | 30.5 |
| Mozambique | 668 | 2015 | 80 | 16.8 | 36.8 |
| Myanmar | 2,237 | 2016 | 86 | 8.1 | 33.5 |
| Namibia | 1,936 | 2013 | 89 | 26.2 | 41.1 |
| Nepal | 4,616 | 2015 | 69 | 10.4 | 46.0 |
| Paraguay | 1,972 | 2017 | 87 | 10.3 | 15.7 |
| Peru | 2,359 | 2010 | 85 | 17.1 | 37.4 |
| Philippines | 6,162 | 2015 | 79 | 16.4 | 38.5 |
| Samoa | 2,200 | 2011 | 79 | 60.7 | 71.1 |
| Solomon Islands | 925 | 2011 | 85 | 32.7 | 55.5 |
| Sri Lanka | 2,254 | 2016 | 89 | 6.8 | 38.1 |
| Suriname | 1,453 | 2016 | 83 | 9.4 | 23.5 |
| Tanzania | 2,615 | 2014 | 87 | 11.1 | 53.5 |
| Thailand | 4,132 | 2015 | 89 | 13.9 | 29.8 |
| Tonga | 2,067 | 2017 | 90 | 15.7 | 49.2 |
| Tuvalu | 679 | 2013 | 90 | 9.6 | 66.8 |
| Vanuatu | 1,288 | 2016 | 57 | 24.2 | 52.0 |

a Based on sample aged 12-15 years.

**Figure 1** Prevalence of suicide attempt by times physically attacked in the past 12 months

Figure 1 Country-wise association between physical attack and suicide attempts estimated by univariable logistic regression

**Figure 1** Country-wise association between physical attack and suicide attempts estimated by univariable logistic regression

Abbreviation: OR Odds ratio; CI Confidence interval

Overall estimate was obtained by meta-analysis with fixed effects

Figure 2 Country-wise association between physical attack and suicide attempts estimated by multivariable logistic regression

**Figure 2** Country-wise association between physical attack and suicide attempts estimated by multivariable logistic regression

Abbreviation: OR Odds ratio; CI Confidence interval

Models are adjusted for age, sex, food insecurity, alcohol consumption, bullying victimization, anxiety-induced sleep problems, low parental support/involvement, and loneliness.

Overall estimate was obtained by meta-analysis with fixed effects.