

# To What Extent can Adolescent Suicide Attempts be Attributed to Violence Exposure?

## A Population-Based Study from Western Canada

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### ABSTRACT

Suicide is the second leading cause of death among adolescents in Canada and globally. The purpose of our study was to calculate what proportion of adolescent suicide attempts could be prevented in the absence of verbal, physical, and sexual violence. Using the province-wide 2008 British Columbia Adolescent Health Survey ( $N = 29,315$ ) we calculated population-attributable fractions for each type of violence, as well as exposure to any violence, separately by gender, among adolescents age 12–19. We found violence victimization is implicated in the majority of suicide attempts. Focusing on violence prevention may be an important strategy for reducing suicide among young people.

**Keywords:** adolescence, attributable fractions, violence, bullying, suicide attempt, school-based survey

### RÉSUMÉ

Le suicide est, en importance, la deuxième cause de décès chez les adolescents et adolescentes au Canada et dans le monde. L'objectif de notre recherche était d'évaluer la proportion des tentatives de suicide chez les adolescents et adolescentes qui est liée à de la violence verbale, physique et sexuelle. À l'aide des données de la British Columbia Adolescent Health Survey ( $N = 29\ 315$ ), nous avons calculé la fraction des cas attribuables à chacun de ces types de violence, ainsi qu'à l'un ou l'autre de ces types de violence, chez les garçons et chez les filles, parmi les jeunes de 12 à 19 ans. Nos résultats montrent que la majorité

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des jeunes qui font une tentative de suicide ont subi de la violence. Prévenir la violence pourrait donc être efficace pour réduire le nombre de tentatives de suicide chez les jeunes.

**Mots clés :** adolescence, fractions des cas attribuables, violence, intimidation, tentatives de suicide, enquête en milieu scolaire

Violence victimization in adolescents has been identified as a significant public health problem (Mrug, Loosier, & Windle, 2008; Ruchkin, Henrich, Jones, Vermeiren, & Schwab-Stone, 2007), not only because adolescents experience higher rates of violence victimization than do other age groups in the general population, but more importantly, such experience significantly contributes to physical injury and death, as well as psychological maladjustment and mental health problems for adolescents (Finkelhor, Turner, Ormrod, & Hamby, 2009; Ruchkin et al., 2007). Considerable evidence exists suggesting that any type of violence, whether verbal teasing, being threatened with weapons, sexual harassment or sexual exploitation, and physical assault by a family member, an intimate partner, or peers at school, can all have negative effects on young people's emotional, behavioral, and developmental well-being (Buka, Stichick, Birdthistle, & Earls, 2001; Hebert, Lavoie, Vitaro, McDuff, & Tremblay, 2008; Swahn et al., 2008).

In spite of the strong relationship demonstrated between violence exposure and youth health and well-being, violence has rarely been identified as a key social determinant of health for adolescents or indeed, any age group. According to the World Health Organization's (WHO) definition, social determinants of health "are the conditions in which people are born, grow, live, work and age" (WHO, 2011). These circumstances shape people's health and are mostly responsible for the existence of health inequities (Raphael, 2010). As Mikkonen and Raphael (2010) argue, "the primary factors that shape the health of Canadians are not medical treatment or lifestyles choices but rather the living conditions they experience" (p. 7). This is particularly true for adolescents, because they less frequently suffer from acute or chronic diseases compared to other age groups. Instead, their health, including their mental health, is largely determined by the living conditions they experience and the nature of their relationships with the people in these environments.

After road traffic accidents, suicide is the next most common cause of death among adolescents both in Canada and throughout the world (Patton et al., 2009; Public Health Agency of Canada, 2011). Among the various risk factors for suicide a previous suicide attempt is considered a key predictor of completed suicide (Evans, Hawton, & Rodham, 2004). In the United States, 7.8% of grades 9–12 students taking part in the 2011 national Youth Risk Behavior Survey reported attempted suicide one or more times in the year prior to the survey (Centers for Disease Control and Prevention [CDC], 2012). Similar prevalence (7%) was reported by students in Grades 7–12 in British Columbia in 2003 (Smith et al., 2009). A number of studies among adolescents have found various types of violence exposure to be associated with suicide attempts (Borowsky, Ireland, & Resnick, 2001; Kaminski & Fang, 2009; Waldrop, Hanson, Resnick, & Kilpatrick, 2007).

Population health promotion efforts should focus on preventing the leading causes of mortality among a population. Given the link between violence and suicide attempts, could violence prevention be a worthwhile approach to deterring suicide among adolescents? The answer to this question would depend on the strength of the relationship between violence and suicide, how pervasive is the exposure to violence, and how readily

it might be effectively prevented. A considerable amount of the research documents the relationship between violence and suicide attempts, and some studies identify the strength of that relationship. To date, there do not appear to be studies that have tried to quantify the degree to which adolescent suicide can be attributed to violence exposure. Put another way, if we were to prevent all forms of violence exposure among adolescents, what proportion of suicide attempts would be prevented? This question guided our study.

## BACKGROUND

There are several types of violence victimization that have been tracked among populations of adolescents in Canada; the most common is peer-to-peer violence, such as bullying. The Health Behaviour of School-Age Children survey compared exposure to relational and physical bullying among nationally representative samples of students aged 11, 13, and 15 years from 27 countries, including Canada (Molcho et al., 2009). In the 2005–6 survey, 36% of Canadian boys and 35% of Canadian girls reported they had been bullied at school in the months prior to the survey, suggesting a higher prevalence than among students from the United States and many European countries. Another study of more than 9,000 students in grades 4 through 11 from schools in a single school district in Western Canada reported one-third of the respondents had experienced physical victimization, and two-thirds experienced verbal victimization (Trach, Hymel, Waterhouse, & Neal, 2010). A province-wide survey of British Columbia high school students in 2008 reported similarly high rates of peer-to-peer verbal and physical violence in the past year, as well as 17% of students reporting cyberbullying (Smith, et al., 2009).

There are relatively few population-based studies in Canada that have documented violence within the family, violence in dating relationships, or sexual violence. Estimates of physical abuse and sexual assault from school-based and population studies can vary widely, depending on the definition of abuse and the wording of the questions, the age groups studied, and whether the sample was secured via police reports, child welfare cases or anonymous surveys (Friedman, et al., 2011; Homma, Wang, Saewyc, & Kishor, 2012). For example, in a meta-analysis of different population-based studies of victimization among high school students, Friedman and colleagues noted the wide-ranging measures, but across the various North American studies, reported the mean of the absolute prevalence of sexual abuse was around 17% for girls and 5% for boys, while the mean of the absolute prevalence for physical abuse by family was about 11% for boys and 18% for girls. In contrast the Canadian General Social Survey (CGSS) of 2009 reported 6.9% of adolescents and young adults age 15 to 24 had been sexually assaulted in the past year, and 16.9% had been physically assaulted, although they did not specify whether those assaults occurred at home, in school, or elsewhere in the community (Perreault & Brennan, 2010). Approximately half of the sexual assaults were reported as perpetrated by friends and acquaintances, and an estimated half of physical assaults by strangers, with only 12% of physical assaults occurring by family members. Although other population-based studies suggest incidence of sexual violence declines with age (Finkelhor et al., 2009), the CGSS did not disaggregate adolescents from young adults, nor did they include adolescents younger than 15. In the British Columbia Adolescent Health Survey of 2008, 17% of adolescents reported physical abuse, and 16% of girls and 6% of boys in the province reported having ever been sexually abused and/or forced to have sex (Smith et al., 2009). In contrast, the 2008 police reports of victimization among children and youth in Canada found only 1.6% of teens reported physical assaults to police, and only 0.3% reported sexual assaults (Ogrodnik, 2010),

but this level of under-reporting has been identified as a significant limitation for using police reporting for population estimates of violence exposure.

Victimization may result in significant emotional distress and feelings of worthlessness (Epstein & Spirito, 2009; Kim, Leventhal, Koh, Hubbard, & Boyce, 2006). A meta-analytic review of twenty years' research on victimization and psychosocial maladjustment indicated violence victimization had the largest effect size on depression, and a medium effect size for lowering self-esteem (Hawker & Boulton, 2000). Depression and decreased self-esteem have been consistently reported as key risk factors of suicidality (Klomek, Marrocco, Kleinman, Schonfeld, & Gould, 2007; Saewyc, 2007; Wilburn & Smith, 2005). If an adolescent experiences severe violence or violence that occurs repeatedly, he or she may develop post-traumatic stress disorder (Kearney, Wechsler, Kaur, & Lemos-Miller, 2010), indicated as an additional risk factor for suicide (Panagioti, Gooding, & Tarrier, 2009). Substance abuse has also been identified as a risk for youth suicide (Saewyc, 2007; Swahn & Bossarte, 2007), and youth who have been victimized are more likely to report problem substance use and suicide attempts, potentially as a way of coping with distress from victimization (Smith et al., 2011).

Although it is unclear which pathways from violence victimization most commonly lead to suicide attempts, it is undoubtedly an important risk factor as indicated by both cross-sectional and longitudinal studies. Among the numerous cross-sectional studies that have been published on the association between victimization and attempted suicide, one U.S. study examined three large-scale school-based surveys (Kaminski & Fang, 2009), and found victimized adolescents were more likely than their counterparts to report suicide attempts in the past year (adjusted odds ratios ranged from 2.4 to 3.8). Another household-based population survey with nearly 4,000 12- to 17-year-olds reported comparable findings, even after controlling for demographics and other significant contributors of suicide attempts (Waldrop et al., 2007). The predictive power of violence victimization for youth suicidality has been supported by several longitudinal studies from Korea (Kim, Leventhal, Koh, & Boyce, 2009), New Zealand (Fergusson, Horwood, & Lynskey, 1996), and the United States (Borowsky et al., 2001; Salzinger, Rosario, Feldman, & Ng-Mak, 2007). Evidence from all of the studies points to a causal relationship between victimization and attempted suicide.

In some studies, violence victimization was measured in a fairly general manner by asking questions such as "How often have you been bullied in the past couple of months?" (Molcho et al., 2009), while in other studies several more specific measures allowed different forms of violence to be assessed. Physical and sexual violence are two forms whose relationship to suicide attempts has been frequently examined, although the effects of different types of sexual violence have often been studied separately as different fields of focus. Examples of different types of sexual violence include abuse within the family or by adults outside the family, sexual assaults by romantic partners, stranger rape, physical sexual harassment, and forced sex by peers in school. Adolescents who had experienced child abuse or maltreatment were found to have an elevated risk of attempted suicide during adolescence (Johnson et al., 2002; Molnar, Berkman, & Buka, 2001). Waldrop and colleagues (2007) reported that both physical and sexual assaults were risk factors of attempted suicide, as have others (Nickerson & Slater, 2009; Smith et al., 2011). Compared to physical and sexual violence, studies on verbal violence and suicide attempts are relatively limited. Findings from Epstein and Spirito's study (2009) suggest that youth who were verbally threatened in the year encompassing their research were 2.4 times more likely to have attempted suicide. Dating violence is another risk factor of suicide attempts.

Those who had been hit by a girlfriend or boyfriend were twice as likely to report attempted suicide (Epstein & Spirito, 2009; Olshen, McVeigh, Wunsch-Hitzig, & Rickert, 2007).

Regardless of where and when the violence victimization occurs, and whether the violence is verbal, physical, or sexual in nature, the findings of previous studies consistently tell us that victimized teens are at a higher risk of attempting suicide, although these studies rarely quantify that risk, either individually or cumulatively. One method for calculating such estimates is population-attributable fractions (Northridge, 1995). This method is a statistical approach which may be used, for example, in estimating the contribution of alcohol or smoking to hospitalization or deaths. Different from odds ratios, which indicate the likelihood of a risk factor leading to a negative health outcome, the population-attributable fraction analysis (PAF) aims to answer what proportion of the negative health outcome would be prevented if the risk factor were eliminated from the environment (Prigerson, Maciejewski, & Rosenheck, 2002). Population-attributable fraction estimates (also known as population-attributable risk fractions) are one tool to help policy makers prioritize where to distribute health care resources, and when to take public health action.

Some studies from other countries have used the PAF approach to quantify contributors to suicide or suicide attempts. For example, a large national study of adult suicide in Denmark examined the population-attributable risk of various factors on completed suicide, although since their focus was on actual suicides, they were limited in their predictive variables to demographic characteristics, and access to mental health services and hospitals (Mortenson, Agerbo, Erikson, Qin, & Westergaard-Nielsen, 2000). In the U.S., a large survey of adults within a health network examined the link between self-reported adverse childhood events, such as abuse, and risk for suicide attempt across the lifespan (Dube et al., 2001). They found the population attributable risk for suicide attempt was 67% for lifetime risk, and 80% for adolescent suicide attempts. Two similar studies were conducted with the U.S. National Comorbidity Survey, although one focused on physical abuse, sexual abuse and family violence but not peer-to-peer violence (Affifi et al., 2008); while the other focused solely on sexual abuse (Molnar et al., 2001). Both of these studies controlled for psychiatric co-morbid disorders, which can be potentially problematic in a cross-sectional population survey when it is difficult to determine whether the psychopathology emerged as a result of the violence exposure or preceded the violence exposure.

Although these previous PAF studies are commendable as large-scale population-based studies, all of them have limitations in their generalizability to Canadian adolescents. First, the majority of such studies have included a wide age range of adults, with mean sample ages between 40 and 50 years in most cases; the potential recall bias for retrospective reporting of both childhood violence exposure and adolescent suicide attempts is a significant limitation. Between adolescence and young adulthood, even a few years' delay in recall has been shown to produce significant inconsistency and under-reporting, much of which may be the result of forgetting but may also be the result of the stigma associated with disclosing sensitive and traumatic events (Fergusson, Horwood, & Woodward, 2000). Second, none of these studies were conducted in Canada. As a result the data were extracted from a sample comprising differing rates and types of ethnicity, potential differences in national violence exposure, and potential differences in social norms regarding violence and suicide. Any attempt to measure Canadian adolescents against these studies may result in an incorrect estimate of the risk for suicide attributable to violence exposure.

The purpose of our study, therefore, was to calculate to what extent adolescent suicide attempts could be attributed to experiences of verbal, physical and sexual violence among young people in a population-based study in Western Canada.

## METHODS

### Sample

This secondary analysis study used data from the 2008 British Columbia Adolescent Health Survey (BC AHS), a province-wide survey that was developed to monitor the health and risks facing youth in the province. The survey employed a cluster-stratified random sample design, in which 1,760 classrooms were randomly selected from a list of all classrooms in each geographic region/grade stratum in the province. All students enrolled in each selected classroom were invited to participate in the survey. In total, 29,315 students (48.5% boys, 51.5% girls) in grades 7 through 12 completed the questionnaire and provided useable data. Data from these students were then weighted to adjust for differential response rates and differential probabilities of sampling, so that they could represent over 280,000 public school students enrolled in the province during the 2007/2008 school year. Detailed information on the survey design, administration, and data processing can be found elsewhere (Saewyc & Green, 2009).

### Measures

Suicide attempt in the past year was measured with the survey item “During the past 12 months, how many times did you actually attempt suicide?” The original response options were ordinal: *0 times*, *1 time*, *2 or 3 times*, *4 or 5 times*, and *6 or more times*. Of those who indicated a suicide attempt, the majority reported a single attempt (1.7% of boys, 3.6% of girls) and fewer than 1% of youth endorsed each of the values beyond one attempt (except 2.0% of girls endorsed *2 or 3 times*). Since the overwhelming majority endorsed zero attempts, this variable was dichotomized, with one or more times being defined as having attempted suicide in the past year.

This study focused on three composite explanatory variables—verbal, physical and sexual violence victimization, all created as dichotomous variables. Verbal violence was measured with two questions asking, “During the past 12 months, how many times did another youth tease you or say something personal about you that made you feel bad or extremely uncomfortable”, with response options of *Never*, *Once*, and *2 or more times*; and “During the past 12 months, how many times have you had unwanted sexual comments or jokes directed at you?” with response options of *Never*, *Once or twice*, and *3 or more times*. A yes answer to either of these questions indicated having been verbally victimized.

Physical violence was measured with four survey items: (a) “During the past 12 months, while at school or on the way to or from school, how many times did another youth physically attack or assault you?” with response options of *Never*, *Once*, and *2 or more times*; (b) During the past 12 months, did your boyfriend or girlfriend ever hit, slap or physically hurt you on purpose?” with *Yes* or *No* as response options; (c) During the past 12 months, how many times were you in a physical fight?” with responses ranging from *0 times* to *4 or more times*, and (d) “Have you ever been physically abused or mistreated by anyone in your family or by anyone else?” with response options of *Yes* or *No*. A yes answer to any one or more of these items was coded

physical violence. Sexual violence was measured with three survey items; (a) “During the past 12 months, about how many times has another person touched, grabbed, pinched or brushed against you in a sexual way (which you did not want)?” (b) “Have you ever been sexually abused? Sexual abuse is when anyone (including a family member) touches you in a place you did not want to be touched, or does something to you sexually which you did not want,” and (c) “Have you ever been forced to have sexual intercourse when you did not want to?” with response options of *No*, *Yes by another youth*, and *Yes by an adult*. An endorsement of one or more of these questions was considered a positive indication of experiencing sexual violence.

Finally, all three of these violence victimization indices were combined to generate a global violence variable, “Any violence exposure,” with *Yes* indicating having been victimized by at least one form of violence.

**Missing responses.** Since the BC AHS is an anonymous questionnaire administered by public health nurses, the missing response rates are generally quite low. This is the case for the variables included in the study, whether the dependent variable, suicide attempts (2.1% missing) or the more sensitive questions about victimization, where most missing rates were between 2.0% for forced sexual intercourse, to 2.7% for physical abuse, to 3.8% for verbal abuse in school. Only one of the variables had a missing rate higher than 5%, being physically attacked or assaulted at school, where 6.5% of students did not answer. These rates are within the tolerance for missing response in population health surveys of adolescents, so cases with missing responses were excluded on an analysis-by-analysis basis.

## ANALYSES

Population attributable fraction estimates (PAF) were calculated to assess to what extent youth suicide attempts could be attributed to the violence that they had experienced, using the formula  $PAF = P(RR - 1)$ . Relative risk (RR) was suggested by Rockhill and colleagues (Rockhill, Newman, & Weinberg, 1998). Given that for rare events such as suicide attempts, the relative risk is almost equal to the odds ratio (OR), especially with large sample sizes (Viera, 2008), and considering our need to use appropriate statistical software to adjust for the complex cluster-stratified sampling design, we used OR as the approximation to RR in this study. Thus in the formula, P stands for the proportion of suicide attempt cases that had been victimized by a certain form of violence (reported in Table 1, lower section). OR represents the adjusted odds ratio of that form of violence victimization for suicide attempts, controlling for other forms of violence as well as age (reported in Table 2). This approach creates an estimate of how much the incidence of the outcome would be reduced if the exposure were prevented. Said another way, if we could completely prevent various types of violence from occurring, we could project a percent decrease of people reporting one or more suicide attempts.

Analyses were performed separately for boys and girls, because it has been documented consistently in the literature that the prevalence rates of both violence victimization and attempted suicide significantly differ by gender (Bridge, Goldstein, & Brent, 2006). To calculate the PAFs, in addition to the prevalence estimates of suicide attempt cases who experienced violence victimization (Table 1), multivariable logistic regressions were used to estimate adjusted odds ratios for suicide attempt in two models. The first model included three explanatory variables—verbal, physical and sexual violence victimization—plus age. The second model included the single global measure of any form of violence victimization, plus age. Age was included in the two models as a covariate to address potential maturation effects, and it was the only demographic variable

available to include in the model, since the potential confound of gender was addressed through separate models for boys and girls. The BC AHS, like many anonymous school-based surveys, has been unable to elicit reliable measures of socioeconomic status from adolescents. All analyses were conducted using the Complex Samples module in SPSS 18 to adjust for the cluster-stratified sampling design and weighted data. Because different types of violence may co-occur, we tested for multicollinearity among the three types of violence and age before conducting the logistic regression analyses. No correlation coefficient between any two of the variables exceeded 0.40. The variance inflation factors were all under 2.0, indicating that multicollinearity was not a concern in the multivariate logistic regressions (Armitage & Berry, 1994).

**Table 1**  
**Prevalence of Suicide Attempts and Violence Victimization among BC Public School Students, 2008**

	Boys % (99% CI)	Girls % (99% CI)
<i>Suicide attempts among general student population</i>		
Suicide attempts overall	3.3% (2.9–3.8)	6.6% (6.0–7.2)
<i>Suicide attempts by victimization status</i>		
Verbal violence	5.2% (4.4–6.1)	8.7% (7.8–9.7)
No verbal violence	1.5% (1.1–2.0)	2.7% (2.0–3.5)
Physical violence	6.4% (5.5–7.5)	15.8% (14.1–17.6)
No physical violence	1.0% (0.7–1.4)	2.7% (2.2–3.3)
Sexual violence	9.1% (7.4–11.1)	11.6% (10.3–13.0)
No sexual violence	2.0% (1.6–2.5)	3.2% (2.6–3.8)
Any violence	4.5% (3.8–5.2)	8.5% (7.6–9.4)
No violence of any type	0.7% (0.4–1.3)	1.6% (1.0–2.4)
<i>Violence victimization among general student population</i>		
Verbal violence	48.0% (46.7–49.3)	64.6% (63.4–65.8)
Physical violence	43.4% (42.1–44.6)	30.4% (29.2–31.5)
Sexual violence	17.1% (16.1–18.0)	40.2% (38.9–41.5)
Any violence	66.4% (65.2–67.6)	72.8% (71.6–73.9)
<i>Violence victimization among students who had attempted suicide</i>		
Verbal violence	76.6% (70.8–81.6)	85.4% (81.8–88.3)
Physical violence	83.2% (77.8–87.5)	71.5% (67.2–75.5)
Sexual violence	48.8% (42.4–55.2)	71.1% (66.9–75.0)
Any violence	92.8% (88.5–95.5)	93.6% (90.9–95.6)



## RESULTS

### Prevalence of Suicide Attempts and Violence Victimization in BC Public School Students

Suicide attempts in the past 12 months were reported by 3.3% of the male students and 6.6% of the female students, as shown in Table 1. The table also shows the prevalence of suicide attempts among those with and without exposure to these different types of violence, as well as the prevalence of the three forms of violence, and the global measure of any violence experienced by adolescent boys and girls. Violence exposure was common, with two-thirds of boys and nearly three-fourths of girls reporting victimization by at least one form of violence. For both genders, verbal violence victimization was the most common form, reported by nearly half of male students and two thirds of female students. Physical violence victimization happened to 43% of boys and 30% of girls, while sexual violence was reported by more girls than boys: 40% vs. 17%. The prevalence rates were much higher among the students who had attempted suicide in the past 12 months. For both genders, the overwhelming majority of students who had attempted suicide had been victims of at least one form of violence.

### Population-Attributable Fraction Estimates

Table 2 lists the adjusted odds ratios of and PAF estimates of both the individual forms of violence victimization for suicide attempts (Model 1), and for global violence experienced (Model 2). Students who had been verbally victimized had about twice the odds of suicide attempts than those who had no such experience, when controlling for other kinds of violence. Sexual violence showed an even stronger relationship; compared to peers who had not experienced sexual violence, the odds of suicide attempts were nearly three times greater for boys, and twice for girls. Likewise, physical violence increased the odds of suicide attempt nearly five times for both boys and girls, compared to those who had not been physically victimized. Youth who had experienced any form of violence were at least six times more likely to attempt suicide, compared to the counterparts who had experienced no violence at all.

When these odds ratios are included with the prevalence data to calculate population-attributable fractions, the PAF estimates (Table 2) indicate that, for male students, eliminating verbal violence would reduce the incidence of those reporting at least one suicide attempt by up to 40%; preventing physical violence could reduce the incidence of suicide attempt by about 66%, and eliminating sexual violence among boys could reduce the proportion who attempt suicide by up to 33%. Similarly, when controlling for other types of violence, the incidence of suicide attempt among adolescent girls might be reduced by 31% by eliminating verbal violence, 57% by eliminating physical violence, and 41% by eliminating sexual violence. The population-attributable fractions of the different forms of violence do not combine to 100% for each group, even though they are derived from models that include each type of violence, because there are some youth who experience multiple forms of violence. For both boys and girls, the population-attributable fractions for suicide attempt among those experiencing any of the types of violence measured in our study were nearly 80%.

**Table 2**  
**Adjusted Odds Ratios and Population-Attributable Fraction (PAF) Estimates of Violence Victimization for Youth Suicide Attempts**

	Boys		Girls	
	AOR (99% CI)	PAF (99% CI)	AOR (99% CI)	PAF (99% CI)
<i>Model 1</i>				
Verbal violence	2.10 (1.53–2.89)*	0.40 (0.23–0.54)	1.56 (1.16–2.08)*	0.31 (0.10–0.47)
Physical violence	4.95 (3.47–7.05)*	0.66 (0.55–0.76)	4.77 (3.83–5.94)*	0.57 (0.49–0.63)
Sexual violence	3.04 (2.29–4.01)*	0.33 (0.24–0.42)	2.34 (1.86–2.96)*	0.41 (0.30–0.50)
Age	1.04 (0.96–1.12)	-	0.89 (0.84–0.95)*	-
<i>Model 2</i>				
Any violence	6.52 (3.93–10.82)*	0.79 (0.65–0.87)	6.06 (4.08–9.00)*	0.78 (0.68–0.85)
Age	1.03 (0.96–1.12)	-	0.91 (0.86–0.97)*	-

Note: \*  $p < 0.001$

## DISCUSSION

This study of adolescent students in British Columbia shows that violence exposure is not only linked to suicide attempts, it is strongly implicated among the majority of adolescents in school who attempt suicide. For both boys and girls, whether that violence is verbal harassment and taunting, physical assaults and abuse, or sexual assaults, we can partially attribute to violence exposure between one-third to two-thirds of those youth who attempt suicide. We also considered the exposure to any form of violence as compared to no violence at all. This comparison offers an even more sobering finding: the majority of the prevalence of suicide attempts could be attributed, in part, to experiencing some form of violence.

Our results are similar to rates found by one large-scale study of suicide attempts and various childhood adverse events among adults (Dube et al., 2001), but are much higher than those reported in the other adult studies. Underreporting of both violence exposure and prior suicide attempts due to recall bias among older adults may help explain differences between our results and those among adults in other countries. The specific focus on more severe forms of violence exposure in some studies is another possible factor. The high prevalence of any violence victimization in our study was similar to that found in a study of peer-to-peer violence in one school district in the same region (Trach et al., 2010), and is much higher than the rates of violence retrospectively reported by adults in other countries, when the questions did not also include exposure to bullying in school or sexual harassment. At the same time, several studies have documented the link between bullying at school and suicidal ideation and attempts, so it is clear these forms of violence should be included in considering global exposures to violence as a contributor to suicide among adolescents.

Exposure to violence victimization, whether in school, at home, or in the community, is a significant social determinant of health for adolescents. Even in a country like Canada, which is not experiencing armed conflicts at home, and where firearms and similar weapons are not easily accessible to the general population, its importance should not be underestimated. These findings suggest that violence prevention initiatives may have further value as a strategy for suicide prevention for adolescents, especially as primary prevention. This perspective, however, does not appear to be widely considered by public health policy makers and others involved in suicide prevention initiatives. International reviews of suicide prevention strategies suggest most strategies are focused on secondary or tertiary prevention, i.e., improving screening to identify those at higher risk for suicide; means restriction for those who are actively suicidal; reducing stigma and promoting help-seeking behaviours among those who are depressed; and pharmacological and therapeutic treatments for those who have already experienced a suicide attempt (Mann et al., 2005; Buus Florentine & Crane, 2010; Cusimamo & Sameem, 2011). When effective, these become important strategies for suicide prevention; however, many are not population-based strategies but “downstream” approaches. Population-based strategies have included tactics such as social media campaigns, psychoeducational awareness-raising campaigns (i.e., how to identify signs of depression and suicidality), instruction in problem-coping skills, and the promotion of emergency sources for help to those at risk. These strategies have been targeted to the general population (Mann et al.) or to students in schools (Buus Florentine & Crane; Miller, Eckert & Mazza, 2009). Although there is evidence that changes in awareness, attitudes, and knowledge of sources for help and referral (Buus Florentine & Crane; Miller et al.), have led to some promising results, these types of population-based strategies offer weak evaluation methods. None of them focus on preventing the risk factors for suicide.

The population-attributable fraction estimates reported in this study suggest that reducing violence in young people’s daily circumstances, while generally beneficial in themselves for preventing injuries and other health issues, might also contribute toward preventing suicide, a leading cause of death among adolescents in Canada. This study offers evidence towards answering the question posed in our introduction, “Could violence prevention be a worthwhile approach to suicide prevention among adolescents?” The feasibility and affordability of such a strategy would still depend on the effectiveness of the various interventions, policies, and initiatives around violence prevention. Insofar as policy changes are guided, this may be considered an important step. Some population-based violence prevention strategies focused on adolescents have had rigorous evaluation and have shown reasonable evidence of effectiveness, especially with regards to bullying, fighting, and dating violence (Wolfe et al., 2009; Leadbeater & Sukhawathanakul, 2011), as well as interventions to prevent physical and sexual abuse (World Health Organization, 2010). To date, however, it is unknown whether effective violence prevention programs have actually led to reductions in suicides or suicidal behaviour at the population level.

As with all research, this study has both limitations and strengths, which need to be considered when weighing its evidence. The BC Adolescent Health Survey is school-based, and only includes students from public schools in British Columbia. Other adolescents, such as those from private schools, may have different victimization experiences, and the impacts on suicide attempts may vary. Adolescents who are not attending school, such as some street-involved or homeless youth, have reported significantly higher levels of both violence exposure and suicidal ideation and attempts (Smith et al. 2007), but it is unclear whether

the attributable fractions would apply equally to their experiences. This is a cross-sectional survey, and some of the measures of violence and suicide attempts are focused within the past 12 months; in some cases it is difficult to ascertain whether the violence occurred before the suicide attempt. Nevertheless, it bears consideration that this survey is one of the largest regularly repeated population-based surveys of adolescent health and risk in Canadian schools and, unlike many other school-based surveys, it includes both younger (age 12, Grade 7) and older (age 18, Grade 12) adolescents. The BC AHS also asks about several different types of violence exposure, rather than solely those forms of violence which take place at school. Although suicidal behaviour has been linked to frequency, severity, and persistence of violence exposure, it is difficult to include more detailed measures of violence exposure in a general population-based adolescent health survey. Dichotomizing the violence exposure measures, and including less severe forms of violence, may have potentially inflated the population attributable fractions results. Considering the unique scope of this research it is reasonable to include these measures of violence and it may in part explain our higher PAFs. The models did not include some other correlates of suicidal behaviour, such as substance abuse, in part because this may be a response to violence victimization as opposed to an independent cause of suicidality. Cross-sectional surveys are unable to disentangle the pathways by which violence exposure leads to suicidal thoughts and behaviour. Further longitudinal research is needed to identify the pathways from violence to suicide attempts among adolescents. Our study is limited in its geographic region to Western Canada, and to the extent that violence involvement may be more or less prevalent in other provinces, the resulting attributable fractions may be different. However, a strength of the survey is its province-wide coverage, which includes students in rural and remote as well as large metropolitan areas, and a diverse, multicultural population, thus increasing the generalizability of the results.

Although it is unlikely Canadian society could ever eliminate all forms of violence exposure among young people, it is clear that we should be placing greater emphasis on promoting effective violence prevention and violence reduction initiatives, thus supporting mental health among young people. For example, programs such as the Fourth R for high school students (Crooks, Wolfe, Hughes, Jaffe, & Chiodo, 2008) and anti-bullying programs for younger students (Leadbeater & Sukhawathanakul, 2011) can help reduce violence involvement among peers. Nurse home visiting programs and other public health strategies can help prevent family violence and physical abuse (Jack, 2010). Although the evidence for effective primary prevention strategies for sexual abuse is limited (Finkelhor, 2009) there are some initiatives that appear to offer promise, such as child and youth education around healthy relationships and abuse, bystander awareness and education programs, and situational prevention policies developed in youth-serving organizations. A wider effort to problematize pervasive forms of violence and raise awareness about violence as a key social determinant of health for adolescents may give rise in Canadian culture to a refusal to tolerate harmful levels of violence in the daily lives of youth (WHO, 2010). Along with implementing such population-based strategies, we also need population monitoring and research to be able to evaluate the effectiveness of violence prevention strategies in reducing suicide attempts among adolescent populations. Given that the societal cost of each adolescent suicide in Canada has been estimated at between \$400,000 and \$4 million (Furi & Guimont, 2003), even modest reductions in suicides from population-based violence prevention interventions would be cost-effective.

Suicide is one of the leading causes of death among adolescents in Canada, as it is around the world, and violence victimization plays a role in suicide attempts. Until we make violence prevention a priority in population health interventions for children and youth, we may achieve only limited progress in eliminating these preventable deaths and promoting mental health for all.

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