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The mediating effect of depressive symptoms on the relationship between bullying victimization and non-suicidal self-injury among adolescents: Findings from community and inpatient mental health settings in Ontario, Canada

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ABSTRACT

Although bullying victimization has been linked to a number of behavioral and emotional problems among adolescents, few studies have investigated the mechanism through which bullying victimization affect non-suicidal self-injury. The objectives of this study were to examine the effect of bullying victimization on non-suicidal self-injury and the mediating effect of depressive symptoms on the relationship between bullying victimization and non-suicidal self-injury among adolescents. Data for this study came from the *interRAI Child and Youth Mental Health* dataset. A total of 1650 adolescents aged 12–18 years ($M = 14.56$; $SD = 1.79$; 54.2% males) were analyzed. Binary logistic and Poisson regression models were conducted to identify the mediating effect of depressive symptoms on the relationship between bullying victimization and non-suicidal self-injury. Of the 1650 adolescents studied, 611 representing 37% engaged in non-suicidal self-injury and 26.7% were victims of bullying. The effect of bullying victimization on non-suicidal self-injury was partially mediated by depressive symptoms after adjusting for the effect of demographic characteristics, history of childhood abuse, social support, and mental health diagnoses. The contribution of bullying victimization and depression to non-suicidal self-injury adds to the case for the development of trauma-focused interventions in reducing the risk of non-suicidal self-injury among adolescents.

1. Introduction

Non-suicidal self-injury (NSSI) refers to “the direct, deliberate destruction of one’s own body tissue in the absence of suicidal intent” (Nock and Favazza, 2009, p. 9). It involves acts such as cutting one’s own skin with a sharp razor, scratching, hair pulling, hitting, pinching, and burning oneself (Nock and Favazza, 2009). NSSI has become a serious global public health concern, particularly among adolescents (Heath et al., 2008; Muehlenkamp, 2014; Muehlenkamp et al., 2012; Nock, 2010). Various studies from Asia (You and Leung, 2012), Australia (Tanner et al., 2015), Canada (Armiento et al., 2014), Europe (Claes et al., 2015), and the US (Sornberger et al., 2012; Brausch and Gutierrez, 2010) have found lifetime prevalence rates of NSSI among adolescent students ranges between 10–32%. Higher rates have been reported among adolescents from clinical settings ranging from 24% in Canada (Armiento et al., 2016), to 40% in Europe (Kaess et al., 2013),

and 63–80% in the US (Auerbach et al., 2014; Victor et al., 2012; Weismore and Esposito-Smythers, 2010). Swannell et al. (2014) conducted a systematic review of published studies on NSSI across the globe and found a pooled lifetime prevalence estimate of NSSI among adolescents to be 17.2%.

To date, various studies have investigated NSSI among adolescents with most showing that adolescents with a history of childhood abuse are at significant risk of engaging in NSSI (Brausch and Holaday, 2015; Ford and Gómez, 2015; Franzke et al., 2015; Gratz, 2006; Smith et al., 2014). However, few studies have examined the relationship between bullying victimization and NSSI among adolescents (e.g., Bakken and Gunter, 2012; Claes et al., 2015; Heilbron and Prinstein, 2010). Therefore, our study sought to add to the extant literature by investigating the effect of bullying victimization on NSSI among adolescents referred to community and inpatient mental health settings in Ontario, Canada.

Bullying is such a broad term that it sometimes can be difficult to distinguish from other forms of peer aggression (Cornell and

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Bandyopadhyay, 2009). Salmivalli (2010) defined bullying to mean “a subtype of aggressive behavior, in which an individual or a group of individuals repeatedly attacks, humiliates, and/or excludes a relatively powerless person” (p. 112). Olweus (1999) suggested three essential criteria in operationalizing bullying: imbalance of power, intentional harm doing, and acts carried out repeatedly over time. First, a bully must exert some sort of power or dominance over the victim. Second, the victim must suffer some form of physical or emotional harm. Teasing of a humorous and somewhat friendly nature that result in no distress would not be classified as bullying. Third, to be considered bullying, the act must be chronic and repetitive over time (Olweus, 1999). An adolescent who pushes his or her peer out of anger or frustration would not be considered a bully unless he or she repetitively does so to the point of humiliation.

Conservative estimates show that as many as 16–38% of children of school-going age will experience bullying at some point (Due and Holstein, 2008; Fekkes et al., 2005; Nansel et al., 2001). Using data from the Developmental Victimization Survey, Finkelhor et al. (2005) investigated victimization experiences in a nationally representative sample of children and adolescents from the US and found that about one in four children and adolescents were teased and harassed repeatedly in the last year. The majority of studies on bullying have reported that adolescent males are more likely to be bullies whereas adolescent females are more likely to be victims of bullying (Claes et al., 2015; Due and Holstein, 2008; Viljoen et al., 2005).

Bullying victimization is a major global public health problem among adolescents that has been linked to a number of behavioral and emotional problems including anxiety (Cohen and Kendall, 2015), depression (Cole et al., 2014; Hamilton et al., 2016), loneliness (Campbell, 2013; Murphy et al., 2015; Storch and Masia-Warner, 2004), social withdrawal (Dill et al., 2004; Runions and Shaw, 2013), low self-esteem (Fredstrom et al., 2011; Jones et al., 2014; Tsaousis, 2016), as well as poor psychosocial adjustment (Nansel et al., 2001). Various meta-analytic studies have also found support for the link between bullying victimization and the onset of depressive symptoms and internalizing problems (Reijntjes et al., 2010; Ttofi et al., 2014).

The issue of causality between bullying victimization and depressive symptoms is not yet firmly resolved. Currently, there is a healthy debate in the bullying and mental health literature regarding the direction between bullying victimization and depressive symptoms among adolescents. On the one hand, some researchers have argued and found that adolescents who are depressed are more likely to engage in bullying behavior as a way of dealing with the underlying negative feelings of depression (Papadaki and Giovazolias, 2015). Papadaki and Giovazolias (2015) in their study of school children aged between 10 and 12 years from Crete, Greece found that depressive symptoms was significantly positively associated with both bullying victimization and bullying others. On the other hand, other researchers have found that adolescents with internalizing behavior problems such as depression and negative mood state are more likely to be victimized than their counterparts who do not have such problems (Fekkes et al., 2006; McLaughlin et al., 2009). McLaughlin et al. (2009) followed 1065 grades 6–8 students from central Connecticut over a four-year period and found that bullying victimization at baseline significantly predicted emotion dysregulation at follow-up. Some of these researchers have noted that victims of bullying show strong emotional reactions and give the impression of being unable to stand up for themselves, thereby making themselves easier targets for bullies (Fekkes et al., 2006; Papadaki and Giovazolias, 2015).

One consistent finding within the literature on NSSI among adolescents has been the association between depressive symptoms and NSSI (Heath et al., 2016; Marshall et al., 2013; You and Leung, 2012), particularly among adolescents in clinical settings (Burke et al., 2015; Tuisku et al., 2012). Burke et al. (2015) followed 110 adolescents from

the US who are at risk for onset of bipolar disorder for 6-months and found that NSSI co-occur with higher levels of depressive symptoms and interpersonal stressful life events at baseline and follow-up. Another longitudinal study by Marshall et al. (2013) found that depressive symptoms at Time 1 significantly predicted NSSI at Times 2 and 3. For a detailed review of the literature on the association between depressive symptoms and NSSI among adolescents, we refer the reader to Plener et al. (2015).

The psychological distress that accompanies bullying victimization has also been linked to NSSI (Claes et al., 2015; Klomek et al., 2008). van Geel et al. (2015) conducted a meta-analysis on nine studies with fourteen independent samples ($n = 20,898$) to identify the relationship between bullying victimization and NSSI among adolescents. The authors found a significant positive relationship between bullying victimization and NSSI with adolescents who were bullied more than twice as likely to report engaging in NSSI than their counterparts who were not victimized. Indeed, some scholars have speculated that individuals with a history of trauma may engage in NSSI as a cry for help, as a form of self-punishment, or to release the stress associated with being traumatized (Hamza et al., 2012; Long et al., 2015; Nock, 2010).

This study is informed by vulnerability-stress theory (Hankin and Abela, 2005). Vulnerability-stress theory asserts that the development of internalizing and externalizing behavior problem is as a result of the combination of predisposing individual cognitive vulnerabilities and environmental hardships, stressors, or adversities (Lazarus, 1993). One's experience of adverse life events and perceptions about those events contributes to psychopathology (Swearer and Hymel, 2015). Various studies have found support for vulnerability-stress theory in understanding adolescent stress and depressive symptoms (Hankin, 2008; Hankin et al., 2015; Paredes and Zumalde, 2015). Studies have also found that the experience of adverse life events such as childhood abuse is related to the onset of depressive symptoms (Paul and Eckenrode, 2015; Widom et al., 2007), which in turn leads to more adverse life events and later depressive symptoms in a cyclical fashion (Ben-David et al., 2015; Stange et al., 2013). Based on vulnerability-stress theory, we conceptualize bullying victimization as an adverse life event that further places adolescents at risk for psychopathology and NSSI.

Notwithstanding the association between bullying victimization and depressive symptoms among adolescents, few studies have investigated the mediating effect of depressive symptoms on the relationship between bullying victimization and NSSI among adolescents from community and inpatient mental health settings. The relatively few studies on the topic are from non-clinical settings where the rate of depression and mental health problems are not as high as they are in clinical settings (Roelofs et al., 2010). A study by Hay and Meldrum (2010) examined the effect of bullying victimization on adolescent NSSI behavior using data on 426 students from selected schools in Southeastern US. In a series of multiple regressions, the authors found that bullying victimization was positively related to NSSI. This relationship was partially mediated by negative emotions among those who were victims of bullying (Hay and Meldrum, 2010). Another study by Claes et al. (2015) that utilized data from high school students from Belgium and the Netherlands found that the relationship between bullying victimization and NSSI was partially mediated by depressive symptoms.

Although studies have investigated factors associated with NSSI among adolescents, to the best of our knowledge, few studies within the Canadian context have investigated the mediating effect of depressive symptoms on the relationship between bullying victimization and NSSI among adolescents with mental health problems. Drawing on a large dataset on adolescents referred to community and inpatient mental health settings in Ontario, Canada, and based on vulnerability-stress theory (Hankin and Abela, 2005), this study has the following objectives: 1) To examine the effect of bullying victimization on NSSI, and

2) To examine the mediating effect of depressive symptoms on the relationship between bullying victimization and NSSI. Accordingly, the following hypotheses were examined: 1) there will be an association between bullying victimization and NSSI, and 2) the effect of bullying victimization on NSSI will be partially mediated by depressive symptoms, after taking into account demographic characteristics, history of childhood abuse, social support, and mental health diagnoses. Given that depressive symptoms tend to be more prevalent in clinical settings than non-clinical settings, we expect stronger association for our findings. Moreover, given that NSSI is also predicted by various factors, it was hypothesized that depressive symptoms would significantly decrease the effect of bullying victimization on NSSI rather than completely eliminate the relationship.

2. Data and methods

2.1. Participants

This study used data from the *interRAI Child and Youth Mental Health* dataset (ChYMH; (Stewart et al., 2015a)), which was collected from 24 mental health agencies in Ontario from November of 2012 to September 2016. Detailed description of the *interRAI* ChYMH including measurements of variables has been provided elsewhere by the authors (Baiden et al., 2017), in previous publications (Armiento et al., 2016; Stewart and Hirdes, 2015; Stewart et al., 2015a, 2015b), and is also available from *interRAI*'s website at <http://www.interrai.org/child-and-youth-mental-health.html>. In brief, the *interRAI* ChYMH is a comprehensive instrument comprising approximately 400 clinical elements covering various behavioral and mental state indicators, stress and trauma, child maltreatment history, strength and resilience, family and social support, substance use, medication history, diagnostic information, cognitive and executive functioning, health, nutritional status, and a number of scales that can be used for outcome measurement, as well as care planning protocols that can be used to identify areas of imminent concern or risk. Clinicians are trained to complete the instrument using information from various sources including the family, child or youth, other service providers, and clinical records.

The sample analyzed in this study consisted of 1650 adolescents between the ages of 12 and 18 years ($M = 14.56$; $SD = 1.79$). The majority (54.2%) of the adolescents were male. About 54% of the adolescents lived with both parents, 33.9% lived with either their mother only or their father only, 5.6% did not live with their mother or father but lived with other relatives, and the remaining 6.4% were from child protection agencies. The majority of the adolescents (42.7%) had parents/caregivers who were married/living with a partner, 33.6% were formerly married, 17.3% were never married, and the marital status of the remaining 6.4% of the parents were unknown. A little over 15% of the adolescents had at least one foster family placement. Ethics approval was sought for analysis of the de-identified data and was approved by the Ethics Review Board of Western University.

2.2. Measures

2.2.1. Dependent variable

The dependent variable investigated in this study was NSSI and was assessed using two items that asked for history of self-injurious behavior and the intent behind the self-injurious behavior. Self-injurious behavior was defined as the deliberate and intentional act of self-injury (e.g., self-cutting, self-mutilation, burning, head-banging, etc.) that requires awareness on the part of the child that his or her actions may have a harmful outcome to him or herself. Those with a history of self-injury were coded as 1 and those with no history of self-injury were coded as 0. Assessors were also asked to enquire as to whether the child had ever intentionally engaged in lethally motivated self-injuri-

ous behavior with the intent to kill him or herself (Stewart et al., 2015a). This was also coded as "0 = No" and "1 = Yes". For the purposes of this study, those who engaged in self-injurious behavior with the intent to kill themselves were excluded from the analyses since NSSI includes self-injurious behavior with no suicidal intent. A similar method has been used by past studies in measuring NSSI (e.g., Armiento et al., 2016; Muehlenkamp and Gutierrez, 2004).

2.2.2. Independent variable

The independent variable examined in this study was history of bullying victimization and was measured as a binary variable. This was assessed from child/youth report, teacher report, parent/guardian report, and clinical charts, with the following coding options: "0 = Never", "1 = more than a year ago", "2 = 31 days to a year ago", "3 = 8 to 30 days ago", "4 = 4-7 days ago", and "5 = in last 3 days". In the *interRAI* ChYMH assessment manual, bullying victimization was defined to mean a child or youth subjected to repeated acts of teasing or harassment, rumours spreading about him or her, physical assault, theft of money or items, intimidation, and/or racial slurs or negative comments about his or her religion, sexual orientation, disability, body type, or socioeconomic status (Stewart et al., 2015a). Bullying victimization may take the form of any one or a combination of these acts as long as it occurs over multiple time points and is perpetrated by someone with physical or social power over the child or youth. In the present study, we conceived of bullying victimization as having a long-term cumulative effect on depressive symptoms and NSSI hence, bullying victimization was measured in reference to lifetime as opposed to past year or past month. Those who were coded as 1 through 5 experienced bullying victimization and were consequently recoded as 1, and compared to those who were coded as 0.

2.2.3. Mediator variable

The mediator variable examined in this study was depressive symptoms and was measured as an interval/ratio variable using the *interRAI* ChYMH Depressive Symptoms Scale (DSS; Stewart et al., 2015). The DSS is a 9-item standardized and validated scale measuring depressive symptoms. Assessors were asked to code on a five-point Likert scale ranging from "0 = Not present" to "4 = Exhibited daily in last 3 days, 3 or more episodes or continuously" the presence of the following mental state indicators: sad, pained, or worried facial expressions; crying, tearfulness; negative statements (e.g., no one likes me, I hate my life, I would rather be dead); self-deprecation (I'm stupid, I can't do anything right, I'm of no use to anyone); expressions of guilt or shame (e.g., I've done something awful, this is my fault, I'm a terrible person); expressions of hopelessness (there's no hope for the future, nothing is going to change for the better); irritability; lack of motivation; and withdrawal from activities of interest (Stewart et al., 2015a). Scores on the DSS range from 0 to 36, with higher scores indicating severe symptoms of depression. The DSS has been used among children and adolescents with mental health problems and has been found to have strong psychometric properties (Stewart and Hamza, 2017). A receiver operating characteristics (ROC) curve analysis conducted on the DSS yielded the following clinical cut-off values: 0 (none), 1-8 (low), 9-14 (moderate), 15-18 (high), and 19-36 (very high) (Stewart et al., 2016). In the present study, internal consistency (Cronbach's α) for the DSS was $\alpha = 0.81$, suggesting that all the nine items are strongly correlated and measure one construct.

2.2.4. Control variables

The study controlled for age, gender, type of patient (inpatient versus outpatient), legal guardianship, marital status of parents/caregivers, history of foster family placement, history of childhood abuse, social support, and mental health diagnoses given that these control

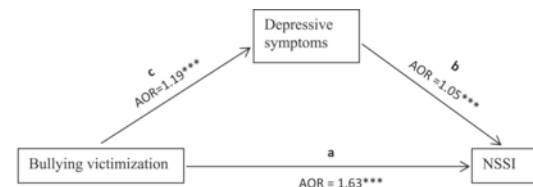
variables can confound the relationship between bullying victimization and NSSI. Age was measured as a continuous variable whereas gender was coded as a binary variable with male as the reference category. History of childhood abuse was measured based on the experience of emotional abuse, physical abuse, sexual abuse, neglect, witnessing domestic violence, and parental addiction or substance abuse.

In the ChYM assessment manual, emotional abuse refers to placing a child in a pervasively hostile emotional environment created by an abuser for the purpose of control, such that the abused child's self-esteem, identity, energy, ability to feel and question his or her wants and needs are invalidated by the abuser. Physical abuse refers to any incident resulting in non-accidental injury, physical confinement, or excessive physical discipline experienced by the child regardless of his or her age when the incident(s) occurred. Sexual abuse was defined to mean any form of exposure of genitals, sexual touching or coercion, rape experienced by the child regardless of his or her age when the incident(s) occurred. Neglect was defined in reference to failure to provide for basic emotional needs (e.g., primary caregiver not providing sufficient affection, warmth, or sensitivity to the child), physical needs (e.g., inadequate winter clothing), or safety needs (e.g., child left in car in summer heat). Witnessing domestic violence refers to the child having an awareness of, or knowledge of, or witnessing physical or verbal actions or threats toward another family member. Parental addiction or substance abuse referred to situations where a parent or primary caregiver is engaging in repetitive and persistent use of alcohol or drugs (Stewart et al., 2015a). These variables were coded as binary variables "0 = Never" versus "1 = Ever." A sum of childhood abuse was computed by summing the six childhood abuse variables.

Social support was measured based on the availability of support that the adolescent can rely on for his or her emotional needs or can draw on in times of crisis. Adolescents who need support but do not have family members (someone outside the nuclear family) or close friends willing and able to provide consistent support were coded as 0 and compared to their supported counterparts who were coded as 1. Adolescents were also assessed for up to four mental health diagnoses (or actual diagnoses, if available at the time assessment), as determined by a psychiatrist, psychologist, or attending physician. The following mental health diagnoses were assessed and coded as binary variables (0 = not diagnosed versus 1 = diagnosed): reactive attachment disorder, attention-deficit/hyperactivity disorder (ADHD), disruptive behavior disorder, learning or communication disorder, autism spectrum disorder, substance-related disorders, schizophrenia and other psychotic disorders, mood disorders, anxiety disorders, eating disorders, sleep disorders, and adjustment disorders.

2.3. Data analyses

Descriptive statistics were first performed using percentages for the categorical variables and mean and standard deviation for age and depressive symptoms. Internal consistency of the nine items measuring depressive symptoms was then examined using Cronbach's alpha coefficient and the corrected item-total correlation, to ascertain the relative contribution of each item to the corrected total score. To test the hypothesis of whether depressive symptoms mediate the effect of bullying victimization on NSSI, we constructed three regression models following the procedure recommended by Baron and Kenny (1986) and Iacobucci (2008). Fig. 1 presents the three regression models. First, in Model A, we regressed the dependent variable (NSSI) on the independent variable (bullying victimization) to establish that indeed bullying victimization is a significant predictor of NSSI. Second, in Model B, we regressed NSSI on the mediator variable (depressive symptoms). Third, in Model C, we regressed the mediator variable (depressive symptoms) on the independent variable (bullying victimization). In all three models, we controlled for the effect of demographic characteristics, history



*** $p < 0.001$.

All paths adjusted for age, gender, type of patient, legal guardianship, marital status of parents/caregivers, history of foster family placement, number of childhood abuse, social support, and mental health diagnoses. These results are not shown.

Fig. 1. Mediation model predicting NSSI. *** $p < 0.001$. All paths adjusted for age, gender, type of patient, legal guardianship, marital status of parents/caregivers, history of foster family placement, number of childhood abuse, social support, and mental health diagnoses. These results are not shown.

of childhood abuse, social support, and mental health diagnoses. According to Baron and Kenny (1986), the following three conditions must be satisfied in order to establish mediation: 1) the independent variable may be associated with both the dependent and mediator variables, 2) the mediator variable must be associated with the dependent variable, and 3) the magnitude effect of the independent variable on the dependent variable must be either eliminated (full mediation) or attenuated (partial mediation) with the inclusion of the mediator variable. In other words, the coefficient of the independent variable must decrease and the p -value must also decrease. The Sobel test was used to assess whether the reduction in the coefficient of bullying victimization was significant (Baron and Kenny, 1986). Indirect effect mediated was calculated as a product of the two regressions as follows (coefficient for bullying victimization when the dependent variable is depressive symptoms) \times (coefficient for depressive symptoms when the dependent variable is NSSI).

Models A and B were estimated using binary logistic regression whereas Model C was estimated using Poisson regression with the log-link function. Binary logistic regression was chosen for Models A and B given that the dependent variable (NSSI) was measured as a binary variable. For Model C, we opted for Poisson regression over linear regression given that Poisson regression is ideal for modeling count data and our mediator variable (depressive symptoms) had a Poisson distribution. A final model was fitted using binary logistic regression to identify the effect of bullying victimization on NSSI over and above depressive symptoms, demographic characteristics, history of childhood abuse, social support, and mental health diagnoses. Variables were considered significant if the p -value was less than 0.05. All statistical analyses were executed using SPSS Version 23 for Windows (SPSS, Inc., Chicago, IL, USA).

3. Results

3.1. Sample characteristics

Overall, 37% ($n = 611$) of the 1650 adolescents engaged in NSSI. A little over one in four (26.7%) adolescents were victims of bullying and 79.7% had someone they could turn to for their emotional needs and support. On average, adolescents experienced 1.21 childhood abuse (50.7% had no history of childhood abuse, 16.4% experienced one childhood abuse, 12.4% experienced two types of childhood abuse, 8.3% experienced three types of childhood abuse, and the remaining 12.2% experienced four or more types of childhood abuse). Of the various mental health diagnoses examined, 42.2% of adolescents were diagnosed with anxiety disorders, 40.2% had a diagnosis of ADHD, 23.3% were diagnosed with learning or communication disorders, 21.3% were diagnosed with mood disorders, 21.1% were diagnosed with disruptive behavior disorders, 10.7% were diagnosed with autism spectrum disorder, 3.5% were diagnosed with sleep disorders, and 3.4% were diagnosed with substance-related disorders. Less than 3% of

the adolescents had adjustment disorders, eating disorders, reactive attachment disorder, and schizophrenia and other psychotic disorders. The average depressive symptoms score among the sample was moderate with a mean of 10.56 ($SD = 7.27$; range = 0–36). Based on the established cut-off values, 4.4% of the adolescents had no symptoms of depression, 41% had low symptoms of depression, 27.9% had moderate symptoms of depression, 12.1% had high symptoms of depression, and 14.6% had very high symptoms of depression. See Table 1 for the distribution of the other variables examined in the analysis.

3.2. Internal consistency of the DSS

Table 2 below shows the scale mean if an item is deleted and corrected item-total correlation, that is, the correlation of each item with the sum of the remaining items. We followed the recommendation of Field (2013) who suggested that any item with a correlation of less than 0.3 suggests that a particular item does not correlate very well with the overall scale. In this study, corrected item-total correlation ranges from 0.37 to 0.67. Cronbach's alpha coefficient of the DSS was $\alpha = 0.81$, indicating high internal consistency among the nine items, and the results indicates that deleting items from the scale would not improve the overall Cronbach's alpha coefficient.

3.3. Mediation analysis between bullying victimization, depression and NSSI

Fig. 1 shows the mediation model described earlier.

Table 3 shows the results of the mediation analysis. In Model A, adolescents who were bullied had 63% higher odds of engaging in NSSI (AOR 1.63, $p < 0.001$, 95% C.I. = 1.26–2.11), controlling for demographic characteristics, history of childhood abuse, social support, and mental health diagnoses. This significant effect was attenuated upon the inclusion of depressive symptoms in the final model where the adjusted odds ratio went from 1.63 to 1.50 (95% C.I. = 1.16–1.95) and the p -value increased moderately from $p < 0.001$ to $p = 0.002$. In Model B, a unit increase in scores on depressive symptoms increased the odds of engaging in NSSI by 5% (AOR = 1.05, $p < 0.001$, 95% C.I. = 1.03–1.07). This significant effect remained unchanged in the final model. A number of control variables were significantly associated with NSSI in the final model. For age, the odds of engaging in NSSI increased by 21% for each increase in age by 1 year (AOR = 1.21, $p < 0.001$, 95% C.I. = 1.13–1.30). Compared to males, the odds were 3.02 times higher for females to engage in NSSI (AOR = 3.02, $p < 0.001$, 95% C.I. = 2.37–3.85). Each additional type of childhood abuse experienced increased the odds of NSSI by 11% (AOR = 1.11, $p = 0.018$, 95% C.I. = 1.02–1.20). Social support had a protective effect on NSSI such that adolescents who had someone they could turn to for their emotional needs had 26% lower odds of engaging in NSSI, net all other factors included in the model (AOR = 0.74, $p = 0.038$, 95% C.I. = 0.55–0.98).

To test whether the reduction in the coefficient of bullying victimization was actually significant, we used the parameter estimates and corresponding standard errors to compute the Sobel test, a two-tailed z -test of the hypothesis that the mediated effect equals zero in the population (Sobel, 1982). There was a significant mediation effect indicating that the relationship between bullying victimization and NSSI decreased significantly when depressive symptoms was included in the model (Sobel test statistic = 5.14, $p < 0.001$). The indirect effect of bullying victimization on NSSI mediated by depressive symptoms was 0.02328. Thus the percentage of indirect effect equals $(0.02328/0.169) \times 100 = 13.8\%$.

Table 1
Sample characteristics ($N = 1650$).

Variables	Frequency (%)	Mean	SD
Age at assessment		14.56	1.79
Depression score		10.56	7.27
Number of childhood abuse		1.21	1.59
Engaged in NSSI			
No	1039 (63.0)		
Yes	611 (37.0)		
Victim of bullying			
No	1210 (73.3)		
Yes	440 (26.7)		
Gender			
Male	894 (54.2)		
Female	756 (45.8)		
Type of patient			
Outpatient	1458 (88.4)		
Inpatient	192 (11.6)		
Legal guardianship			
Both parents	893 (54.1)		
Mom/Dad alone	560 (33.9)		
Other caregivers	92 (5.6)		
Child Protection Agency	105 (6.4)		
Marital status of parents/caregivers			
Married/Living with partner	704 (42.7)		
Formerly married	555 (33.6)		
Never married	285 (17.3)		
Unknown	106 (6.4)		
History of foster family placement			
None	1398 (84.7)		
At least one	252 (15.3)		
Adolescent has social support			
No	335 (20.3)		
Yes	1315 (79.7)		
Reactive attachment disorder			
No	1614 (97.8)		
Yes	36 (2.2)		
ADHD			
No	986 (59.8)		
Yes	664 (40.2)		
Disruptive behavior disorder			
No	1302 (78.9)		
Yes	348 (21.1)		
Learning or communication disorder			
No	1266 (76.7)		
Yes	384 (23.3)		
Autism spectrum disorder			
No	1474 (89.3)		
Yes	176 (10.7)		
Substance-related disorders			
No	1594 (96.6)		
Yes	56 (3.4)		
Schizophrenia and other psychotic disorders			
No	1632 (98.9)		
Yes	18 (1.1)		
Mood disorders			
No	1298 (78.7)		
Yes	352 (21.3)		
Anxiety disorders			
No	954 (57.8)		
Yes	696 (42.2)		
Eating disorders			
No	1606 (97.3)		
Yes	44 (2.7)		
Sleep disorders			
No	1593 (96.5)		
Yes	57 (3.5)		
Adjustment disorders			
No	1604 (97.2)		
Yes	46 (2.8)		

Table 2
Reliability test for DSS^a (N = 1650).

Items	Scale mean if item deleted	Corrected item-Total correlation	Cronbach's alpha if item deleted
Sad, pained, or worried facial expressions	8.96	0.545	0.785
Crying, tearfulness	9.51	0.471	0.795
Made negative statements	9.33	0.670	0.768
Self-deprecation	9.39	0.624	0.775
Expressions of guilt or shame	9.81	0.480	0.774
Expressions of hopelessness	9.70	0.621	0.778
Irritability	8.56	0.419	0.803
Lack of motivation	9.33	0.367	0.811
Withdrawal from activities of interest	9.91	0.399	0.802

^a Cronbach's alpha for DSS = 0.81.

3.4. Predictors of depressive symptoms

Table 4 shows the results of the Poisson regression model predicting depressive symptoms. We found that difference in the logs of expected depressive symptoms score was 0.169 unit higher for adolescents who were bullied compared to adolescents who were not bullied, while holding the other variables in the model constant. Age and social support were both inversely associated with depressive symptoms. However, female gender and history of childhood abuse were both positively associated with depressive symptoms.

As shown in Tables 3 and 4, all the goodness-of-fit indices suggest that the models fit the data reasonably well. For instance, in the final model in Table 3, all the variables explained 24.9% of the variance in NSSI and 69.2% of the adolescents were correctly classified as having engaged in NSSI versus not engaged in NSSI. Also, in Table 4, the Omnibus test result was statistically significant suggesting that the Poisson regression model is fit and the estimated coefficients are significantly different from zero.

4. Discussion

The objectives of this study were to examine the effect of bullying victimization on NSSI and the mediating effect of depressive symptoms on the relationship between bullying victimization and NSSI, after taking into account demographic characteristics, history of childhood abuse, social support, and mental health diagnoses. We found that

Table 3
Logistic regression analyses predicting NSSI (N = 1650)^a.

Variables	Model A			Model B			Final Model		
	AOR	p-value	95% C.I.	AOR	p-value	95% C.I.	AOR	p-value	95% C.I.
Age at assessment	1.20	0.001	1.12–1.28	1.19	0.001	1.11–1.27	1.21	0.001	1.13–1.30
Gender – Female	3.15	0.001	2.48–4.01	3.07	0.001	2.41–3.91	3.02	0.001	2.37–3.85
Number of childhood abuse	1.13	0.004	1.04–1.23	1.12	0.008	1.03–1.22	1.11	0.018	1.02–1.20
Social support	0.69	0.012	0.52–0.92	0.71	0.020	0.53–0.95	0.74	0.038	0.55–0.98
Bullying victimization	1.63	0.001	1.26–2.11				1.50	0.002	1.16–1.95
Depression				1.05	0.001	1.03–1.07	1.05	0.001	1.03–1.06

Model fitness statistics:

Model A: Omnibus Tests of Model Coefficient: 300.53 (p-value < 0.001); Nagelkerke pseudo R square = 22.7%; Overall percent correctly classified = 68.1%

Model B: Omnibus Tests of Model Coefficient: 322.30 (p-value < 0.001); Nagelkerke pseudo R square = 24.2%; Overall percent correctly classified: 68.8%

Final Model: Omnibus Tests of Model Coefficient: 331.61 (p-value < 0.001); Nagelkerke pseudo R square = 24.9%; Overall percent correctly classified = 69.2%

^a The model also adjusted for the following variables: type of patient, legal guardianship, marital status of parents/caregivers, history of foster family placement, and mental health diagnoses.

more than one in three adolescents (37%) engaged in NSSI and more than one in four were victims of bullying (26.7%). Given that more than one-third of adolescents with mental health needs engaged in NSSI, additional efforts to understand why adolescents with mental health needs engage in NSSI is needed. These efforts are especially critical given that NSSI is a strong predictor of suicide-related behaviors including attempted and completed suicides (Kessler et al., 2005; Lofthouse and Yager-Schweller, 2009) and suicide is the second leading cause of death among adolescents aged 10–24 years in Canada (Statistics Canada, 2009). NSSI has also been identified as one of the leading reasons for emergency room visits by adolescents in Canada (Eggertson, 2013).

Three important findings emerged from the present study. First, supporting our hypothesis, bullying victimization was a significant predictor of NSSI. Second, corroborating past research, bullying victimization was a significant predictor of depressive symptoms and depressive symptoms was a predictor of NSSI. Third, extending prior research, depressive symptoms partially mediate the effect of bullying victimization on NSSI, over and above demographic characteristics, history of childhood abuse, social support, and mental health diagnoses. Next, we discuss these findings in relation to the extant literature as well as their implications for clinical practice, policy, and suicide prevention.

Based on the findings reported herein, the first conclusion was that bullying victimization predicted NSSI. This finding corroborates emerging past studies that relied on student samples and have found that bullying victimization has an important relationship with not only aggression directed towards others but also with aggression directed towards oneself (Claes et al., 2015; Hay and Meldrum, 2010). Our findings add to the extant literature and underscore the harmful effect of bullying (Finkelhor et al., 2005; Storch and Ledley, 2005). The desire to regulate mood and affect is one consistent reason that has been adduced in explaining adolescent NSSI behavior (Nock, 2010; Noll et al., 2003; Stewart et al., 2014). A qualitative study undertaken by Long et al. (2015) shows that many of their participants engaged in NSSI as a means to manage the traumatic life experience and emotional distress. Viewed this way, NSSI becomes a maladaptive coping mechanism to deal with past trauma.

The second conclusion from this study was that adolescents who were victims of bullying were more likely to experience depressive symptoms even after controlling for age, gender, history of childhood abuse, social support, and mental health diagnoses. Bullying victimization has been consistently linked to a number of externalizing and internalizing behavior problems in community and school-based samples of adolescents (Nansel et al., 2001). Storch and Ledley's (2005) review of cross-sectional and longitudinal studies on the effect of bullying victimization on psychological adjustment among adolescents found that bullying victimization during childhood predicts a number of internal-

Table 4
Poison regression result between bullying victimization and depressive symptoms ($N = 1650$)^a.

Variables	β	Exp (β)	p-value	95% C.I.
Age at assessment	-0.016	0.98	0.001	0.97-0.099
Gender – Female	0.140	1.15	0.001	1.11-1.19
Number of childhood abuse	0.045	1.05	0.001	1.03-1.06
Social support	-0.135	0.87	0.001	0.77-0.91
Bullying victimization	0.169	1.19	0.001	1.15-1.23

Deviance statistic = 7736.20, $df = 1624$, Value/ $df = 4.76$; Omnibus test statistic: Likelihood Chi-square value = 870.41 (p -value < 0.001)

^a The model also adjusted for the following variables: type of patient, legal guardianship, marital status of parents/caregivers, history of foster family placement, and mental health diagnoses.

izing problems later in life. A meta-analysis of longitudinal studies on the effect of bullying victimization on internalizing problems by Reijntjes et al. (2010) also concluded that bullying victimization serves both as a predictor of, and an outcome of depressive symptoms, suggesting a vicious cycle that contributes to the high stability of bullying victimization. Similar to recent findings from a normative sample of 355 adolescents with baseline and follow-up data, those who reported bullying victimization were also at risk of developing depressive symptoms (Hamilton et al., 2016).

Third, support emerged for our hypothesis that depressive symptoms partially mediate the effect of bullying victimization on NSSI. This finding extends past research that has found a significant effect of bullying victimization on NSSI (Bowes et al., 2014; Claes et al., 2015; Heilbron and Prinstein, 2010). The main contribution of the present study was that the effect of bullying victimization on NSSI was attenuated by depressive symptoms. Specifically, 13.8% of the effect of bullying victimization was mediated by depressive symptoms. It is important to also point out that this was after adjusting for the effect of age, gender, history of childhood abuse, and mental health diagnoses, all of which are well established predictors of NSSI (Franzke et al., 2015; Smith et al., 2014). Given that the onset of depression typically occurs during the period of adolescence (Kessler et al., 2005; Schwartz et al., 2012) and bullying victimization peaks during the age of middle school (Kljakovic and Hunt, 2016), interventions aimed at reducing NSSI among adolescents should also take into account how bullying exacerbates depressive symptoms and consequently NSSI.

The finding that depressive symptoms partially mediate the effect of bullying victimization on NSSI offers important clinical implications for clinicians, psychologists, school social workers, and other mental health care professionals towards suicide prevention. Assessment of adolescents who present with mental health problems should also include a brief evaluation to assess any history of bullying victimization. Endorsements of peer victimization and expressions of guilt, shame, self-deprecation, or feelings of sadness, and hopelessness should guide clinicians in conducting a more thorough assessment or refer the adolescent to a mental health care professional for further consultation and treatment.

Ideally, peer relations are socially rewarding (Holland et al., 2007; Sletten, 2011) and serve as an important protective factor against a variety of mental health problems including NSSI (Andover et al., 2007; Heath et al., 2010). However, peer victimization serves as a significant source of stress (Rosen et al., 2012; Storch and Ledley, 2005), and consequently a risk factor for NSSI (Baetens et al., 2014; Gandhi et al., 2015; Hankin and Abela, 2011; Zetterqvist et al., 2014). Bullying victimization might also prevent victimized youth from reaching out for help or prevent them from developing appropriate social and coping skills (Bandyopadhyay et al., 2009; Hunter and Borg, 2006; Leach and

Rickwood, 2009), all of which are known to reduce the risk of engaging in NSSI (Frost et al., 2016; Long et al., 2015).

The results of this study indicate that adolescents who experienced multiple childhood abuse are more likely to engage in NSSI. This corroborates many past studies that have also found the debilitating effect of childhood abuse and its relationship to internalizing and externalizing behavior problems including NSSI (Brausch and Holaday, 2015; Gratz, 2006; Smith et al., 2014). Scholars have tried to explain the underlying mechanisms by which childhood abuse may relate to long-term emotional dysfunction and have observed that adolescents with a history of childhood abuse are likely to have trouble regulating their affect and emotions and experience a sense of insecurity (Briere and Jordan, 2009), which consequently leads to NSSI (Santangelo et al., 2016).

That adolescents who had a confidant or someone they could turn to for emotional needs are less likely to engage in NSSI underscores the protective effect of social support. Various studies (Rothson et al., 2012; Smokowski and Bacallao, 2007) and systematic reviews (Bigby, 2012; Jennings et al., 2014) have documented the positive effect of social support in enhancing mental health and well-being of adolescents. Hay and Meldrum (2010) found that a combination of social support and self-control provides adolescents with the ability to deliberate on their stressful life situation and avoid taking actions that might be deleterious to their mental health and well-being. Efforts aimed at preventing NSSI should first identify and reduce risk factors for NSSI while at the same time identifying and increasing factors found to be associated with a diminished likelihood of engaging in NSSI. Instead of concentrating solely on identifying adolescents who are at risk of engaging in NSSI, future studies could attempt to identify protective factors that reduce the risk of NSSI among specific subgroups of adolescents with childhood abuse histories or who are victims of bullying.

4.1. Implications

A number of clinical and policy implications as well as avenues for future research emerged particularly as they relate to the prevention of NSSI among adolescents. Given that adolescents with a history of bullying victimization are more likely to engage in NSSI, it might be beneficial for clinicians, teachers, and school social workers to use information obtained about adolescent's bullying history to target NSSI prevention and intervention efforts. At the classroom and institutional level, teachers and principals should be educated on the long-term effect of bullying on NSSI particularly given that the majority of bullying occurs in school where adolescents spend a greater portion of their time (Arseneault et al., 2010). Clinicians and school social workers can then use this knowledge to not only inform their practice but also inform schools about the risk and protective factors associated with engaging in NSSI. In addition to universal prevention programs, targeted evidence-based interventions based on identified risk would be of benefit. Adolescents who were victims of bullying might benefit from trauma-focused interventions such as cognitive behavior therapy and cognitive processing therapy, evidence-based interventions that are known to alleviate symptoms through overcoming avoidance behavior (Ekman and Hiltunen, 2015).

Our findings have implications for public health as well, particularly given the rising incidence of bullying and suicide-related behaviors among adolescents in Canada. Bullying intervention programs that are aimed at addressing internalizing symptomatology are only as effective as the manner in which they are delivered. The use of brief solution-focused therapy in dealing with trauma arising from bullying (Carney, 2008) could be therapeutically effective when combined with other trauma-focused interventions such as supportive counseling and cognitive behavior therapy. In addition, expanding coping strategies of adolescents would be helpful for those dealing with trauma arising

from bullying and also help in reducing future anxiety-provoking thoughts (Carney, 2008).

4.2. Limitations

This study has some limitations that deserve mentioning. First, this study relied on cross-sectional data; hence, no causal inferences could be drawn regarding the association between some of the factors examined and NSSI. Additional studies that follow adolescents who have been bullied are needed in order to tease apart some of the nuances between bullying victimization and NSSI, including the onset of depression and NSSI. A longitudinal study would also allow for the examination of the effect of bullying victimization on NSSI across different developmental ages. Second, the use of secondary data limits the analysis of other important factors relating to adolescent NSSI behaviors that would be interesting to examine. For instance, we were unable to examine race/ethnicity in this study. Third, although the sample was large, and representative of the population of adolescents receiving clinical care in Ontario, future studies should examine clinical populations in different geographical regions of Canada. Additionally, cross-cultural studies that use the interRAI ChYMh would provide additional evidence of the impact of bullying victimization on NSSI.

4.3. Conclusion

In conclusion, the findings presented in this study offer some important understanding about the mechanism through which bullying victimization affects NSSI. The contribution of bullying victimization and depressive symptoms to NSSI adds to the case for the development of trauma-focused interventions in reducing the risk of NSSI among adolescents. Obtaining information about history of bullying victimization from adolescents who present with mental health needs could help in the identification of adolescents who might be at risk of engaging in NSSI. School authorities and mental health practitioners should also consider the broad range of trauma experienced by adolescents who are victims of bullying. These adolescents are at risk of developing mental health symptoms including engaging in NSSI.

Uncited references

Berg et al., 2016; Frost et al., 2016; interRAI, 2016.

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