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Examining Non-Suicidal Self-Injury among Adolescents with Mental Health Needs, in Ontario, Canada

Shannon L. Stewart, Philip Baiden, and Laura Theall-Honey

The objectives of this study were to examine the prevalence of non-suicidal self-injury (NSSI) among adolescents with mental health needs and specific factors associated with NSSI among adolescents aged 14 to 18 years who received mental health services in adult mental health facilities in Ontario, Canada. Data on 2,013 adolescents were obtained from the Ontario Mental Health Reporting System using the Resident Assessment Instrument—Mental Health (RAI-MH) and were analyzed using logistic regression. Approximately, 20.2% (407 adolescents) of the sample engaged in NSSI within the last 12 months. Results from multivariate logistic regression indicate that females were 2.19 times more likely to engage in NSSI than males. Intentional misuse of prescription medication emerged as the most important factor associated with NSSI. Other factors found to be associated with NSSI included multiple psychiatric admissions, sexual abuse, use of alcohol, mood disorders (e.g., depression), adjustment disorders, personality disorders and symptoms of depression. The article discusses the implications of the findings, with suggestions for future research.

Keywords adolescents, mental health, non-suicidal self-injury (NSSI), RAI-MH

INTRODUCTION

Non-suicidal self-injury (NSSI), commonly defined as “purposely inflicting injury that results in immediate tissue damage, done without suicidal intent and not socially sanctioned” (Nixon & Heath, 2008, p. 4), is a major concern for many Western countries and is receiving increasing research attention (Hamza, Stewart, & Willoughby, 2012; Muehlenkamp, Claes, Havertape et al., 2012; Nock, Joiner, Gordon et al., 2006; Sornberger, Heath, Toste et al., 2012; Victor, Glenn, & Klonsky, 2012),

especially given that NSSI is a strong known predictor of future death from suicide (Welch, 2001). Indeed, close to 70% of adolescent inpatients with mental health needs engaging in NSSI made at least one suicide attempt (Nock, Joiner, Gordon et al., 2006). However, despite this growing interest in NSSI, there still remain important differences among researchers regarding the prevalence and the factors associated with NSSI among adolescents due in part either to the behaviors studied or the sample population (Whitlock, Muehlenkamp, & Eckenrode, 2008).

Prevalence estimates of NSSI among adolescents range from 13% to as high as 60% (Brausch & Gutierrez, 2010; Heath, Toste, Nedecheva et al., 2008; Muehlenkamp & Gutierrez, 2007; Nixon, Cloutier, & Jansson, 2008; Nock, Joiner, Gordon et al., 2006; Ross & Heath, 2002). Nixon, Cloutier, and Aggarwal (2002) analyzed data from inpatient and acute adolescent partial-hospitalization programs at a tertiary-care teaching hospital in Canada and found 29.7% of adolescent inpatients and 38.5% of adolescents with partial hospitalization engaged in NSSI. In another study, Cloutier, Martin, Kennedy et al. (2010) found 45.3% of adolescents presenting to pediatric emergency departments engaged in NSSI. Prevalence estimates of NSSI reported in past studies vary greatly depending on how it was defined or measured (Silverman, Berman, Sanddal et al., 2007; Whitlock, Muehlenkamp, & Eckenrode, 2008). Such definitional obfuscation (Linehan, 1997) is a major limitation particularly when one tries to compare results across studies.

Some studies have suggested that NSSI is more prevalent among adolescent females than males (Canetto & Sakinofsky, 1998; Madge, Hewitt, Hawton et al., 2008; Ross & Heath, 2002; Sornberger, Heath, Toste et al., 2012) although other studies found no gender differences in rates of NSSI (Baetens, Claes, Muehlenkamp et al., 2011; Heath, Toste, Nedecheva et al., 2008; Muehlenkamp & Gutierrez, 2004). Handwerk, Clopton, Huefner et al. (2006) examined gender differences in a sample of adolescents admitted to a residential mental health facility in the mid-western United States and found that females admitted to the facility were significantly more likely to have made threats of suicide and to have engaged in NSSI than their male counterparts. Prinstein, Nock, Simon et al. (2008) in their longitudinal study also found that adolescent females reported significantly more episodes of NSSI at baseline than their male counterparts.

Furthermore, Nixon, Cloutier, and Aggarwal (2002) found that although adolescent females in their partial-hospitalization sample were more likely to have engaged in NSSI than males, no significant association between gender and NSSI was found among their inpatient sample. Muehlenkamp, Ertelt, Miller et al. (2011) examined NSSI among adolescents admitted to an outpatient depression and suicide treatment clinic in the United States and found no significant association between gender and NSSI. Nock, Joiner, Gordon et al. (2006) also found no gender differences on episodes of NSSI, duration of NSSI history and number of different NSSI methods among adolescents in an inpatient psychiatric setting. Although it is clear that among the general population, males are more likely to complete and females are more likely to attempt suicide (Canetto & Sakinofsky, 1998; Kposowa & McElvain, 2006), the evidence with respect to the association between gender and NSSI among adolescents with mental health needs is still ambiguous and warrants further research (Gratz, 2001; Sornberger, Heath, Toste et al., 2012).

Available literature also suggests that mood (e.g., depressive symptoms) is a major predictor of NSSI among adolescents (Cloutier, Martin, Kennedy et al., 2010; Jenkins & Schmitz, 2012; Muehlenkamp & Gutierrez, 2007; Nixon, Cloutier, & Aggarwal, 2002; Nixon, Cloutier, & Jansson, 2008; Ross & Heath, 2002). Nock, Joiner, Gordon et al. (2006) found 87.6% of adolescents engaging in NSSI met the criteria for Axis I diagnosis of major depressive disorder suggesting that depressive symptoms are more prevalent among adolescents who engage in NSSI. Also, Jacobson and Gould (2007) conducted a critical review of the literature on NSSI among adolescents admitted to hospital and found that the most commonly cited predictor of NSSI was mood disorder, specifically depression.

Other studies have also found childhood physical and sexual abuse and the experience of Post Traumatic Stress Disorder (PTSD) to be valid predictors of NSSI (Heath, Toste, Nedecheva et al., 2008; Klonsky & Moyer, 2008; Muehlenkamp, Ertelt, Miller et al., 2011). Using data from the National Comorbidity Survey (NCS), Joiner, Sachs-Ericsson, Wingate et al. (2007) found childhood physical and sexual abuse to have strong effect on suicide attempt after taking into account psychiatric and psychosocial factors. Also, Weierich and Nock (2008) performed a hierarchical linear regression to examine the relationship between sexual abuse, PTSD symptoms, and NSSI frequency among adolescents and found sexual abuse and depression to be significantly associated with the frequency of NSSI. Noll, Horowitz, Bonanno et al. (2003) suggested that adolescent females with a history of sexual abuse may engage in self-injury as a way of re-enacting the abuse perpetrated on them. Other scholars have also noted that adolescents with a history of abuse may use NSSI as a maladaptive coping strategy to deal with feelings of emotional and mental discomfort (Heath, Toste, Nedecheva et al., 2008; Klonsky & Moyer, 2008; Nixon, Cloutier, & Aggarwal, 2002).

Although there are controversies regarding the association between borderline personality disorder (BPD) and NSSI among adolescents, some recent studies have argued and found BPD to be frequent diagnosis among adolescent inpatients who engage in NSSI (Muehlenkamp, Ertelt, Miller et al., 2011; Nock, Joiner, Gordon et al., 2006). Muehlenkamp, Ertelt, Miller et al. (2011) examined borderline personality symptoms and NSSI among adolescents admitted to an outpatient depression and suicide treatment clinic in the United States and found BPD symptoms significantly predicted NSSI. Jacobson, Muehlenkamp, Miller et al. (2008) also found higher rates of BPD among adolescents who engaged

in NSSI. Weierich and Nock (2008) maintained that although BPD symptoms do not automatically relate to NSSI among adolescents, BPD symptoms thus predispose adolescents to dysregulation. Weierich and Nock (2008) found BPD symptoms mediate the effect of childhood abuse and NSSI frequency.

Studies examining the relationship between substance use and NSSI among adolescent populations have been inconclusive. For example, Brausch, Decker, and Hadley (2011) found that adolescents who use substances (alcohol, tobacco, and other drugs) were more likely to have engaged in both NSSI and self-asphyxial risk-taking behaviors. Giletta, Scholte, Engels et al. (2012) also analysed data from Italy, United States and the Netherlands and found cigarette smoking and frequent marijuana use to be more strongly related to NSSI in the sample from the United States than the samples from Italy and the Netherlands. However, others (e.g., Jacobson, Muehlenkamp, Miller et al., 2008) failed to find any statistically significant association between substance use and NSSI.

While there are several studies examining substance use and NSSI, less is known about the association between misuse of prescription medication and NSSI (Buykx, Dietze, Ritter et al., 2010). There is research evidence suggesting that medication misuse is a unique clinical behavior which should be considered separately from use of street drugs such as heroin, cocaine, and crack (Cicero, Inciardi, & Munoz, 2005; Friedman, 2006; Stewart, Baiden, & den Dunnen, 2013). Recent studies also indicate an increase in prescription medication use among adolescents (Johnston, O'Malley, Bachman et al., 2012; Paglia-Boak, Adlaf, & Mann, 2011). According to the Ontario Student Drug Use and Health Survey (OSDUHS), 14% of adolescents in grades 7 through 12 used prescription opioid pain reliever non-medically in the past year (Paglia-Boak, Adlaf, & Mann, 2011).

McCabe, Boyd, and Teter (2006) also found 21% of adolescents use illicit prescription medication. This increased use of prescription medication appears to be in contrast with the rate of alcohol, tobacco, and illicit drug use by adolescents (Johnston, O'Malley, Bachman et al., 2012). Two reasons have been proposed for the distinction between misuse of prescription medication and that of misusing street drugs. First, the fact that prescription medication is perceived as less dangerous may account for its misuse (Friedman, 2006; Stewart, Baiden, & den Dunnen, 2013). Second, prescription medications are relatively easier to obtain than the difficulties involved in obtaining street drugs (Cicero, Inciardi, & Munoz, 2005).

The Present Study

Although the examination of NSSI among the general populations has been under way for some time, studies that examined NSSI among adolescents tend to focus on student populations (see, e.g., Heath, Toste, Nedecheva et al., 2008; Martin, Bureau, Cloutier et al., 2011; Ross & Heath 2002) or used relatively small sample size (see, e.g., Nixon, Cloutier, & Aggarwal, 2002) thereby limiting the extent to which findings could be generalized to other populations. Moreover, the examination of prescription medication misuse and NSSI among adolescent inpatients has not received much research attention. Thus, this study extends past research on NSSI by examining the association between medication misuse and NSSI using a large dataset on adolescents with mental health needs in Ontario, Canada. The objectives of this study were to examine the prevalence of NSSI among adolescents with mental health needs and the specific factors associated with NSSI among adolescents aged 14 to 18 years who received mental health services in adult mental health facilities in

Ontario, Canada. First, it was hypothesized that adolescents who have a mood (e.g., depression) or personality disorders would be more likely to engage in NSSI than those without such diagnoses. Second, it was hypothesized that adolescents with a history of abuse (sexual, emotional, and physical) would be more likely to engage in NSSI than their non-abused counterparts. It was also hypothesized that adolescents who engage in substance use and intentionally misuse prescription medications would be more likely to engage in NSSI than adolescents who did not. Lastly, given the association between gender with mood and abuse history, it was hypothesized that gender would be associated with NSSI with females being more likely to engage in NSSI than males.

METHOD

Participants

The analyses presented in this article are based on the initial assessment record of 2,013 adolescents aged 14 to 18 years ($M = 17.73$, $SD = 1.05$), who were admitted into adult mental health facilities in Ontario, Canada between October 2005 and March 2010. These adolescents were treated in adult mental health facilities due to unavailability of beds in adolescent centered mental health facilities or they may have been in rural settings with non-existent adolescent inpatient mental health services. The adolescents in this study represent a heterogeneous population in terms of their mental health problems, daily adaptation, and functioning. The majority were 18 years old (1,007); 571 were 17 years old; 289 were 16 years old; 106 were 15 years old; and 43 were 14 years old. A little over half (55.5%) of the adolescents were male. Of the 2,013 adolescents, 118 representing 5.9% were of Aboriginal origin (Inuit, Metis, or First Nations). About 71% of

the adolescents were being admitted for the first time, the remainder having had one or more previous admissions. The details of the data including study methods have been described elsewhere (see, e.g., Stewart & Baiden, 2013; Stewart, Baiden, & den Dunnen, 2013).

Instrument

Data for the current study were obtained from the Resident Assessment Instrument—Mental Health (RAI-MH) submitted to the Canadian Institute for Health Information (CIHI), Ontario Mental Health Reporting System (OMHRS). The RAI-MH is a standardized and comprehensive instrument administered to all inpatients admitted into adult mental health facilities in Ontario, Canada and consists of items and definitions that serve as a guide in designing clinical assessment with many of the items serving as specific triggers for care planning (Hirdes, Perez, Curtin-Telegdi et al., 2005; Perlman, Hirdes, Barbaree et al., 2013). Participating facilities were determined by the Ministry of Health and Long Term Care (MOHLTC), Ontario and include approximately 4,500 mental health beds in general, provincial psychiatric, and specialty psychiatric facilities. The instrument takes about an hour to complete and is completed by trained clinical hospital staff by interviewing the patient, family, and friends, as well as using information from clinical chart notes and clinical observation (for a detailed description of the RAI-MH see Hirdes, Perez, Curtin-Telegdi et al., 2005; Perlman, Hirdes, Barbaree et al., 2013).

The psychometric properties of the RAI-MH have been previously documented with an 83% average agreement rate for all items (see e.g., Hirdes, Ljunggren, Morris et al., 2008; Hirdes, Smith, Rabinowitz et al., 2002). One additional advantage of using the RAI-MH data for this study is that

the data are managed by CIHI, which has built-in validation rules to ensure data quality. Data submitted to CIHI are encrypted in a secure format (see CIHI, 2011 for more information regarding the RAI-MH data quality http://www.cihi.ca/CIHI-external/pdf/internet/OMHRS_DQ_2010-2011_EN). Assessors are trained to adhere to the documentation of coding guidelines contained in the RAI-MH manual. In addition, CIHI uses standard processing edits in assessing data quality. A submission can be either accepted, flagged, or rejected with warning messages produced for inconsistent data. For example, a discharge record is rejected if the date of discharge precedes the date of admission for the same episode of care. Facilities are then expected to correct rejected records and resubmit. Furthermore, Hirdes, Poss, Caldarelli et al. (2013) recently examined the RAI data and found data quality with respect to reliability, validity, completeness, and freedom from logical coding errors to be consistently high.

Variables

Outcome Variable. NSSI was assessed based on responses provided for past history of engaging in self-injurious behavior. Responses were coded as: “0 = no reported incident of self-injurious behavior,” “1 = self-injurious behavior was more than 1 year ago, irrespective of how long ago it was,” “2 = self-injurious behavior was in the last year but not in the last 7 days,” “3 = self-injurious behavior was in the last week but more than 3 days ago,” and “4 = self-injurious behavior was in the last 3 days.” Positive responses provided by those who engaged in self-injurious behavior within the last year (i.e., those who were coded 2 to 4) resulted in further inquiry with respect to the intent behind their self-injurious behavior. For the purposes of this study, those who engaged in self-injurious behavior within the last 12

months, but not with the intent to die by suicide, were classified as having engaged in NSSI. These items have been used in past studies to assess NSSI and have been found to be a good measure of suicidality and purposeful self-harm (Neufeld, Hirdes, & Rabinowitz, 2011).

Explanatory Variables. The explanatory variables include demographic characteristics such as age and gender, Aboriginal origin status, residential instability, number of psychiatric admissions, history of abuse (emotional abuse, sexual abuse, and physical abuse), intentional misuse of prescription medication as well as past year use of substances such as inhalants, hallucinogens, stimulants, cocaine and crack, opiates (heroin) and cannabis, use of alcohol and daily use of tobacco. Provisional psychiatric diagnoses, based on DSM-IV criteria (disorders of childhood/adolescence, substance-related disorders, schizophrenia and other psychotic disorders, mood disorders, anxiety disorders, adjustment disorders, and personality disorders) (APA, 2000) were also included in the analysis as well symptoms of depression.

The provisional psychiatric diagnosis variables were coded dichotomously as 0 (not present) and 1 (present). The RAI-MH dataset also includes items that can be used to measure the presence of symptoms of depression. In this study, depression was assessed based on the Depressive Severity Index (DSI). The DSI is a clinical indicator of possible symptoms of depression and is based on the following five items: negative statements, self-deprecation, guilt/shame, hopelessness, and sad, pained, worried facial expression. Scores on the DSI range from 0 to 15 with scores between 3 and 6 considered to be indicative of possible depression and scores greater than 6 considered to be indicative of more severe depression. Perlman, Hirdes, Barbaree et al. (2013) found the DSI to have good reliability and strong convergent validity.

Data Analyses. Statistical analyses were performed at three different but related levels. First, the frequency distribution of the outcome and explanatory variables were obtained. Second, a bivariate analysis using chi-square test of association was performed to determine if there was any significant association between the categorical explanatory variables and NSSI. Variables whose bivariate test had a p-value of .25 or less were retained for inclusion in the multivariate model. Hosmer and Lemeshow (1989) suggested using .25 in screening variables with the view that using a more conservative level (such as .05) at the initial model building stage often fails to identify important known predictors. Following this, logistic regression with backward stepwise elimination procedure was built using SAS PROC LOGISTIC (SAS Institute Inc, Cary, NC) to examine the likelihood of engaging in NSSI. Logistic regression was chosen because the outcome variable (NSSI) was dichotomous and the explanatory variables were measured as either nominal or interval/ratio variables. Logistic regression is a more flexible statistical technique to use than ordinary least square regression because with logistic regression, the explanatory variables do not have to be normally distributed or linearly related (Hosmer & Lemeshow, 1989; Tabachnick & Fidell, 2007).

The goodness-of-fit (GOF) of the models was assessed by calculating the Hosmer-Lemeshow test statistic with non-significant chi-square values indicating that the model is fit (Hosmer & Lemeshow, 1989). The predictive performance of the model was assessed using the c -statistic. The c -statistic is a term similar to the area under a receiver operating characteristic (ROC) curve (Cook, 2008; Hanley & McNeil, 1982). Generally, the c -statistic ranges from 0.5 (no predictive ability) to 1 (perfect discrimination) (Cook, 2008). All analyses were performed using SAS version 9.2 (SAS Institute Inc, Cary, NC).

RESULTS

Sample Description

Of the 2,013 adolescents, 407 representing 20.2%, engaged in NSSI within the last 12 months. The distribution of abuse is as follows: 29.4% experienced emotional abuse, 19.4% experienced physical abuse, and 15.3% experienced sexual abuse. Approximately half of the adolescents reported using cannabis within the past year, and one in three (36.6%) use tobacco daily. About 28% consumed alcoholic beverages. Intentional misuse of prescription medication was reported by 11% of the adolescents. Of the various psychiatric diagnoses, mood disorders was the most common diagnosis (50.1%), followed by schizophrenia and other psychotic disorders (29.5%) and substance-related disorders (25.0%). See Table 1 for a detailed distribution of the variables used in the analyses.

Bivariate Analysis of Sample Characteristics by NSSI

At the bivariate level, a number of explanatory variables were found to be significantly associated with engaging in NSSI. The proportion of older adolescents who engaged in NSSI was significantly smaller than the proportion of younger adolescents who engaged in NSSI ($\chi^2 = 29.99, p < .001$). About 30% of females compared to 12.4% of males engaged in NSSI ($\chi^2 = 96.21, p < .001$). Close to 29% of adolescents with 3 or more psychiatric admissions, compared to 22.1% of those with 1 to 2 admissions and 18.8% of those admitted for the first time engaged in NSSI ($\chi^2 = 8.82, p < .05$). The proportion of adolescents that experienced emotional abuse (26.1%), physical abuse (25.6%), and sexual abuse (34.1%), and engaged in NSSI was significantly greater than the proportion that had not experienced emotional abuse (17.8%), physical abuse (18.9%), and sexual

TABLE 1. Frequency Distribution of Sample Characteristics

Variables	Frequency (%)
Outcome variable	
Engaged in NSSI	
No	1606 (79.8)
Yes	407 (20.2)
Demographic variables	
Age in years	
14	43 (2.14)
15	103 (5.12)
16	289 (14.36)
17	571 (28.37)
18	1007 (50.02)
Sex	
Male	1117 (55.5)
Female	896 (44.5)
Patient is of an Aboriginal origin	
No	1895 (94.1)
Yes	118 (5.9)
Residential instability	
Lives at home	1555 (77.3)
Temporary shelter	458 (22.8)
Number of recent admissions	
None	1425 (70.8)
1–2 admissions	456 (22.7)
3 or more admissions	132 (6.6)
History of abuse	
Emotional abuse	
No	1422 (70.6)
Yes	591 (29.4)
Physical abuse	
No	1622 (80.6)
Yes	391 (19.4)
Sexual abuse	
No	1702 (84.6)
Yes	311 (15.5)
Substance use/medication misuse	
Intentional misuse of prescription medication	
No	1792 (89.0)

(Continued)

TABLE 1. Continued

Variables	Frequency (%)
Yes	221 (11.0)
Inhalant	
No	1965 (97.6)
Yes	48 (2.4)
Hallucinogens	
No	1744 (86.6)
Yes	269 (13.4)
Cocaine and crack	
No	1734 (86.1)
Yes	279 (13.9)
Stimulants	
No	1866 (92.7)
Yes	147 (7.3)
Opiates	
No	1889 (93.8)
Yes	124 (6.2)
Cannabis	
No	1015 (50.4)
Yes	998 (49.6)
Use of alcohol	
No	1446 (71.8)
Yes	567 (28.2)
Tobacco use	
No	1276 (63.4)
Yes	737 (36.6)
DSM-IV provisional psychiatric diagnosis	
Disorders of childhood/adolescence	
Absent	1738 (86.3)
Present	275 (13.7)
Substance-related disorders	
Absent	1510 (75.0)
Present	503 (25.0)
Schizophrenia and other psychotic disorders	
Absent	1420 (70.5)
Present	593 (29.5)
Mood disorders	

(Continued)

TABLE 1. Continued

Variables	Frequency (%)
Absent	1004 (49.9)
Present	1009 (50.1)
Anxiety disorders	
Absent	1769 (87.9)
Present	244 (12.1)
Adjustment disorders	
Absent	1855 (92.1)
Present	158 (7.9)
Personality disorders	
Absent	1801 (89.5)
Present	212 (10.5)
Depressive symptoms	
No/low symptoms of depression	1236 (61.4)
Moderate symptoms of depression	432 (21.5)
More severe symptoms of depression	345 (17.1)

abuse (17.7%) and engaged in NSSI. Of the various substance use variables, this study found that the proportion of adolescents that engaged in NSSI was significantly greater among adolescents who intentionally misused prescription medication, used inhalants or alcohol (see Table 2). Adolescents were also more likely to have engaged in NSSI if they had a diagnosis of mood disorders, adjustment disorders, or personality disorders or had symptoms of depression. Schizophrenia and other psychotic disorders was negatively associated with NSSI at the bivariate level. The following variables were moderately associated with NSSI ($p < .25$): Aboriginal origin, use of tobacco, provisional diagnosis of substance-related disorders, and anxiety disorders.

Multivariate Results Examining the Likelihood of Engaging in SSI

Variables found to be significantly or moderately associated with NSSI at the

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TABLE 2. Bivariate Analysis of Sample Characteristics by NSSI

Characteristics	No NSSI N (%)	NSSI N (%)	χ^2
Age in years			29.99***
14	29 (67.4)	14 (32.6)	
15	72 (69.9)	31 (30.1)	
16	209 (72.3)	80 (27.7)	
17	453 (79.3)	118 (20.7)	
18	843 (83.7)	164 (16.3)	
Sex			96.21***
Male	979 (87.6)	138 (12.4)	
Female	627 (70.0)	269 (30.0)	
Residential instability			0.55 ns
Lives at home	1235 (79.4)	320 (20.6)	
Temporary shelter	371 (81.0)	87 (19.0)	
Patient is of an Aboriginal origin			2.11[†]
No	1518 (80.1)	377 (19.9)	
Yes	88 (74.6)	30 (25.4)	
Number of recent admissions^a			8.82*
None	1157 (81.2)	268 (18.8)	
1–2 admissions	355 (77.9)	101 (22.1)	
3 or more admissions	94 (71.2)	38 (28.8)	
Emotional abuse			17.68***
No	1169 (82.2)	253 (17.8)	
Yes	437 (73.9)	154 (26.1)	
Physical abuse			8.63**
No	1315 (81.1)	307 (18.9)	
Yes	291 (74.4)	100 (25.6)	
Sexual abuse			43.84***
No	1401 (82.3)	301 (17.7)	
Yes	205 (65.9)	106 (34.1)	
Inhalant			7.04**
No	1575 (80.2)	390 (19.8)	
Yes	31 (64.6)	17 (35.4)	
Hallucinogens			0.57 ns
No	1396 (80.0)	348 (20.0)	
Yes	210 (78.1)	59 (21.9)	
Cocaine and crack			0.004 ns
No	1383 (79.8)	351 (20.2)	
Yes	223 (79.9)	56 (20.1)	
Stimulants			1.26 ns
No	1494 (80.1)	372 (19.9)	
Yes	112 (76.2)	35 (23.8)	

(Continued)

TABLE 2. Continued

Characteristics	No NSSI N (%)	NSSI N (%)	χ^2
Opiates			0.46 ns
No	1510 (79.9)	379 (20.1)	
Yes	96 (77.4)	28 (22.6)	
Cannabis			0.18 ns
No	806 (79.4)	209 (20.6)	
Yes	800 (80.2)	198 (19.8)	
Intentional misuse of prescription medication			56.43***
No	1472 (82.1)	320 (17.9)	
Yes	134 (60.6)	87 (39.7)	
Use of alcohol			9.79**
No	1179 (81.5)	267 (18.5)	
Yes	427 (75.3)	140 (24.7)	
Tobacco use			1.32[†]
No	1028 (80.6)	248 (19.4)	
Yes	578 (78.4)	159 (21.6)	
Disorders of childhood/adolescence			0.07 ns
Absent	1385 (79.7)	353 (20.3)	
Present	221 (80.4)	54 (19.6)	
Substance-related disorders			1.88[†]
Absent	1194 (79.1)	316 (20.9)	
Present	412 (81.9)	91 (18.1)	
Schizophrenia and other psychotic disorders			43.05***
Absent	1079 (76.0)	341 (24.0)	
Present	527 (88.9)	66 (11.1)	
Mood disorders			26.06***
Absent	847 (84.4)	157 (15.6)	
Present	759 (75.2)	250 (24.8)	
Anxiety disorders			3.29[†]
Absent	1422 (80.4)	347 (19.6)	
Present	184 (75.4)	60 (24.6)	
Adjustment disorders			13.88***
Absent	1498 (80.8)	357 (19.2)	
Present	108 (68.4)	50 (31.7)	
Personality disorders			20.65***
Absent	1462 (81.2)	339 (18.8)	
Present	144 (67.9)	68 (32.1)	
Depressive symptoms^a			28.90***
No/low symptoms of depression	1032 (83.5)	204 (16.5)	
Moderate symptoms of depression	326 (75.5)	106 (24.5)	
More severe symptoms of depression	248 (71.9)	97 (28.1)	

Note. ^adf = 1 for all comparisons except number of recent admissions and depressive symptoms (df = 2).

[†] $p < .25$; * $p < .05$; ** $p < .01$; *** $p < .001$.

bivariate level were entered in a multivariate logistic regression model to identify the most parsimonious variables in explaining NSSI. Table 3 presents the multivariate logistic regression results for engaging in NSSI. Since each explanatory variable is controlled for by all the other variables in the model, the multivariate analysis gives the net effect of each explanatory variable in relation to the likelihood of engaging in NSSI. The Hosmer-Lemeshow chi-square GOF test statistic was non-significant ($p = 0.736$) indicating that the overall model is good and the variables in the model are all relevant in explaining NSSI. The c -statistic also indicates that 73% of adolescents were correctly classified into NSSI and no NSSI.

Nine variables were positively associated with the likelihood of engaging in NSSI and one variable (age) was negatively associated with NSSI. For every increase in age, the odds of engaging in NSSI was

predicted to decrease by a factor of 25%, holding all other variables in the model constant (OR = 0.75, $p < .001$, 95% CI = 0.67–0.83). Compared to males, odds are more than doubled for adolescent females to have engaged in NSSI (OR = 2.19, $p < .001$, 95% CI = 1.70–2.82). Adolescents with 3 or more psychiatric admissions within the last 2 years were 1.90 times more likely to have engaged in NSSI (OR = 1.90, $p < .01$, 95% CI = 1.23–2.95), and adolescents with 1 to 2 psychiatric admissions within the last 2 years were 1.35 times more likely to have engaged in NSSI (OR = 1.35, $p < .05$, 95% CI = 1.02–1.78) both when compared to adolescents admitted for the first time. The results regarding history of abuse indicate that adolescents who were sexually abused were 51% more likely to have engaged in NSSI compared to their non-abused counterparts (OR = 1.51, $p < .01$, 95% CI = 1.12–2.03).

TABLE 3. Multivariate Logistic Regression Results Examining the Likelihood of Engaging in NSSI

Characteristics	β	S.E.	Exp(β)	95% C.I.
Age in years	-0.2920	0.0539	0.75***	0.67–0.83
Gender—Female	0.7832	0.1292	2.19***	1.70–2.82
Number of recent admissions				
None (RC)			1.00	
1–2 admissions	0.3003	0.1422	1.35*	1.02–1.78
3 or more admissions	0.6431	0.2241	1.90**	1.23–2.95
Sexual abuse	0.4119	0.1505	1.51**	1.12–2.03
Intentional misuse of prescription medications	0.8591	0.1646	2.36***	1.71–3.26
Alcohol	0.3079	0.1299	1.36*	1.06–1.76
Mood disorders	0.3912	0.1269	1.48**	1.15–1.90
Adjustment disorders	0.6996	0.1970	2.01***	1.37–2.96
Personality disorders	0.3651	0.1731	1.44*	1.03–2.02
Depressive symptoms				
No/low symptoms of depression (RC)			1.00	
Moderate symptoms of depression	0.4039	0.1443	1.50**	1.13–1.99
More severe symptoms of depression	0.3533	0.1542	1.42*	1.05–1.93

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.
 Hosmer-Lemeshow χ^2 GOF test (sig) = 5.199 ($p = .736$)
 C statistic = 0.73;
 RC = Reference category.

Intentional misuse of prescription medication emerged as the most robust factor to be associated with NSSI. Thus, odds were 2.36 times higher for adolescents who intentionally misused prescription medication to have engaged in NSSI compared to their counterparts who did not (OR = 2.36, $p < .001$, 95% CI = 1.71–3.26). Odds of engaging in NSSI were 36% higher for adolescents who use alcohol compared to adolescents who do not use alcohol (OR = 1.36, $p < .05$, 95% CI = 1.06–1.76). Adolescents were also more likely to have engaged in NSSI if they had a diagnosis of a mood disorders (OR = 1.48, $p < .01$, 95% C = 1.15–1.90), adjustment disorders (OR = 2.01, $p < .001$, 95% CI = 1.37–2.96), or personality disorders (OR = 1.44, $p < .05$, 95% CI = 1.03–2.02). Compared to adolescents with no symptoms of depression, those with moderate symptoms of depression were 50% more likely to have engaged in NSSI (OR = 1.50, $p < .01$, 95% CI = 1.13–1.99), and those with more severe symptoms of depression were 42% more likely to have engaged in NSSI (OR = 1.42, $p < .05$, 95% CI = 1.05–1.93).

DISCUSSION

This is one of the very few studies in Canada to investigate NSSI among adolescents with mental health needs using a large dataset. The study found that one in five adolescents engaged in NSSI within the last year. Similar proportions have been reported in other studies both in Canada (Nixon, Cloutier, & Aggarwal, 2002; Nixon, Cloutier, & Jansson, 2008) and elsewhere (see, e.g., Brausch & Gutierrez, 2010; Madge, Hewitt, Hawton et al., 2008; Muehlenkamp & Gutierrez, 2007). Brausch, Decker, & Hadley (2011) found 21% of their adolescent sample engaged in NSSI in the last 12 months. Other studies on NSSI have reported higher prevalence rates of this behavior than that found in the present study (see, e.g., Cloutier,

Martin, Kennedy et al., 2010; Heath, Toste, Nedecheva et al., 2008). Differences in how NSSI was measured, the population involved and the sampling procedure are some factors that may account for the variation in prevalence rates (Silverman, Beman, Sanddal et al., 2007). In trying to understand suicide as a phenomenon, it is important to recognize that suicide is a process that starts days, months, or sometimes years before the act itself is executed (Joiner, 2005; Oravec & Moore, 2006). Acquired capability for suicide and habituation to pain, according to Joiner's (2005) theory, place individuals who engage in NSSI at risk for future death from suicide. Thus, adolescents who engage in NSSI should be closely monitored particularly given that these are adolescents with mental health and behavior problems.

The finding that adolescent females are more likely to engage in NSSI than their male counterparts is consistent with previous studies (e.g., Handwerk, Clopton, Huefner et al., 2006; Ross & Heath, 2002; Rossow & Lauritzen, 1999; Sornberger, Heath, Toste et al., 2012). However, Gratz (2001) failed to find any significant association between NSSI and gender. Furthermore, Baetens, Claes, Muehlenkamp et al. (2011) investigated both NSSI and suicidal self-injury among Flemish youth and found no significant association between gender and NSSI or suicidal self-injury, although females reported more incidences of both NSSI and suicidal self-injury than males. Various explanations have been offered for the gender differences in NSSI with the most common reason being the method used in carrying out the act (Canetto & Sakinofsky, 1998; Langhinrichsen-Rohling, Friend, & Powell, 2009; Sornberger, Heath, Toste et al., 2012). Langhinrichsen-Rohling, Friend, and Powell (2009) in their review noted that whereas females are more likely to engage in NSSI using less harmful and unpredictable methods, males are more likely to engage in NSSI using lethal methods. Other researchers have also noted that

females requiring attention often engage in NSSI using less lethal methods as a way of “crying for help” than males (Canetto & Sakinofsky, 1998; Hamza, Stewart, & Willoughby, 2012; Langhinrichsen-Rohling, Friend, & Powell, 2009).

The central finding of the present study suggested that adolescents who intentionally misused prescription medication were more likely to have engaged in NSSI than those who did not. This finding is consistent with some past studies on medication overdose and NSSI (Buykx, Dietze, Ritter et al., 2010; Nixon, Cloutier, & Aggarwal, 2002; Rossow & Lauritzen, 1999). Rossow and Lauritzen (1999) found that almost half (45.5%) of substance users in their sample reported having experienced one or more life-threatening medication overdose and were six times more likely to have made a suicide attempt than their counterparts who had not overdosed. Kposowa and McElvain (2006) also found that females in their study were less likely to die by use of firearms but more likely to die from medication misuse compared to males, suggesting a gender by medication interaction effect in explaining NSSI. Medication misuse and life threatening behaviors such as NSSI should therefore not be seen as two separate phenomena as individuals with a history of medication misuse have increased risk of death by suicide (Carter, Reith, Whyte et al., 2005; Langhinrichsen-Rohling, Friend, & Powell, 2009). The present findings also give credence to the view that NSSI among substance abusers and those who misused medication is related to risk-taking behavior, originating in deep-seated mental health problems (Jenkins & Schmitz, 2012; Neufeld, Hirdes, & Rabinowitz, 2011; Rossow & Lauritzen, 1999; Stewart, Baiden, & den Dunnen, 2013).

The strong relationship between medication misuse and NSSI could also be a reflection of the fact that some adolescents may be using medication irresponsibly as a form of NSSI. In some

situations, medication misuse and substance use may serve as maladaptive coping strategies to divert painful emotions related to unresolved trauma or to help in releasing unbearable tension. It is also possible that some adolescents may be using medication to regulate their affect and emotions, as is NSSI. Misuse of medication may also be a future risk factor for NSSI or an indicator of adolescents already engaging in NSSI. Further research is needed to identify the type of psychotropic medication that is frequently misused by those who engage in NSSI. Also, the interaction between gender and medication misuse in explaining NSSI warrants additional examination in future research studies.

It was not surprising that adolescents with multiple admissions were more likely to have engaged in NSSI. These adolescents generally require various services including multiple hospitalizations, psychotherapy, medication, and treatment follow-up. The profile complexity of adolescents who engaged in NSSI has also been highlighted by the findings of Olfson, Gameroff, Marcus et al. (2005), who found that adolescents readmitted to psychiatric hospitals for NSSI have severe psychiatric problems. Bethell and Rhodes (2009) also found repeated NSSI behaviors to be associated with multiple use of emergency department services. Similar results have also been found by Cloutier, Martin, Kennedy et al. (2010). The findings regarding the association between multiple admissions and NSSI should alert clinicians about the risk of suicidal behavior among repeated users of mental health services.

Findings from this study indicate that adjustment, personality, mood disorders, and depression were all associated with engaging in NSSI. The association of depression and other mental health symptoms with NSSI has been noted by other scholars (Cloutier, Martin, Kennedy et al., 2010; Jenkins & Schmitz, 2012; Martin, Bureau, Cloutier et al., 2011; Muehlenkamp,

Ertelt, Miller et al., 2011; Nock, Joiner, Gordon et al., 2006). The diagnosis of personality disorders during the period of adolescence is not without controversy. Whereas the DSM-IV notes that the presence of personality disorders is stable over time and can be traced back at least to adolescence or early adulthood (American Psychiatric Association, 2000), most diagnosticians do not make this diagnosis until after age 18 despite the fact that many of the features related to personality issues (e.g., Shiner, 2005; Tackett, Balsis, Oltmanns et al., 2009) and coping styles are evidenced in earlier stages of development. For example, Shiner (2005) noted that childhood and adult personality disorders do have common traits with adult personality disorders rooted in childhood.

The experience of sexual abuse was found to be associated with engaging in NSSI. Past studies have found childhood trauma to be associated with a variety of negative outcomes including NSSI, and other suicide related behaviors (Joiner, Sachs-Ericsson, Wingate et al., 2007; Klonsky & Moyer, 2008; Noll, Horowitz, Bonanno et al., 2003; Weierich & Nock, 2008). NSSI appears to be related to factors surrounding the abuse such as the age of the child at the time of the abuse, the severity and chronicity of the abuse, the child's connection to the perpetrator, as well as whether the child received validation at the time of the disclosure (Gladstone, Parker, Mitchell et al., 2004; Lange, De Beurs, Dolan et al., 1999; Wind & Silvern, 1994). Issues related to the violation of trust as well as the lack of validation after the disclosure have been previously reported to have a significant impact on future healing (Gladstone, Parker, Mitchell et al., 2004; Stewart, Leschied, den Dunnen et al., 2013). Tailored interventions to address unresolved trauma while combating self-defeating coping styles are needed to address issues of self worth and self-definition that may, in turn, prevent future

self-damaging behaviors as well as re-victimization (Gladstone, Parker, Mitchell et al., 2004).

Study Limitations

Just as many other studies, this study has some limitations that must be taken into account when interpreting the findings. First, even though a number of variables have been shown to be associated with NSSI, the cross-sectional nature of the data impedes our ability to make causal inferences between the explanatory variables and the outcome variable. In other words, we were unable to establish the temporal order of effects between NSSI and some of the explanatory variables. It is possible that some of the factors assessed (e.g., substance use, medication misuse, and history of abuse) could have occurred after engaging in NSSI. We plan on addressing this in future studies. Second, the assessment of constructs using a single-item rather than multiple-items could affect some of the results. Third, the sample used for this study was comprised of adolescents placed in adult facilities rather than mental health treatment facilities tailored to the needs of children and adolescents. This may limit the generalizability of the findings to other populations as these adolescents, on average, tend to be older than those in mainly child and adolescent facilities. Also, the findings cannot be generalized to other cultures. In addition, we were unable to examine certain patient characteristics such as race/ethnicity or parents' socioeconomic factors for the most part because these variables were not readily available in the RAI-MH dataset. This should be investigated in future studies as other studies have shown associations between these variables and engaging in life threatening acts (Heath, Toste, Nedecheva et al., 2008; Muehlenkamp, Ertelt, Miller et al., 2011; Welch, 2001). Lastly, we were unable to

investigate whether adolescents who engaged in NSSI were also more or less likely to engage in other suicidal behaviors. Hamza, Stewart, and Willoughby (2012), in their review on NSSI and suicidal behavior identified three leading theories—the gateway theory, the third variable theory, and the theory of acquired capability for suicide—in the field of suicidology that account for the link between NSSI and other suicidal behaviors. In future studies, we hope to examine these three theoretical models among adolescents with mental health needs. Despite these limitations, the findings reported in this study highlight some of the factors associated with engaging in NSSI among adolescents with mental health needs.

Conclusion

The objectives of this study were to examine the prevalence of NSSI among adolescents with mental health needs and identify specific factors associated with engaging in NSSI. Findings of this study provide evidence suggesting that various factors contribute to engaging in such behaviors. We have shown that over and above other patient characteristics, medication misuse was the most contributing factor in explaining NSSI. Although various ideas regarding etiology of NSSI have been offered, the influence of medication misuse among adolescents with mental health deserves further attention. As the number of adolescents receiving mental health services in Canada continues to grow, various stakeholders are confronted with the challenge of providing services to reduce the risk of NSSI among this population. This issue has clinical relevance given that understanding factors associated with NSSI will assist physicians, nurses, and care providers in the identification of adolescents that may require close or constant observation or have other protective measures in place to prevent NSSI and even suicide. Clinicians

treating adolescents at risk for self-injury and suicide-related behaviors will benefit from obtaining a comprehensive assessment of the adolescent's mental health related symptoms, history of medication misuse, and abuse history, as well as factors related to the increased likelihood of engaging in NSSI. Physicians, clinicians, and care providers also need to consider these factors in discharge planning and future service delivery.

AUTHOR NOTE

Shannon L. Stewart, Philip Baiden, and Laura Theall-Honey. Child and Parent Resource Institute, London, Ontario, Canada.

Correspondence concerning this article should be addressed to Shannon L. Stewart, Child and Parent Resource Institute, 600 Sanatorium Road, London, ON N6H 3W7, Canada. E-mail: shannon.stewart@ontario.ca

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