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The role of adverse childhood experiences as determinants of non-suicidal self-injury among children and adolescents referred to community and inpatient mental health settings

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ABSTRACT

The objectives of this study were to examine the prevalence of, and determine the effect of adverse childhood experiences on non-suicidal self-injury among children and adolescents referred to community and inpatient mental health settings. Data for this study were obtained from the *interRAI Child and Youth Mental Health* dataset. A total of 2038 children and adolescents aged 8–18 years ($M = 12.49$; $SD = 2.88$, 61.1% males) were analyzed. Binary logistic regression was fitted to identify predictors of non-suicidal self-injury as a function of adverse childhood experiences, depression, and social support while simultaneously controlling for age, gender, type of patient, legal guardianship, marital status of parents/caregivers, history of foster family placement, and mental health diagnoses. Of the 2038 children and adolescents examined, 592 (29%) of this clinical sample engaged in non-suicidal self-injury. In the multivariate logistic regression model, children and adolescents who were physically abused had 49% higher odds of engaging in non-suicidal self-injury and children and adolescents who were sexually abused had 60% higher odds of engaging in non-suicidal self-injury, when compared to their non-abused counterparts. Other predictors of non-suicidal self-injury include: older age, female gender, inpatient status, depression, attention deficit-hyperactivity disorder, disruptive behavior disorder, and mood disorders. Children and adolescents who had some form of social support had a 26% decrease in the odds of engaging in non-suicidal self-injury. Assessment procedures for indicators of mental health, particularly among children and adolescents with a history of adverse childhood experiences, should also take into account non-suicidal self-injury. In addition to bolstering social support networks, addressing depression and related emotion regulation skills in childhood may help prevent future non-suicidal self-injury behaviors.

1. Introduction

The phenomenon of non-suicidal self-injury (NSSI), which is generally defined as “the direct, deliberate destruction of one’s own body tissue in the absence of suicidal intent” (Nock & Favazza, 2009, p. 9), is now recognized globally as a major public health issue, with up to 70% of children and adolescents with mental health problems engaging in NSSI (Kaess et al., 2013; Thomassin, Shaffer, Madden, & Londi, 2016; Weismore & Esposito-Smythers, 2010; Zetterqvist, Lundh, & Svedin, 2014). Historically, NSSI has been

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considered primarily as a symptom of borderline personality disorder (BPD) such that in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III) of the American Psychiatric Association (American Psychiatric Association, 1980), it was classified as one of the defining symptoms of BPD and included behaviors such as “physically self-damaging acts, e.g., suicidal gestures, self-mutilation, recurrent accidents or physical fights” (American Psychiatric Association, 1980, p. 323). However, over time, NSSI has begun to be understood more broadly as a behavior requiring its own diagnostic category (Claes & Vandereycken, 2007; Muehlenkamp, 2005, 2014; Posner, Brodsky, Yershova, Buchanan, & Mann, 2014). In the DSM-5, NSSI was considered as an autonomous diagnostic category where it was listed in the appendix as one of the mental health conditions requiring further study. The authors of the DSM-5 have proposed the following definition of NSSI “in the last year, the individual has, on 5 or more days, engaged in intentional self-inflicted damage to the surface of his or her body of a sort likely to induce bleeding, bruising, or pain (e.g., cutting, burning, stabbing, hitting, excessive rubbing), with the expectation that the injury will lead to only minor or moderate physical harm” (American Psychiatric Association, 2013, p. 803).

Behaviors such as cutting, pinching, poking, scratching, sticking pins and needles into the skin, and hair pulling, that result in self-injury but with no suicidal intent and causes less lethal damage to bodily tissue are classified as NSSI (Nock & Favazza, 2009), whereas behaviors, such as self-injury involving fire arms and medication overdose with suicidal intent are classified as suicidal self-injury (SSI) (Messer & Fremouw, 2008; Muehlenkamp, 2014; Posner et al., 2014). Intent, lethality, and repetition/frequency are three important constructs that distinguish NSSI from SSI. For a detailed discussion of these constructs, the reader is referred to the following papers: Hamza, Stewart, and Willoughby (2012), Silverman, Berman, Sanddal, O’Carroll, and Joiner (2007a) and Silverman, Berman, Sanddal, O’Carroll, and Joiner (2007b).

1.1. Prevalence estimates of NSSI among children and adolescents

Prevalence estimates of NSSI among children and adolescents vary widely as a result of a number of factors including the time since last episode of NSSI, number of NSSI episodes to be endorsed, population examined, as well as reasons for engaging in NSSI. Within the Canadian context, prevalence estimates typically range from as low as 7% in student samples (Duggan, Heath, & Hu, 2015), to as high as 77% in clinical samples (Preyde et al., 2014). Using the Deliberate Self-Harm Inventory (DSHI), Heath, Toste, Nedecheva, and Charlebois (2008) assessed NSSI among students from a large urban university in Montreal, Quebec, and found 11.7% of the students reported engaging in NSSI at some point in their life. In a longitudinal study, Preyde et al. (2012) examined data on 169 children and adolescents from five mental health agencies in southwestern Ontario and found that 57 (34%) of the participants engaged in NSSI at baseline. Of these 57 participants, 27 (47%) engaged in mild NSSI behaviors (e.g., repeated pinching), 23 (40%) engaged in severe NSSI behaviors (e.g., deep razor cuts), and 7 (12%) engaged in life-threatening NSSI behaviors (e.g., running into the path of an oncoming vehicle on a busy street) (Preyde et al., 2012).

Studies from other jurisdictions have also reported wide variation in prevalence estimates of NSSI among adolescents in clinical samples ranging from 40% (Kaess et al., 2013) to 80% (Auerbach et al., 2014). A systematic review performed by Swannell, Martin, Page, Hasking, and St John (2014) to investigate the effect of methodological factors on NSSI in non-clinical samples found a pooled NSSI prevalence estimate among adolescents to be 17.2%. Swannell et al. (2014) also found that methodological factors contributed to more than half of the heterogeneity in prevalence estimates. In addition, Muehlenkamp, Claes, Havertape, and Plener (2012) undertook a systematic review of studies published between 2005 and 2011 on the prevalence rate of NSSI among adolescents and found the mean lifetime prevalence of NSSI across studies to be 18% (SD = 7.3%). They also found that assessing NSSI using a single item often results in a lower prevalence rate than assessment with a specific behavior checklist.

1.2. Factors associated with NSSI

One consistent factor that has been identified as a significant predictor of NSSI among adolescents is adverse childhood experiences (ACEs) (Franzke, Wabnitz, & Catani, 2015; Glassman, Weierich, Hooley, Deliberto, & Nock, 2007; Gratz, 2006; Kaess et al., 2013; Zetterqvist et al., 2014). Yates (2009) observed that as much as 80% of those who engaged in NSSI reported having a history of ACEs. ACEs refer to distressing and/or traumatic events that occur during childhood, such as emotional, physical, and sexual abuse; emotional and physical neglect; caregiver risk factors such as of addiction or substance use, mental illness, incarceration, separation or divorce; and violent treatment of the mother (Saul et al., 2014).

Estimates based on data from the Canadian Incidence Study of Reported Child Abuse and Neglect (CIS) suggest that the number of children and adolescents with investigated incidents of child abuse and neglect in Canada is on the rise (Trocmé et al., 2010). For instance, an estimated 135,261 investigated incidents of child abuse and neglect were conducted in Canada in 1998 representing a rate of 21.57 per 1000 children investigations. By 2008, this rate has increased to 39.16 investigations per 1000 children (235,842 child abuse and neglect related investigations) (Trocmé et al., 2010). According to the CIS-2008, more than two-thirds of the substantiated child maltreatment investigations were related to either witnessing domestic violence (34%) or neglect (34%), followed by physical abuse (20%), emotional abuse (9%), and sexual abuse (3%).

The extant literature has found a history of ACEs to be associated with increased likelihood of a number of negative outcomes later in life, including anxiety and depression (Coohey, Dirks-Bihun, Renner, & Baller, 2014; Greger, Myhre, Lydersen, & Jozefiak, 2015; Larkin, Felitti, & Anda, 2014), suicide attempt (Dube et al., 2001), alcohol, tobacco, and illicit drug use (Braciszewski & Colby, 2015; Traube, James, Zhang, & Landsverk, 2012), poor self-esteem (Arslan, 2016), and risky sexual behavior (Anda et al., 2006;

Noll, Haralson, Butler, & Shenk, 2011). Other longitudinal studies (e.g., Lewis et al., 2011), systematic reviews and meta-analyses (Agnew-Blais & Danese, 2016; Maniglio, 2010, 2012) have also found a strong relationship between ACEs and mental health problems. Using data from the longitudinal study of child abuse and neglect, Lewis et al. (2011) found that history of ACEs predicted internalizing behavior problems at age 14 and cigarette smoking at age 16. Furthermore, Maniglio (2010, 2012) conducted systematic reviews and found that having a history of childhood sexual abuse was a significant risk factor for developing both depression and anxiety disorder, regardless of gender of the victim and severity of the abuse.

With respect to the association between ACEs and NSSI, various systematic reviews and meta-analyses (Ford & Gómez, 2015; Lang & Sharma-Patel, 2011; Maniglio, 2011; Smith, Kouros, & Meuret, 2014) have shown that adolescents with a history of ACEs are more likely to engage in NSSI, even after adjusting for demographic and known mental health factors. Similar results have been found among adolescent inpatients (e.g., Bifulco et al., 2014; Kaess et al., 2013; Thomassin et al., 2016). History of foster placement has also been linked to NSSI (Grenville, Goodman, & Macpherson, 2012). Shenk, Noll, and Cassarly (2010) examined data on 129 maltreated and 82 non-maltreated adolescent females aged 14–18 years in the Midwest region of the US and found that adolescents who were sexually abused, neglected, or experienced multiple abuses were significantly more likely to report engaging in NSSI. A burgeoning number of studies have found that children and adolescents exposed to indirect forms of childhood adversities, such as parental addiction or mental health problems or witnessed domestic violence, are at increased risk of engaging in NSSI (Armiento, Hamza, Stewart, & Leschied, 2016). However, some studies have failed to find a significant association between having a history of ACEs, specifically physical abuse and neglect, and NSSI (Auerbach et al., 2014; Glassman et al., 2007).

Studies that have found a relationship between NSSI and history of ACEs have noted that adolescents with a history of ACEs are likely to have trouble coping with their past traumatic experiences and as a result may engage in NSSI as a means to regulate their affect and emotion, which is referred to as the theory of affect regulation (Messer & Fremouw, 2008; Suyemoto, 1998). The theory hypothesizes that engaging in NSSI stems from the need to control past experiences of trauma, or anger and pain that cannot be expressed verbally or through other means (Suyemoto, 1998). Various studies, both cross-sectional and longitudinal, have found support for the theory of affect regulation in explaining NSSI among children and adolescents with a history of ACEs (Joiner et al., 2007; Nock & Prinstein, 2005; Noll, Horowitz, Bonanno, Trickett, & Putnam, 2003). Brown, Comtois, and Linehan (2002) examined reasons for suicide attempts versus NSSI among 75 suicidal women meeting criteria for BPD and found that the desire to express anger, punish oneself, generate normal feelings, and distract oneself were the most common reasons cited for engaging in NSSI, whereas the desire to make others better off was the most common reason cited for attempting suicide.

Additionally, Nock and Prinstein (2004) examined the functions of NSSI among adolescents and found that more than half (53%) of their sample engaged in NSSI as a way of regulating their affect (other reasons cited include: to relieve numbness or emptiness, to punish oneself, and to feel relaxed). Bureau et al. (2010) investigated specific aspects underlying the association between early parent-child relationships and NSSI among university students from Eastern Canada. The relationship between the NSSI group and their parents, in comparison to the parent-child relationships in the non-NSSI group, was associated with more failed protection, fear, overprotection, alienation, less care, less trust, and less communication (Bureau et al., 2010). Also, Tatnell, Kelada, Hasking, and Martin (2014) analyzed longitudinal data on 2637 adolescents from 40 high schools across Australia and found that students who grew up in families with insecure attachment had 11% higher odds of engaging in NSSI at follow-up.

The existing literature has also shown that mental health problems such as anxiety (Claes, Luyckx, Bijttebier et al., 2015), depression (Bentley, Cassiello-Robbins, Vittorio, Sauer-Zavala, & Barlow, 2015; Tuisku et al., 2006), and alcohol and substance use problems (Brausch & Boone, 2015; Gratz & Tull, 2010; Rossow et al., 2007) are significant predictors of NSSI among children and adolescents. Bentley et al. (2015) conducted a meta-analysis on 56 studies that examined NSSI among individuals with and without emotional disorders and found that those diagnosed with emotional disorders, such as mood disorders, anxiety disorders, posttraumatic stress disorder (PTSD), and obsessive-compulsive disorder (OCD), were significantly more likely to report engaging in NSSI than their counterparts with no such diagnosis.

1.3. Study objective

Whereas studies from other countries have investigated the effect of ACEs on NSSI among adolescent inpatients (see e.g., Kaess et al., 2013; Thomassin et al., 2016), to date, few studies within the Canadian context have examined the effect of ACEs on NSSI among clinical samples of children and adolescents with mental health problems. Most of the existing studies on NSSI among children and adolescents in Canada are from the general population or relied on student samples where the proportion of individuals with a history of ACEs is much lower than that found in clinical samples or child welfare samples (Heath et al., 2008). Thus, using data from the *interRAI Child and Youth Mental Health Assessment*, the objectives of this study were to: 1) examine the prevalence of NSSI among children and adolescents referred to community and inpatient mental health settings in Ontario, Canada, and 2) determine the effect of ACEs on NSSI after taking into account demographic factors, depression, social support, and mental health diagnoses.

2. Data and methods

2.1. Participants

This study used data from the *interRAI Child and Youth Mental Health* dataset ChYMH; (Stewart, Hirdes et al., 2015), which was collected from 24 mental health agencies in Ontario from November of 2012 to June 2016. The interRAI ChYMH is a comprehensive instrument comprising of approximately 400 clinical elements covering various behavioral and mental state indicators, stress and trauma, child maltreatment history, strength and resilience, social support, substance use, medication history, DSM-IV 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 interRAI suite of assessments was designed to be used by researchers and clinicians to assist vulnerable populations and is currently being used internationally. Numerous studies have found items and scales embedded in the ChYMH to have strong psychometric properties (Phillips et al., 2012; Phillips & Hawes, 2015; Stewart, Currie, Arbeau, Leschied, & Kerry, 2015; Stewart & Hamza, 2017). The sample analyzed in this study consisted of 2038 children and adolescents aged 8–18 years ($M = 12.49$; $SD = 2.88$). The majority (61.1%) of the children and adolescents were males and 239 (11.7%) were inpatients. About 55% of the children and adolescents lived with both parents, 33.6% lived with their mother only or their father only, 6.5% lived alone or lived with other relatives, and the other 5.4% were from child protection agencies. About 17% of the children and adolescents had a history of foster family placements. In terms of marital status, 44.1% of the parents/caregivers were married or lived with a partner, 29.5% were formerly married, 21.1% were never married, and 5.4% were unknown. Of the various mental health diagnoses, 47.4% had diagnosis of attention-deficit/hyperactivity disorder (ADHD), 38.0% were diagnosed with anxiety disorders, 24.7% were diagnosed with disruptive behavior disorders, 23.8% were diagnosed with learning/communication disorders, 15.1% were diagnosed with mood disorders, and 11.2% were diagnosed with autism spectrum disorder. Less than 3.5% of the children and adolescents had diagnoses of sleep disorders, adjustment disorders, reactive attachment disorder, substance related disorders, eating disorders, and schizophrenia and other psychotic disorders. Ethics approval was sought for analysis of the de-identified data and was approved by the Research Ethics Board of Western University.

2.2. Measures

2.2.1. Outcome variable

The outcome variable investigated in this study was NSSI; it 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 that requires awareness on the part of the child that his or her actions may have a harmful outcome to him or herself. Assessors were asked to evaluate the recency of any self-injurious behavior by the child, including both lethally motivated suicidal behavior and behavior that inflicts self-injury without suicidal intent (e.g., self-cutting, self-mutilation, burning, head-banging, etc.) on a six-point scale ranging from “0 = Never”, “1 = More than a year ago”, “2 = 31 days - 1 year ago”, “3 = 8 – 30 days ago”, “4 = 4 – 7 days ago”, to “5 = In the last 3 days”. For the purposes of this item, non-intentional, accidental, or unconscious self-destructive behaviors that may lead to injury or premature death are not considered self-injurious behaviors. 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 whether the child had ever intentionally engaged in lethally motivated self-injurious behavior with the intent to kill him or herself. This variable 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 (see e.g., Armiento et al., 2016; Muehlenkamp & Gutierrez, 2004).

2.2.2. Explanatory variables

Explanatory variables examined in this study include a history of emotional abuse, physical abuse, sexual abuse, neglect, witnessing domestic violence, and parental addiction or substance abuse. The recency of occurrence of these stressful and traumatic life events were 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 ChYMH 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, identify, 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 was defined to mean, parent or primary caregiver having a repetitive and persistent use of alcohol or drugs (Stewart, Hirdes et al., 2015). These variables were coded as binary variables “0 = Never” versus “1 = Ever.”

This study also takes into account social support and measures of depression. Social support was measured based on the availability of support that a child has that he or she can rely on for his or her emotional needs or can draw on in times of crisis. Children who need support but do not have family members (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.

Lastly, depression was measured as an interval/ratio variable using the interRAI ChYMH Depression Symptoms Scale (DSS) which is a 9-item standardized and validated scale for measuring depression (Stewart & Hamza, 2017). Assessors were asked to code on a five-point Likert scale (ranging from “0 = Not present”, “1 = present but not exhibited in last 3 days”, “2 = Exhibited on 1–2 of last 3 days”, “3 = Exhibited daily in the last 3 days, 1–2 episodes”, and “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 (e.g., furrowed brow, constant frowning); crying, tearfulness; made negative statements (e.g., nothing matters, no one likes me, I hate my life, would rather be dead, what’s the use, let me die); self-deprecation (I’m stupid, I’m bad, I can’t do anything right, I’m nothing, 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 (marked increase in being short-tempered or easily upset); lack of motivation; and withdrawal from activities of interest (Stewart, Hirdes et al., 2015). Scores on the DSS range from 0 to 36, with higher scores indicating severe symptoms of depression. 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, Fadiya, & Hirdes, 2016). The DSS has been used among children and adolescents with mental health problems and has been found to have strong psychometric properties (Stewart & Hamza, 2017). Internal consistency of the 9-items was assessed using Cronbach’s alpha to determine the extent to which the items correlate with each other. 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.

2.2.3. Control variables

The study also controlled for the following variables: age, gender, type of patient, legal guardianship, marital status of parents/caregivers, and history of foster family placement. Age was measured as a continuous variable whereas gender was coded as a binary variable with male as the reference category. Children and adolescents from inpatient mental health clinics were coded as 1 and compared with children and adolescents from outpatient mental health clinics who were coded as 0. Both legal guardianship and marital status of parents/caregivers were measured as nominal variables. Children and adolescents with a history of foster family placement were coded as 1 and compared with their counterparts with no history of foster family placement who were coded as 0.

2.3. Data analyses

Descriptive statistics for all the variables were first conducted using percentages for the categorical variables. Mean, standard deviation, and range were computed for age and depression. The bivariate association between NSSI and the categorical variables was examined using Pearson chi-square test of association and one-way analysis of variance (ANOVA) was used to compare the average age and depression score among children and adolescents who engaged in NSSI versus children and adolescents who did not engage in NSSI. Binary logistic regression was then fitted to identify predictors of NSSI as a function of ACEs, depression, and social support while simultaneously controlling for age, gender, type of patient, legal guardianship, marital status of parents/caregivers, history of foster family placement, and mental health diagnoses. Binary logistic regression was chosen as it is more robust in predicting binary dependent variables with independent variables that could be measured as continuous or categorical variables (Hosmer & Lemeshow, 2000; Tabachnick & Fidell, 2007). All the variables were entered in the model using the enter method. A number of model fitness indexes were employed to assess the general fit of the model including the Hosmer-Lemeshow Goodness-Of-Fit test statistic whereby a nonsignificant chi-square test statistic indicates good fit (Hosmer & Lemeshow, 2000). The Omnibus Tests of Model Coefficients, which follows a chi-square distribution, was also used to evaluate the statistical significance of the logistic regression model. The proportion of variance in NSSI that could be explained by the predictors was assessed based on the Nagelkerke pseudo R square, whereas the proportion of children and adolescents correctly classified as having engaged in NSSI versus having not engaged in NSSI was assessed based on the classification table. Variables were considered significant if the p -value was less than 0.05. Adjusted odds ratios (AOR) and 95% C.I. were reported. All statistical analyses were executed using SPSS Version 23 for Windows (SPSS, Inc., Chicago, IL, USA).

3. Results

3.1. Sample characteristics

Table 1 shows the general distribution of the variables examined in this study. Of the 2038 children and adolescents examined, 592 representing 29% indicated that they had engaged in NSSI. Approximately four out of five children and adolescents (79.1%) had some family members or close friends who are able to provide consistent support when needed. With respect to ACEs, more than one in four children and adolescents were emotionally abused (26.5%) or had witnessed domestic violence (26.6%), 19.7% had parents with addiction or substance abuse issues, 17.6% had a history of neglect, 16.1% were physically abused, and 8.1% were sexually abused. The average depression score among the sample fell within the moderate range ($M = 11.13$ ($SD = 7.37$); range = 0–36).

3.2. Bivariate results

As shown in Table 2, the average age among children and adolescents who engaged in NSSI was significantly greater than the average age among children and adolescents who did not engage in NSSI ($M_{\text{noNSSI}} = 12.01$ versus $M_{\text{NSSI}} = 13.66$, $F(1, 2037) = 146.82$, $p < 0.001$). Also, the average depression score among children and adolescents who engaged in NSSI was significantly greater than the average depression score among children and adolescents who did not engage in NSSI ($M_{\text{noNSSI}} = 10.24$ versus $M_{\text{NSSI}} = 13.31$, $F(1, 2037) = 75.55$, $p < 0.001$).

A number variables examined were significantly associated with NSSI at the bivariate level in Table 3. About 42% of females compared to 21% of males engaged in NSSI ($\chi^2 = 102.09$, $df = 1$, $p < 0.001$). The proportion of adolescent inpatients that engaged in NSSI (40.6%) was significantly greater than the proportion of adolescent outpatients that engaged in NSSI (27.5%; $\chi^2 = 17.49$, $df = 1$, $p < 0.001$). More than one third of adolescents with a history of foster family placement engaged in NSSI (35.4%) compared to 27.8% of adolescents with no history of foster family placement that engaged in NSSI ($\chi^2 = 7.88$, $df = 1$, $p = 0.005$). A little over one in three children and adolescents who do not have social support (34.3%) compared to a little over one in four children and adolescents who have social support (27.6%) engaged in NSSI ($\chi^2 = 7.23$, $df = 1$, $p < 0.001$). Children and adolescents were more likely to engage in NSSI if they: were emotionally abused (39.6% vs. 25.3%, $\chi^2 = 39.46$, $df = 1$, $p < 0.001$), were physically abused (41.9% vs. 26.6%, $\chi^2 = 31.66$, $df = 1$, $p < 0.001$), were sexually abused (53.6% vs. 26.9%, $\chi^2 = 52.92$, $df = 1$, $p < 0.001$), were neglected (34.3% vs. 27.9%, $\chi^2 = 5.72$, $df = 1$, $p = 0.017$), witnessed domestic violence (33.9% vs. 27.3%, $\chi^2 = 8.6$, $df = 1$, $p = 0.003$), or had parents with addiction or substance abuse issues (35.6% vs. 27.4%, $\chi^2 = 10.34$, $df = 1$, $p < 0.001$).

Table 4 shows the distribution of ACEs by type of patient (inpatient versus outpatient). The proportion of ACEs among adolescent inpatients was significantly greater than the proportion of ACEs among adolescent outpatients, except sexual abuse which was not statistically significant.

3.3. Multivariate results

Although most of the variables were significantly associated with NSSI at the bivariate level, because the bivariate results did not control for the effect of other predictors, we could not ascertain the net effect of each variable on NSSI. The multivariate results adjusted for the effect of all the other predictors. History of foster family placement, legal guardianship, emotional abuse, neglect, witnessing domestic violence, and parental addiction were reduced to nonsignificance once we adjust for other factors in the multivariate model. Results shown in Table 5 indicate that each additional increase in age by 1 year increased the odds of engaging in NSSI by 21% (AOR = 1.21, 95% C.I. = 1.16–1.27). Odds were more than two times higher for females to engage in NSSI, when compared to their male counterparts (AOR = 2.43, 95% C.I. = 1.92–3.06). Inpatients had 40% higher odds of engaging in NSSI when compared with their outpatient counterparts (AOR = 1.40, 95% C.I. = 1.01–1.95). Each additional increase in symptoms of depression increase the odds of engaging in NSSI by 6%, net the effect of all the other predictors (AOR = 1.06, 95% C.I. = 1.04–1.07). Children and adolescents with diagnosis of ADHD (AOR = 1.31, 95% C.I. = 1.01–1.69), disruptive behavior disorder (AOR = 1.52, 95% C.I. = 1.15–2.01), or mood disorders (AOR = 1.78, 95% C.I. = 1.33–2.39) also had higher odds of engaging in NSSI. Children and adolescents with a diagnosis of learning or communication disorder had lower odds of engaging in NSSI (AOR = 0.56, 95% C.I. = 0.43–0.75). Children and adolescents who had some form of social support had a 24% decrease in the odds of engaging in NSSI when compared to their counterparts who did not have some form of social support (AOR = 0.76, 95% C.I. = 0.58–0.99).

Of the various ACEs variables examined, only physical abuse and sexual abuse emerged as significant predictors of NSSI in the multivariate model. Children and adolescents who were physically abused had 49% higher odds of engaging in NSSI (AOR = 1.49, 95% C.I. = 1.06–2.09) and children and adolescents who were sexually abused had 60% higher odds of engaging in NSSI (AOR = 1.60, 95% C.I. = 1.09–2.34), when compared to their non-abused counterparts.

Examination of the Hosmer-Lemeshow G.O.F. test statistic indicates that the overall fit of the model was good and, together, the variables made a significant contribution to the model ($\chi^2 = 7.37$, $df = 8$, $p = 0.498$). The Omnibus Tests of Model Coefficients produced a chi-square value of 403.61, which was statistically significant, $p < 0.001$. Together, all the predictors in the model ex-

Table 1
Sample characteristics (N = 2038).

Variables	Frequency (%)	Mean	SD
Age at assessment		12.49	2.88
Depression score		11.13	7.37
Engaged in NSSI			
No	1446 (71.0)		
Yes	592 (29.0)		
Gender			
Male	1246 (61.1)		
Female	792 (38.9)		
Type of patient			
Outpatient	1799 (88.3)		
Inpatient	239 (11.7)		
Legal guardianship			
Both parents	1110 (54.5)		
Mom/Dad alone	685 (33.6)		
Other caregivers	133 (6.5)		
Child Protection Agency	110 (5.4)		
Marital status of parents/caregivers			
Married/Living with partner	898 (44.1)		
Formerly married	600 (29.5)		
Never married	430 (21.1)		
Unknown	109 (5.4)		
History of foster family placement			
None	1701 (83.5)		
At least one	336 (16.5)		
Child/adolescent has social support			
No	426 (20.9)		
Yes	1611 (79.1)		
Emotional abuse			
No	1497 (73.5)		
Yes	541 (26.5)		
Physical abuse			
No	1709 (83.9)		
Yes	329 (16.1)		
Sexual abuse			
No	1872 (91.9)		
Yes	166 (8.1)		
Neglect			
No	1678 (82.4)		
Yes	359 (17.6)		
Witnessed domestic violence			
No	1496 (73.4)		
Yes	542 (26.6)		
Parental addiction/substance abuse			
No	1636 (80.3)		
Yes	402 (19.7)		
Reactive attachment disorder			
No	1989 (97.6)		
Yes	49 (2.4)		
ADHD			
No	1072 (52.6)		
Yes	966 (47.4)		
Disruptive behaviour disorder			
No	1535 (75.3)		
Yes	503 (24.7)		
Learning or communication disorder			
No	1552 (76.2)		
Yes	486 (23.8)		
Autism spectrum disorder			
No	1809 (88.8)		
Yes	229 (11.2)		
Substance-related disorders			
No	1992(97.7)		
Yes	46 (2.3)		
Schizophrenia and other psychotic disorders			
No	2023 (9.93)		
Yes	15 (0.7)		

Table 1 (Continued)

Variables	Frequency (%)	Mean	SD
Mood disorders			
No	1730 (84.9)		
Yes	308 (15.1)		
Anxiety disorders			
No	1263 (62.0)		
Yes	775 (38.0)		
Eating disorders			
No	1999 (98.1)		
Yes	39 (1.9)		
Sleep disorders			
No	1974 (96.9)		
Yes	64 (3.1)		
Adjustment disorders			
No	1977 (97.0)		
Yes	61 (3.0)		

Table 2

ANOVA result examining the relationship between NSSI, and age and depression (N = 2038).

Variables	No NSSI Mean (SD)	NSSI Mean (SD)	F value (df)
Age at assessment	12.01 (2.82)	13.66 (2.69)	146.82 (1, 2036)***
Depression	10.24 (7.10)	13.31 (7.55)	75.55 (1, 2036)***

*** $p < 0.001$.

plained 25.7% of the variance in NSSI and 71.6% of the children were correctly classified as having engaged in NSSI or not engaged in NSSI.

4. Discussion

This study sought to examine the prevalence of NSSI among children and adolescents referred to community and inpatient mental health settings in Ontario, Canada, and determine the effect of ACEs on NSSI after controlling for the effect of other known predictors. We found that 29% of the children and adolescents engaged in NSSI. This proportion is fairly consistent with that found by Preyde et al. (2012) among children and adolescents accessing mental health services in southwestern Ontario but much higher than that found among college students in Canada (e.g., Duggan et al., 2015; Heath et al., 2008). The proportion of adolescents who experienced ACEs and engaged in NSSI may be underestimated and appears to be relatively lower than what has been found in other clinical samples (see e.g., Kaess et al., 2013; Thomassin et al., 2016). The fact that our sample was made up of younger adolescents (mean age = 12.49) could play a role in the proportion of individuals reporting NSSI. In the multivariate logistic regression model, the following factors emerged as predictors of NSSI: older age, female gender, inpatient status, depression, diagnosis of ADHD, disruptive behavior disorder, mood disorders, as well as physical abuse and sexual abuse. Having social support was negatively associated with NSSI.

The finding that older adolescents are more likely to engage in NSSI corroborate past studies that have found NSSI typically begins in adolescence between the ages of 12 and 17 (Claes, Luyckx, Baetens, Van de Ven, & Witteman, 2015; Muehlenkamp & Gutierrez, 2004; Sornberger, Heath, Toste, & McLouth, 2012), although some cases begin after age 18 (Whitlock, Eckenrode, & Silverman, 2006). Muehlenkamp and Gutierrez (2004) found that by age 13, 15% of their respondents had engaged in NSSI, 26% had engaged in NSSI by age 14, and 17% had engaged in NSSI by age 15. In a longitudinal study, Sourander et al. (2006) examined data on 839 adolescents and 738 parents and found a significant increase in acts of NSSI from age 12 to age 15. They found that at age 12, 2.7% of adolescent males compared to 3.1% of adolescent females engaged in NSSI. At age 15, 4.6% of males compared to 12.6% of females engaged in NSSI. They also found that compared to children under age 12, adolescents aged 12–15 years old were three times more likely to have engaged in NSSI during the study duration. This finding was maintained even after the researchers had controlled for gender, Child Behavior Checklist (CBCL) internalizing and externalizing behavior scores, nervousness, family structure, and mother's and father's self-perceived health (Sourander et al., 2006).

The finding that adolescent females are more likely to engage in NSSI than their male counterparts both corroborates and contradicts previous research on NSSI. Whereas some scholars (e.g., Christoffersen, Møhl, DePanfilis, & Vammen, 2015; Heilbron & Prinstein, 2010; Sornberger et al., 2012; Zetterqvist et al., 2014) have found prevalence rates of NSSI to be higher among adolescent females than their male counterparts, others (e.g., Heath et al., 2008; Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008; Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007; Muehlenkamp & Gutierrez, 2004) failed to find any significant association between gender and NSSI. Sornberger et al. (2012) found that one in three adolescent females compared to one in six adolescent males

Table 3
Bivariate association between NSSI and predictors (N = 2038).

Variables	History of NSSI		Chi-square (sig.)
	No	Yes	
Gender			102.09 (0.001)
Male	985 (79.1)	261 (20.9)	
Female	461 (58.2)	331 (41.8)	
Type of patient			17.49 (0.001)
Outpatient	1305 (72.5)	495 (27.5)	
Inpatient	142 (59.4)	97 (40.6)	
Legal guardianship			9.77 (0.021)
Both parents	808 (72.8)	302 (27.2)	
Mom/Dad alone	485 (70.8)	200 (29.2)	
Other caregivers	86 (64.7)	47 (35.3)	
Child Protection Agency	67 (60.9)	43 (39.1)	
Marital status of parents/caregivers			5.74 (0.125)
Married/Living with partner	661 (73.4)	237 (26.4)	
Formerly married	411 (68.5)	189 (31.5)	
Never married	299 (69.5)	131 (30.5)	
Unknown	74 (67.9)	35 (32.1)	
History of foster family placement			7.88 (0.005)
None	1228 (72.2)	437 (27.8)	
At least once	217 (64.6)	119 (35.4)	
Social support			7.23 (0.007)
No	1166 (72.4)	445 (27.6)	
Yes	280 (65.7)	146 (34.3)	
Emotional abuse			39.46 (0.001)
No	1119 (74.7)	378 (25.3)	
Yes	327 (60.4)	214 (39.6)	
Physical abuse			31.66 (0.001)
No	1255 (73.4)	454 (26.6)	
Yes	191 (58.1)	138 (41.9)	
Sexual abuse			52.92 (0.001)
No	1369 (73.1)	503 (26.9)	
Yes	77 (46.4)	89 (53.6)	
Neglect			5.72 (0.017)
No	1209 (72.1)	469 (27.9)	
Yes	236 (65.7)	123 (34.3)	
Witnessed domestic violence			8.60 (0.003)
No	1088 (72.7)	408 (27.3)	
Yes	358 (66.1)	184 (33.9)	
Parental addiction/substance abuse			10.34 (0.001)
No	1187 (72.6)	449 (27.4)	
Yes	259 (64.4)	143 (35.6)	

engaged in NSSI. They also found that among adolescents who reported ever engaging in NSSI, 23% of females compared to 17.9% of males engaged in NSSI more frequently.

The manner in which males and females respond to stress (Altemus, 2006; Kuehner, 2003) or regulate emotions (Nolen-Hoeksema, 2012) could be one of the reasons for the gender differences in NSSI prevalence rates. For instance, whereas females are likely to use more internally focused and passive responses such as rumination to regulate emotions, males are more likely to rely on suppression or avoidance such as turning to alcohol to regulate emotions (Nolen-Hoeksema, 2012). As a result, some studies that have found higher NSSI rates among females have also found higher rates of depression among females than males (Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005).

We found that although both history of foster family placement and legal guardianship were associated with NSSI at the bivariate level, this effect disappears once we adjust for other factors in the multivariate model. Often, the reason why a child is placed in foster care is due to safety conditions in their family of origin (e.g., abuse, neglect). Once the type of abuse was controlled for in the model, foster placement was no longer significant. This is likely due to the fact that physical and sexual abuse accounted for that effect within our model.

Research has consistently identified the importance of social support and having a confidant as protective factors against NSSI (Claes, Bouman et al., 2015; Christoffersen et al., 2015; Heath, Baxter, Toste, & McLouth, 2010). Tseng and Yang (2015) found an inverse association between family support and NSSI for both boys and girls as well as between family support and thoughts of NSSI in girls. Andover, Pepper, and Gibb (2007) examined NSSI and coping strategies among 44 adolescents who engaged in NSSI and 44 adolescents as controls and found that those who engaged in NSSI sought support significantly less often from their parents and used avoidance coping strategies more frequently. Having some amount of support provides adolescents with the ability to deliberate on

Table 4
Bivariate association between type of patient and ACEs (N = 2038).

Variables	Type of patient		Chi-square (sig.)
	Outpatient	Inpatient	
Emotional abuse			14.66 (0.001)
No	1346 (74.8)	151 (63.2)	
Yes	453 (25.2)	88 (36.8)	
Physical abuse			8.32 (0.004)
No	1524 (84.7)	185 (77.4)	
Yes	275 (15.3)	54 (22.6)	
Sexual abuse			1.94 (0.164)
No	1658 (92.2)	214 (89.5)	
Yes	141 (7.8)	25 (10.5)	
Neglect			29.60 (0.001)
No	1512 (84.0)	166 (69.7)	
Yes	287 (16.0)	72 (30.3)	
Witnessed domestic violence			18.28 (0.000)
No	1348 (74.9)	148 (61.9)	
Yes	451 (25.1)	91 (38.1)	
Parental addiction/substance abuse			5.75 (0.017)
No	1458 (81.0)	178 (74.5)	
Yes	341 (19.0)	61 (25.5)	

their stressful life situation and avoid taking actions that might be deleterious to their mental health and well-being (Hay & Meldrum, 2010).

After controlling for demographic factors, depression, and social support, we found that the experience of adversity directed to the child (physical and sexual abuse) predicted NSSI whereas adversities indicative of parental risk such as parental mental health issues and domestic violence were not predictive of NSSI. Although research suggests that direct and indirect abuse often co-occur (Brownridge et al., 2016), our findings corroborates some past studies that have found that only direct abuse toward the child predicts psychopathology (Diamond & Muller, 2004; McKee & Payne, 2014). A study by Kulkarni, Graham-Bermann, Rauch, and Seng (2011) also failed to find any significant association between witnessing domestic violence and current and lifetime diagnosis of posttraumatic stress disorder, although direct child abuse was. Additional studies are needed to fully understand the effect of indirect abuse on NSSI.

Sexual abuse has consistently been identified as a risk factor for NSSI (Ford & Gómez, 2015; Shenk et al., 2010). Bolen, Winter, and Hodges (2013) examined various attachment styles as moderators of the relationship between childhood sexual abuse and NSSI among survivors of childhood sexual abuse entering treatment in the US and found that participants engaged in NSSI as a way to balance their neurophysiological posttraumatic symptoms. Additionally, physical abuse was a significant predictor of NSSI but has not been consistently associated with NSSI in the literature (Auerbach et al., 2014; Glassman et al., 2007). Physical and sexual abuse are two types of abuse that are direct and involve attack on the physical body whereas witnessing domestic violence, emotional abuse, and parental addiction/substance abuse are indirect forms of abuse. It is possible that feelings related to violation of one's body increase the likelihood of engaging in NSSI.

The non-significant findings relating to witnessing domestic violence, neglect, emotional abuse, and parental addiction appears to contradict some past studies (e.g., Bifulco et al., 2014; Kaess et al., 2013; Thomassin et al., 2016). A recent study by Armiento et al. (2016) found exposure to indirect child maltreatment was the only predictor of NSSI after controlling for participants' age and gender. Severity (frequency, intensity, and duration) and recency of direct and indirect abuse may be important to consider in future research to tease apart current findings. Longitudinal research would also be helpful in clarifying the timing of ACEs and age at onset of NSSI.

Depression and mood disorders among adolescents are known predictors of NSSI (Bentley et al., 2015; Duggan et al., 2015; Tuisku et al., 2006), and have also been found in this study. The finding does lend support to the affect regulation theory. Depression is one indication that an individual is having difficulty coping with his/her life situation and being depressed can severely impact one's ability to regulate emotions and focus almost exclusively on the negative aspect of life. Depression can also manifest itself as emotional pain, for which NSSI can be an outlet. Negative statements, feelings of shame/guilt, and expression of sense of hopelessness (e.g., I hate my life, I'm of no use to anyone, I've done something awful, this is my fault, there's no hope for the future, and nothing is going to change for the better) have been observed particularly among survivors of sexual abuse (Aakvaag et al., 2016; Feiring & Taska, 2005; Gorey, Richter, & Snider, 2001). The fact that adolescents with ADHD and disruptive behavior disorder are more likely to engage in NSSI is also consistent with other past studies that suggest that adolescents who have difficulty controlling their own behavior or lack planning or insight into their actions may engage in risk-taking behaviors that put the safety of themselves and others at risk (Allely, 2014; Hinshaw et al., 2012; Meza, Owens, & Hinshaw, 2016).

As a result of this, it is important for clinicians and mental health service professionals to understand that the impact of mental health on life-threatening behaviors, such as NSSI, may be compounded by ACEs, particularly the experience of direct abuse. These

Table 5
Logistic regression analysis predicting NSSI (N = 2038).

Variables	β	OR	95% C.I.	P value
Age at assessment	0.193	1.21	1.16–1.27	0.001
Gender – Female	0.886	2.43	1.92–3.06	0.001
Type of patient – Inpatient	0.338	1.40	1.01–1.95	0.045
Legal guardianship				
Both parents (RC)	1.00			
Mom/Dad alone	–0.149	0.86	0.67–1.10	0.249
Other caregivers	0.182	1.20	0.76–1.90	0.435
Child Protection Agency	0.070	1.07	0.61–1.90	0.811
Marital status of parents/caregivers				
Married/Living with partner (RC)	1.00			
Formerly married	0.073	1.08	0.80–1.45	0.628
Never married	0.272	1.31	0.93–1.86	0.123
Unknown	–0.005	0.99	0.58–1.72	0.986
History of foster family placement	0.126	1.14	0.78–1.65	0.509
Depression	0.056	1.06	1.04–1.07	0.001
Social support	–0.271	0.76	0.58–0.99	0.047
Emotional abuse	0.061	1.06	0.78–1.45	0.700
Physical abuse	0.396	1.49	1.06–2.09	0.023
Sexual abuse	0.467	1.60	1.09–2.34	0.017
Neglect	–0.091	0.91	0.63–1.32	0.626
Witnessed domestic violence	–0.011	0.99	0.73–1.34	0.943
Parental addiction/substance abuse	0.211	1.24	0.91–1.68	0.179
Provisional psychiatric diagnosis				
Reactive attachment disorder	0.532	1.70	0.87–3.34	0.122
ADHD	0.270	1.31	1.01–1.69	0.040
Disruptive behaviour disorder	0.421	1.52	1.15–2.01	0.003
Learning or communication disorder	–0.573	0.56	0.43–0.75	0.001
Autism spectrum disorder	0.073	1.08	0.76–1.53	0.684
Substance-related disorders	0.657	1.93	0.98–3.82	0.059
Schizophrenia and other psychotic disorders	0.855	2.35	0.74–7.53	0.150
Mood disorders	0.577	1.78	1.33–2.39	0.001
Anxiety disorders	–0.035	0.97	0.77–1.22	0.769
Eating disorders	0.662	1.94	0.91–4.13	0.086
Sleep disorders	–0.181	0.84	0.45–1.56	0.570
Adjustment disorders	0.202	1.22	0.67–2.22	0.507

Note: RC = Reference category.

Hosmer-Lemeshow G.O.F. test statistic = 8.34 (0.401).

Omnibus chi-square = 403.38 (0.001).

Nagelkerke pseudo R square = 0.257.

Overall percent correctly classified = 71.7%.

findings are in line with past studies outside Canada that have investigated the link between ACEs and NSSI among adolescents drawing on clinical samples (Glassman et al., 2007) and non-clinical samples (Gratz, 2006; Zetterqvist et al., 2014). The finding that physical abuse predicts NSSI however, contradicts some past studies that found only sexual abuse and not physical abuse predicted NSSI among their clinical sample of adolescents (Auerbach et al., 2014; Kaess et al., 2013). It is important to note however, that the studies by Auerbach et al. (2014) and Kaess et al. (2013) were hampered by small sample size and lower statistical power (194 and 125 adolescents, respectively).

4.1. Study limitations

There are some limitations with this study that should be noted. First, this study relied on cross-sectional data; hence, no causal inferences could be drawn regarding the association between some of the factors associated with NSSI. Additional studies that rely on longitudinal data are needed to tease apart some of the nuances between ACEs and NSSI and some of the inconsistencies in the literature. Second, although the sample was large, and representative of the population of children and adolescents receiving clinical care in Ontario, future studies should examine clinical populations in different geographical regions of Canada. Third, the extant literature on ACEs has acknowledged the importance of measurement in understanding outcomes and specificity. However, the dichotomous nature of the questions examined only whether ACEs occurred or not does not permit for further examination of 'dosage' effects. Future studies that examine the 'dosage' effects of ACEs on NSSI and the underlying mechanism through which risk and protective factors influence NSSI may assist in the identification of children and adolescents with a history of ACEs who are more or less likely to engage in NSSI. Additional studies are also needed to ascertain how generalizable the findings of the present study would

be to other mental health settings outside Canada. Lastly, cross-cultural studies using the ChYMH would provide additional evidence of the impact of ACEs on NSSI.

4.2. Clinical implications

The findings of this study have implications for child and adolescent mental health delivery in Ontario. Children and adolescents who experienced physical and sexual abuse are at higher risk of engaging in NSSI. Assessment procedures that incorporate indicators of mental health issues particularly among children and adolescents with a history of ACEs should also take into account NSSI. Children and adolescents with a history of ACEs and depression are at an even greater risk of engaging in NSSI. From a clinical perspective, understanding the mechanism through which NSSI may occur can inform clinicians and social workers working with formerly abused children and adolescents in preventing future NSSI behaviors. A combination of ACEs and symptoms of depression among children and adolescents who engage in NSSI can also alert clinicians to develop interventions aimed at helping these individuals and their caregivers with emotion regulation skills so as to cope with past trauma and consequently enhance their mental health well-being. Teaching emotion regulation skills in childhood for those who have experienced physical or sexual abuse may also help prevent future NSSI behaviors. Social support is a protective factor and adds to the literature that advocates for a focus on resilience and increasing support as a way to improve functioning. Interventions targeting children and adolescents with a history of ACEs should also consider ways to help them establish early in life a close tie with at least one family member or peer who will be sensitive to their emotions and also take their needs into account.

Uncited reference

Allely (2014).

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