



Predictors and correlates of lifetime and persistent non-suicidal self-injury and suicide attempts among adult survivors of childhood sexual abuse

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ABSTRACT

Background: Childhood sexual abuse (CSA) is a well-established risk factor for non-suicidal self-injury (NSSI) and suicide attempts (SA); still few studies have examined predictors of individual differences in NSSI/SA amongst CSA survivors.

Objective: To examine predictors of NSSI and SA among adult CSA-survivors.

Methods: In a sample of 516, primarily female adult CSA-survivors recruited from support centres for sexual abuse survivors in Norway, we examined the role of abuse/perpetrator characteristics, and the degree/severity of exposure to other types of childhood maltreatment (cumulative childhood maltreatment; CCM), as predictors of *lifetime* NSSI and SA. In a subsample of 138 individuals responding to follow-up waves two- and four years later, these same distal factors, as well as previous NSSI and proximal factors in the form of symptoms of mental health disorders (posttraumatic stress, anxiety, depression, sleep disturbances, and eating disorders), relational problems, and perceived social support, were examined as predictors of *persistent* NSSI. Finally, those attempting new SA during the follow-up period were compared to those who did not on these variables.

Results: Higher CCM scores and having had an unknown perpetrator positively predicted lifetime NSSI scores. Higher CCM scores, violent abuse, and having had an unknown perpetrator predicted lifetime SA. Higher CCM scores, previous NSSI, having had a known perpetrator, as well as higher depression-, anxiety- and eating disorder scores, positively predicted persistent NSSI during the four-year follow-up period. Compared to those with no new SA, those reporting new SA during the follow-up period had higher CCM, lifetime NSSI, mental health symptoms and relational problem scores, lower perceived social support scores, and were more likely to have done a past SA and to have experienced abuse involving physical violence.

Conclusions: A broad range of both distal and proximal factors should be assessed as potential predictors of NSSI and SA among adult CSA-survivors.

Predictores y correlatos de autolesiones no suicidas e intentos suicidas en la vida y persistentes en adultos sobrevivientes de abuso sexual infantil

Antecedentes: El abuso sexual infantil (CSA por sus siglas en inglés) es un factor de riesgo bien establecido para las autolesiones no suicidas (NSSI por sus siglas en inglés) y los intentos suicidas (SA por sus siglas en inglés); aun así, pocos estudios han examinado los predictores de las diferencias individuales en NSSI/SA en los sobrevivientes de CSA.

Objetivo: Examinar los predictores de NSSI y SA entre adultos sobrevivientes de CSA.

Métodos: En una muestra de 516, primariamente mujeres adultas sobrevivientes de CSA reclutadas de centros de apoyo para sobrevivientes de abuso sexual en Noruega, examinamos el rol de las características del abuso/perpetrador y el grado/severidad de la exposición a otros tipos de maltrato infantil (maltrato acumulativo infantil; CCM por sus siglas en inglés), como predictores de NSSI y SA en la vida. En una submuestra de 138 individuos que respondieron a las etapas de seguimiento dos y cuatro años después, se examinaron como predictores de NSSI persistente, estos mismos factores distales, así como NSSI previos y factores proximales en la forma de síntomas de trastornos de salud mental (estrés postraumático, ansiedad, depresión, trastornos del sueño y trastornos de la conducta alimentaria), problemas relacionales, y apoyo social percibido. Finalmente, se compararon en estas variables los que intentaron un nuevo SA durante el periodo de seguimiento con los que no lo hicieron.

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PALABRAS CLAVE

Abuso sexual infantil; sobrevivientes adultos; autolesiones no suicidas; intentos suicidas; estudio de seguimiento; factores de riesgo; problemas relacionales

关键词

童年期性虐待; 成年幸存者; 非自杀性自伤; 自杀企图; 随访研究; 风险因素; 关系问题

HIGHLIGHTS:

- Among CSA-survivors, cumulative childhood maltreatment and abuse/perpetrator features predicted lifetime NSSI/SA.
- At four-years follow-up, previous NSSI and severity of depression-, anxiety-, and eating disorder symptoms predicted persistent NSSI.
- Those attempting a new SA had higher mental health symptom scores, relational problems, lower perceived social support and a history of past SA and abuse involving physical violence.

Resultados: Puntajes más altos de CCM y haber tenido un perpetrador desconocido, predijeron positivamente puntajes de NSSI en la vida. Puntajes de CCM más altos, abuso violento y haber tenido un perpetrador desconocido predijeron el SA en la vida. Los puntajes más altos de CCM, NSSI previos, haber tenido un perpetrador conocido, así como puntajes más altos de depresión, ansiedad y trastornos alimentarios, predijeron positivamente NSSI persistente durante el periodo de seguimiento de 4 años. Comparado con los individuos sin nuevos SA, los que reportaron SA nuevos durante el periodo de seguimiento tenían puntajes más altos de CCM, NSSI en la vida, síntomas de salud mental y problemas relacionales, puntajes más bajos de apoyo social percibido y tenían más probabilidades de haber realizado SA en el pasado y haber experimentado abuso que involucraba violencia física.

Conclusiones: Se debe evaluar una amplia gama de factores distales y proximales como posibles predictores de NSSI y SA entre adultos sobrevivientes de CSA.

童年期性虐待成年幸存者中终身及持续性非自杀性自伤和自杀企图的预测因素和相关因素

背景: 童年期性虐待 (CSA) 是非自杀性自伤 (NSSI) 和自杀企图 (SA) 的公认风险因素;很少有研究考查CSA幸存者中NSSI/SA个体差异的预测因素。

目的: 考查CSA成年幸存者中NSSI和SA的预测因素。

方法: 在从挪威性虐待幸存者支持中心招募的516名主要为CSA成年女性幸存者的样本中,我们考查了虐待/施暴者特征以及暴露于其他类型童年期虐待的程度/严重程度 (累积童年期虐待; CCM) 的作用,作为终身NSSI和SA的预测指标。在参与两年和四年后的随访的138名个体的子样本中,这些相同的远因,先前的NSSI和以心理健康障碍 (创伤后应激,焦虑,抑郁,睡眠障碍和进食障碍),关系问题和感知社会支持形式出现的近因,被确定为持续性NSSI的预测指标。最后,将随访期间尝试新SA的人与未尝试新SA的人在变量上进行了比较。

结果: 较高的CCM评分和不明施暴者,可以正向预测终身NSSI评分。较高的CCM评分,暴力虐待以及不明施暴者可预测终身SA。较高的CCM评分,先前的NSSI,认识施暴者以及较高的抑郁,焦虑和进食障碍评分,可以正向预测四年随访期间的持续性NSSI。与无新SA的患者相比,在随访期间报告新SA的患者具有更高的CCM,终身NSSI,心理健康症状和关系问题评分,较低的感知社会支持评分,并且更有可能曾进行过SA和遭受过包括身体暴力的虐待。

结论: 众多远因和近因应被评估为CSA成年幸存者中NSSI和SA的潜在预测指标。

1. Background

Childhood sexual abuse (CSA) is a highly prevalent (Barth, Bermetz, Heim, Trelle, & Tonia, 2013), well-established risk factor for non-suicidal self-injury (NSSI) (Liu, Scopelliti, Pittman, & Zamora, 2018) and suicide attempts (SA) (Angelakis, Gillespie, & Panagioti, 2019; Zatti et al., 2017), both of which are public health concerns and frequently encountered in clinical practice. Still, studies documenting the elevated prevalence of NSSI and SA among CSA-survivors also show that the majority of CSA-survivors do *not* develop NSSI or attempt suicide (see for example Fergusson, McLeod, & Horwood, 2013; Noll, Horowitz, Bonanno, Trickett, & Putnam, 2003), highlighting notable individual differences in outcomes.

To better understand these individual differences, studies are needed examining the role of risk and protective factors of NSSI and SA, both generally and pertaining to childhood maltreatment specifically (Halicka & Kiejna, 2015; Serafini et al., 2017). Despite decades of research and recent developments in predictive algorithms, SA are still difficult to predict (Belsher et al., 2019; Franklin et al., 2017). Thus, increasing our understanding of risk factors for

NSSI and SA among CSA-survivors is important as it may aid clinicians in assessing, identifying, and managing the risk of these harmful and potentially fatal behaviours. In addition, it may promote research on the early detection of at-risk individuals and the development of interventions targeting modifiable risk factors.

A few previous studies examined in CSA survivors the impact of abuse and perpetrator characteristics on the risk for subsequent NSSI and SA. These studies reported increased propensity for these outcomes among those reporting more invasive abuse (e.g. abuse involving penetration; Briere & Runtz, 1986; Fergusson et al., 2013), abuse involving physical violence (Briere & Runtz, 1986; Rabinovitch, Kerr, Leve, & Chamberlain, 2015), abuse perpetrated by an acquaintance (Plunkett et al., 2001), and among those who lacked family- or social support (Plunkett et al., 2001); although some of these abuse/perpetrator findings were inconsistent across studies. Moreover, most of these studies were conducted in samples of children/youth (Plunkett et al., 2001; Rabinovitch et al., 2015; Wherry, Baldwin, Junco, & Floyd, 2013), providing little information about outcomes in adulthood. In adult samples, a few previous studies showed that the degree and severity of

exposure to other types of childhood maltreatment (*cumulative childhood maltreatment*) positively predicted lifetime NSSI (Steine et al., 2017) and the likelihood of lifetime SA (Ullman & Brecklin, 2002). To our knowledge, however, no previous study examined the role of abuse and perpetrator characteristics and cumulative childhood maltreatment as predictors of lifetime NSSI and SA in a large sample of adult CSA-survivors. Moreover, previous studies using adult samples were cross-sectional only (Briere & Runtz, 1986; Ullman & Brecklin, 2002), and we know of no previous study that examined whether both distal factors (e.g. abuse/perpetrator characteristics, cumulative childhood maltreatment) and proximal factors (e.g. mental health symptoms) predicted NSSI and SA over time.

Thus, to date, no study comprehensively examined the role of abuse and perpetrator characteristics, cumulative childhood maltreatment, and other factors as predictors of lifetime NSSI and SA. To address these literature gaps, the present study utilized a unique sample of adult CSA-survivors recruited from support centres for sexual abuse survivors in Norway. First, we examined whether distal factors in the form of abuse- and perpetrator characteristics and cumulative childhood maltreatment predicted reports of *lifetime* NSSI and SA among 516 CSA-survivors who responded to the first wave of the study (W1). Based on previous literature (Steine et al., 2017; Ullman & Brecklin, 2002), we hypothesized that cumulative childhood maltreatment would be positively associated with NSSI and SA. No specific hypotheses were made for the abuse/perpetrator characteristics due to the previous inconsistent findings and lack of comparable studies in adult samples. Secondly, we examined whether these same distal factors, in addition to previous NSSI/SA; current age; and proximal factors in the form of mental health symptoms (posttraumatic stress, anxiety, depression, insomnia, nightmare-related distress, and eating disorders, measured in W1), and socio-relational factors (perceived social support and relational problems), predicted *persistent* NSSI among 138 participants who responded to follow-up waves two and four years later. Due to the lack of previous studies simultaneously examining the role of all these factors for future NSSI within the same statistical model, no specific hypotheses were made for these variables. Finally, we compared individuals who did versus did not attempt a *new* SA during the four-year follow-up period of the study, in order to examine whether significant differences could be found between these two groups on any of the above-mentioned variables.

2. Methods

2.1. Procedure

This study utilized data from the *Longitudinal Investigation of Sexual Abuse (LISA)*, a three-wave study among users of abuse support centres for sexual abuse survivors in Norway. Support centres for sexual abuse survivors provide low threshold help in terms of information, free individual consultations, support groups, talks, and social events to people who have been sexually abused, and are situated in every county in Norway. The LISA-project is a collaborative effort between the University of Bergen and the four largest support centres for sexual abuse survivors in Norway. Data collection waves were conducted in 2009 (W1), 2011 (W2), and 2014 (W3) (for detailed information on the recruitment of the initial LISA-study sample, see Steine et al., 2012). The study was conducted in line with the Declaration of Helsinki and approved by the Regional Ethics Committee for Medical and Health Research of Western Norway (approval number 264.08), the Norwegian Directory of Health, and the Norwegian Social Science Data Services.

2.2. Definition of childhood sexual abuse

Sexual abuse was defined according to the Norwegian criminal code, which distinguishes between sexually abusive *behaviours* (e.g. peeping, sexual exposure), *acts* (e.g. touching/fondling of genitalia) and *intercourse* (e.g. penetration of penis/fingers/object into the victim's vagina/anus/mouth) (The Norwegian General Civil Penal Code, 2005). All participants reported sexually abusive *acts* and/or *intercourse* according to these definitions, and only those reporting abuse onset of below age 18 were included in the present study.

2.3. Outcome variables

2.3.1. Lifetime NSSI and SA

The Self-Harm Inventory (SHI) (Sansone, Wiederman, & Sansone, 1998) was used to assess the respondents' history of NSSI and SA. The SHI contains 22 items assessing different types of self-harm behaviours, where the respondents are asked to endorse whether they *ever purposely* engaged in these behaviours. Response categories are 'no' (coded as '0') and 'yes' (coded as '1'). A summary score is generated by totalling the number of 'yes' responses to the 22 items, providing scores ranging from 0 to 22, where higher scores indicate more types of self-harm. Each endorsement of self-harm behaviour is

considered pathological. Kuder–Richardson 20 (the equivalent of Cronbach’s α when response alternatives are dichotomized) for the total scale was 0.80.

2.3.3.1. Variable coding. One of the SHI-items specially assessed the respondent’s history of SA (*‘Did you ever try to attempt suicide’*). This item was isolated into a separate dichotomous variable named *lifetime suicide attempt* (‘yes’ coded as ‘1’, ‘no’ coded as ‘0’). Then, a *lifetime NSSI* variable was created by totalling the number of ‘yes’ responses for the remaining 21 SHI-items.

2.3.2. Persistent NSSI and new SA

In W2 and W3, an adapted version of the SHI was used to assess *persistent* NSSI and *new* SA. Specifically, the participants were asked to report whether they had engaged in the same 22 self-harm behaviours *during the past 2 years* only. Due to the different time frames used for assessment by the SHI in W1 versus in W2 and W3 (lifetime versus past two years), no change scores could be calculated for the SHI between study waves. To reduce the number of dependent variables and thereby statistical analyses, and to maximize the sample size of individuals who did a new SA, data from W2 and W3 were combined to create NSSI and SA variables for the follow-up analyses. Specifically, a dichotomous variable was made based on whether the respondent reported having done a *new suicide attempt* during the four-year follow-up period (‘yes’ coded as ‘1’, ‘no’ coded as ‘0’). Then, a *persistent NSSI* summary mean score was

created by totalling the number of ‘yes’ responses for the remaining 21 items reported in the second and third study wave, and dividing this number by two to obtain the mean. This variable was then used as the outcome variable.

2.4. Predictor variables

2.4.1. Characteristics of the abuse and perpetrator

Dichotomous variables (1 = yes; no = 0) assessed whether or not the abuse had involved *penetration*, the use of *threats*, *violence*, or *manipulation* by the perpetrator, and whether or not at least one of the perpetrators was someone they had *trusted*, a *parent*, or if the *perpetrator was unknown* (see Table 1 for how these variables were operationalized). These variables were correlated at the bivariate level with the NSSI and SA outcome measures, after which those showing statistically significant associations were included in the regression analyses (see statistical analyses).

2.4.2. Cumulative childhood maltreatment

The presence and frequency of a wider range of childhood maltreatment were measured using the short form of the Childhood Trauma Questionnaire (CTQ-SF) (Bernstein & Fink, 1998), which measures five types of childhood maltreatment: physical/emotional/sexual abuse, and physical/emotional neglect. In the present study, a cumulative maltreatment score was used, where respondents were classified as either ‘No childhood maltreatment’ (coded as ‘0’), ‘1–5 childhood maltreatment types at low level’ (‘1’), ‘1

Table 1. Operationalization of variables capturing aspects of the abuse and the perpetrator.

Penetration ¹	Penetration of penis in vagina/rectum/mouth Penetration of object in vagina/rectum Penetration of fingers in vagina/rectum
Threats ²	«They threatened to hurt something or someone I loved if I told anyone» «They threatened to hurt me if I told anyone» «They threatened that I would be rejected/sent to an orphanage»
Violence ²	«I was held in place, I was attacked, the perpetrator used physical violence»
Manipulation ²	«I was manipulated so I felt that the abuse was my fault» «I was manipulated to feel sorry for my abuser» «I was fooled by the perpetrator, the perpetrator pretended that the abuse was normal, as a child you do what adults tell you to do»
Trust ²	«I trusted the person who abused me»
Unknown perpetrator ³	Unknown person
Perpetrator was a parent ³	Biological parent Step parent Foster parent

¹These were answers listed in a checklist prompted by the following question: “What type of sexual abuse did you experience? Check all boxes that are true for you. (You can check multiple boxes)».

²These were answers listed in a checklist prompted by the following question: «Which strategies were used by the person(s) who abused you to achieve control over you to enable the abuse? Check all boxes that are true for you. (You can check multiple boxes)».

³This/these alternatives were listed in a checklist of possible perpetrators, prompted by the following questions: “Who was/were your perpetrator(s)? Check all boxes that are true for you. (You can check multiple boxes)».

type of childhood maltreatment at moderate to severe level' ('2'), or '2 childhood maltreatment types at moderate/severe level' ('3'), '3 childhood maltreatment types at moderate/severe level' ('4'), '4 childhood maltreatment types at moderate/severe level' ('5'), or '5 childhood maltreatment types at moderate/severe level' ('6'). Since all participants had experienced sexual abuse, none scored '0' on this cumulative childhood maltreatment variable. Cronbach's α for the total score was .84.

2.4.3. Post-traumatic stress symptoms (PTSS)

PTSS were assessed using the *Impact of Event Scale-Revised* (IES-R). The IES-R is a 22-item questionnaire measuring core symptoms of post-traumatic stress the past week: Intrusion of trauma-related memories/emotions, avoidance of trauma-related stimuli, and hyperarousal (Weiss, 2004), providing total scores ranging from 0 to 88, where higher scores indicate more pronounced PTSS. Cronbach's α for the IES-R sum score in the current sample was 0.94.

2.4.4. Anxiety and depression symptoms

The *Hospital Anxiety and Depression Scale* (HADS; Zigmond & Snaith, 1983) was used to measure anxiety and depression symptoms the past week. The HADS consists of two sub-scales, measuring anxiety (HADS-A) and depression (HADS-D), respectively. Each subscale consists of seven items (coded from 0 to 3), providing possible subscale scores ranging from 0 to 21. Cronbach's α was 0.83 for both HADS-Anxiety and HADS-Depression.

2.4.5. Insomnia symptoms

Insomnia symptoms were measured using the *Bergen Insomnia Scale* (BIS). The respondents indicate how many days per week one has experienced nocturnal symptoms and daytime consequences of insomnia during the past month. Total scores range from 0 to 42, with higher scores indicating more insomnia symptoms (Pallesen et al., 2008). Cronbach's α was 0.84.

2.4.6. Nightmare distress

Distress due to nightmares was assessed using the *Nightmare Distress Questionnaire* (NDQ), a 13-item questionnaire where respondents indicate on a 1–5 point scale the degree of distress experienced due to nightmares, and the effects of nightmares on daytime functioning and quality of life. Total scores range from 13 to 65 (Belicki, 1992). Cronbach's α was 0.92.

2.4.7. Eating disorder symptoms

Eating disorder symptoms were assessed using the *Eating Disorder Examination Self-Report Questionnaire* (EDE-Q), a questionnaire based on the eating disorder examination (EDE) (Cooper & Fairburn, 1987). Its 36 items assess main behavioural features of eating

disorders the past month. Most items are rated along a 7-point scale. The scores are summarized and divided by the number of items, providing a mean item score. Cronbach's α was 0.94.

2.4.8. Relational Problems

Relational problems were assessed by five items pertaining to the person's subjectively experienced relational problems in general, constructed for the purpose of the study. The items ('I have difficulties trusting others', 'I find it difficult to engage in close relationships with others', 'I find it difficult to grow fond of others', 'I attach to others easily' [reversed] and 'I believe that others like me/are fond of me' [reversed]). Response categories (coded from 1 to 5) were 'strongly disagree', 'disagree', 'neither disagreeing nor agreeing', 'agree', and 'strongly agree'. Total scores ranged from 5 to 25, with higher scores reflecting more relational problems. Cronbach's α was 0.74.

2.4.9. Perceived social support

The Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet, Dahlem, Zimet, & Farley, 1988) was used to measure perceived social support. Its 12 items provide a continuous score ranging from 12 – 84, with higher scores indicating higher levels of perceived social support. Cronbach's α was 0.92.

All predictor variables were assessed in W1, with the exception of cumulative childhood maltreatment, which was assessed in wave 2.

2.5. Statistical Analyses

2.5.1. Preliminary correlation analyses

Preliminary bivariate correlation analyses were conducted to identify variables showing significant bivariate correlations with the NSSI and SA variables for inclusion in the statistical analyses (see Supplementary Table). Statistically significant correlations were found for the variables *threats*, *violence*, *manipulation*, *unknown perpetrator*, *cumulative childhood maltreatment*, the variables measuring symptoms of *post-traumatic stress*, *anxiety*, *depression*, *insomnia*, *nightmare distress*, and *eating disorders*, and the variables measuring *relational problems* and *perceived social support*. Thus, these variables were included as predictor variables in the regression analyses.

2.5.2. Hierarchical linear regression

Hierarchical linear regression analyses were used to examine predictors of the continuous *lifetime NSSI* and *persistent NSSI* outcome variables. Hierarchical regression was chosen in order to assess the unique contribution of different categories of variables to the explained variance in the outcome variables. Preliminary analyses were conducted to ensure no violation of the assumption of normality, linearity,

multicollinearity, and homoscedasticity. Missing data were handled using the 'exclude cases pairwise' option.

For the *lifetime NSSI* outcome variable, step 1 of the analyses included the abuse and perpetrator related predictor variables *threats*, *violence*, *manipulation*, and *unknown perpetrator*. The *cumulative childhood maltreatment* variable was added in step 2. This analysis was conducted with the full sample ($n = 516$).

For the *persistent NSSI* outcome variable, step 1 of the analyses included age at study enrolment. Step 2 included the abuse- and perpetrator related variables *threats*, *violence*, *manipulation*, and *unknown perpetrator*. Step 3 included the *cumulative childhood maltreatment* variable. Step 4 included the mental health symptom variables (summary scores of IES-R, HADS-Anxiety, HADS-Depression, BIS, NDQ, and EDE-Q, all measured in W1). Step 5 included the social and relational variables *relational problems* and *perceived social support*. Finally, the *lifetime NSSI* score was entered in step 6. This analysis conducted with the follow-up sample only ($n = 138$). Post hoc power analysis indicated a power of 0.81 when setting the effect size to medium and the alpha level to 0.05.

2.5.3. Logistic regression

Binary logistic regression was conducted to examine predictors of the dichotomous variables *lifetime SA*, using the same predictor variables as described above for *lifetime NSSI* and *persistent NSSI*, respectively.

2.5.4. Independent samples t-test and Fisher's exact test of independence

Due to the comparatively low number of cases reporting new SA during the follow-up period ($n = 19$), logistic regression was not performed for this outcome variable. Instead, independent samples t-test with Levene's test for equality of variances (for continuous variables) and Fisher's Exact test of independence (for categorical variables) were carried out to examine whether the 19 individuals who reported a new SA during the follow-up period differed on any of the study variables compared to those who reported no new SA. Missing data were handled using the 'exclude cases analysis by analysis' option.

3. Results

3.1. Study sample

3.1.1. Total study sample

For an overview of the total number of respondents in each wave, see Figure 1. In the first data collection in 2009, 458 people responded to the survey, representing a response rate of 32.7%. In 2011, an

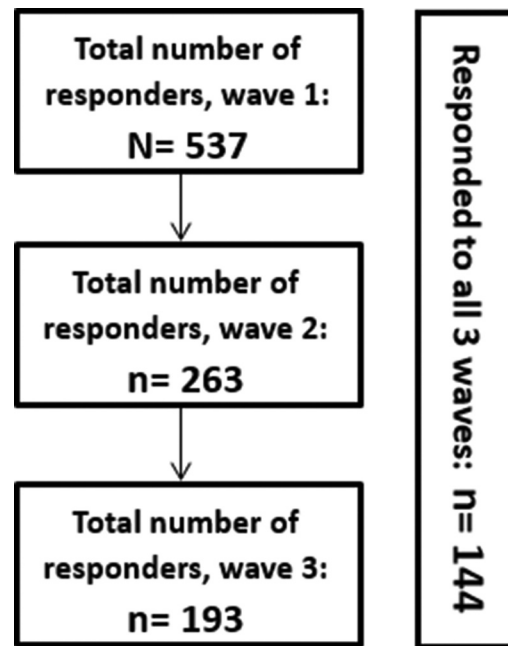


Figure 1. Study respondents.

additional 79 new centre users were enrolled, increasing the total number of wave 1 participants to 537. The response rate of this additional data collection wave is unknown due to registration routine shortcomings.

3.1.2. Analysis sample

Of the 537 participants responding to the first study wave, 516 (94.9% women) reported being below 18 years at abuse onset and were thus included in the present analyses. Of these, 138 responded to *both* follow-up waves, carried out approximately two and four years after wave 1, and were included in the follow-up analyses. Independent samples t-tests and chi-square tests revealed that those responding to all three study waves were older than those who did not (42.9 versus 37.9 years, $t(df = 476) = 4.1, p < 0.001$), but that those responding to all three study waves did not differ from those who did not on any of the other study variables. Descriptive statistics of participants and study variables are shown in Table 2.

3.2. Lifetime NSSI and SA

See Table 3 for summary of hierarchical regression analyses for lifetime/persistent NSSI, and Tables 4 and 5 for logistic regression analyses for variables predicting lifetime/new SA.

3.2.1. Lifetime NSSI

The abuse- and perpetrator characteristics (entered in Step 1) explained 9.3% (adjusted R^2) of the variance in lifetime NSSI ($F(4,234) = 7.11, p < 0.001$). The

Table 2. Descriptive statistics of sample and variables used in the study.

Continuous Variables	Total Sample (N = 516)			Follow-up sample (n = 138)		
	Mean	SD	Range	Mean	SD	Range
Age at enrolment	39.9	12.1	18–71	42.9	11.6	19–71
Age at first abusive incident	6.3	3.6	0–17	6.0	3.5	0–16
Lifetime NSSI (Lifetime SHI sum score)	6.5	3.9	0–21	6.5	3.9	0–19
Persistent NSSI (SHI W2+ W3 mean sum score)	-	-	-	3.0	2.9	0–15
Childhood maltreatment (CTQ sum score)	69.2	17.6	29–116	68.9	16.8	33–116
Cumulative maltreatment score (CTQ)	4.1	1.5	1–6	4.1	1.4	1–6
PTSD (IES-R sum score, W1)	43.8	19.5	0–87	41.1	19.9	0–87
Anxiety (HADS-Anxiety sum score, W1)	11.1	4.5	0–21	11.1	4.6	1–21
Depression (HADS-Depression sum score, W1)	6.6	4.4	0–20	6.5	4.6	0–20
Insomnia (BIS sum score, W1)	22.5	10.7	0–42	22.3	11.4	0–42
Nightmare distress (NDQ sum score, W1)	34.4	10.6	13–60	34.6	10.4	14–58
Eating disorder (EDE-Q mean score, W1)	3.1	1.3	1–5.8	3.0	1.2	1–5.4
Perceived social support (MSPSS sum score, W1)	52.4	15.0	12–84	53.9	14.0	12–84
Relational problems (sum score, W1)	16.1	4.2	5–25	15.9	4.3	6–25
Categorical Variables	N (%)		N (%)			
Suicide attempt						
Lifetime suicide attempt	216	(41.9%)	61	(44.2%)		
New suicide attempt	-	-	19	(13.8%)		
Work status						
Disability/occupational rehabilitation pension	230	(44.6%)	65	(47.1%)		
Full-time employment	129	(25.0%)	34	(24.6%)		
Part-time employment	61	(11.8%)	21	(15.2%)		
Student	55	(10.7%)	7	(5.1%)		
Unemployed	19	(3.7%)	6	(4.3%)		
Home maker	8	(1.6%)	1	(0.7%)		
Retired	7	(1.4%)	3	(2.2%)		
Work status not reported	7	(1.4%)	1	(0.7%)		
Highest education level achieved						
Undergraduate degree, university/college	148	(28.7%)	39	(28.3%)		
High school	126	(24.4%)	37	(26.8%)		
Graduate degree, university/college	88	(17.1%)	25	(18.1%)		
Primary school	75	(14.5%)	14	(10.1%)		
Professional vocation education	69	(13.4%)	19	(13.8%)		
Not completed primary school	5	(1.0%)	1	(0.7%)		
Work status not reported	5	(1.0%)	3	(2.2%)		
Abuse- and perpetrator variables						
Manipulated by perpetrator	392	(76.0%)	99	(71.7%)		
Abuse involved physical force/violence	252	(48.8%)	64	(46.4%)		
Threatened by perpetrator	205	(39.7%)	54	(39.1%)		
Unknown perpetrator	63	(12.2%)	15	(10.9%)		

W1 = Wave 1. W2 = Wave 2. W3 = Wave 3. M = Mean. SD = Standard Deviation. 95% CI = 95% Confidence Interval. SHI = Self-Harm Inventory. CTQ = Childhood Trauma Questionnaire. IES-R = Impact of Event Scale-Revised. HADS = Hospital Anxiety and Depression Scale. BIS = Bergen Insomnia Scale. NDQ = Nightmare Distress Questionnaire. EDE-Q = Eating Disorder Examination Self-Report Questionnaire. MSPSS = Multidimensional Scale of Perceived Social Support. Categorical variables: Numbers represent the number/percentage of respondents with affirmative score on the respective variable.

cumulative childhood maltreatment variable (Step 2) added an additional 4.9% of explained variance, bringing the adjusted R^2 up to 14.0% ($F(5,233) = 8.73$, $p < 0.001$). In this final model, the variables *cumulative childhood maltreatment* ($\beta = 0.234$, $p < 0.001$) and *unknown perpetrator* ($\beta = 0.141$, $p = 0.023$) were positively associated with lifetime NSSI.

3.2.2. Lifetime SA

The full model containing all predictors was statistically significant ($\chi^2(5, N = 239) = 36.69$, $p < 0.001$). The model as a whole explained between 14.2% (Cox and Snell R^2) and 19.1% (Nagelkerke R^2) of the variance in suicide attempts and correctly classified 66.9% of cases. The variables *violence* (OR = 2.39, $p = 0.007$), *cumulative childhood maltreatment* (OR = 1.36, $p = 0.003$), and *unknown perpetrator* (OR = 2.37, $p = 0.046$) were associated with an increased odds of lifetime suicide attempt.

3.3. Persistent NSSI and new SA

3.3.1. Persistent NSSI

Age at enrolment (Step 1) explained a non-statistically significant 0.9% of the variance in lifetime NSSI ($F(1,109) = 1.96$, $p = 0.164$). The abuse- and perpetrator characteristics (Step 2) added a non-statistically significant 5.8% of explained variance (F -change (4,105) = 1.66, $p = 0.164$), increasing the adjusted R^2 to 3.2%. The *cumulative childhood maltreatment* variable (Step 3) added an additional 12.3% of variance (F -change (1,104) = 15.96, $p < 0.001$), increasing the adjusted R^2 to 15.3%. The addition of the mental health symptom variables in step 4 added 27.0% of explained variance (F -change (6,98) = 8.30, $p < 0.001$), increasing the adjusted R^2 to 40.4%. The *perceived social support* and *relational problems* variables (Step 5) added a non-statistically significant 0.9% of explained variance (F -change (2,96) = 0.80, $p = 0.451$), bringing the adjusted R^2 to 40.2%.

Table 3. Summary of hierarchical linear regression for variables predicting lifetime and persistent non-suicidal self-injury (NSSI).

Predictor variables	Lifetime NSSI (n = 516)					Persistent NSSI (n = 138)				
	Unstandardized			Standardized		Unstandardized			Standardized	
	coefficients			coefficients		coefficients			coefficients	
	B	SE	95% CI	β	<i>p</i>	B	SE	95% CI	β	<i>p</i>
Threats	0.76	0.54	-0.30-1.82	0.10	0.159	0.13	0.41	-0.69-0.94	0.02	0.756
Manipulation	0.86	0.55	-0.23-1.95	0.09	0.123	0.17	0.43	-0.68-1.01	0.02	0.698
Violence	0.81	0.53	0.24-1.86	0.10	0.128	0.08	0.41	-0.73-0.88	0.01	0.852
Unknown perpetrator	1.63	0.71	0.23-3.01	0.14	0.023*	-1.22	0.55	-2.32 - -0.13	-0.14	0.028*
Cumulative maltreatment	0.63	0.17	0.29-0.96	0.23	0.000*	0.30	0.15	0.00-0.60	0.15	0.048*
Age at recruitment	-	-	-	-	-	-0.02	0.01	-0.06 - -0.01	-0.09	0.155
Anxiety symptoms	-	-	-	-	-	0.13	0.06	0.02-0.24	0.20	0.027*
Depression symptoms	-	-	-	-	-	0.12	0.06	0.00-0.23	0.18	0.044*
Insomnia symptoms	-	-	-	-	-	-0.03	0.02	-0.07-0.02	-0.10	0.207
PTSD-symptoms	-	-	-	-	-	-0.01	0.01	-0.03-0.02	-0.05	0.602
Eating disorder symptoms	-	-	-	-	-	0.33	0.16	0.01-0.66	0.15	0.043*
Nightmare distress	-	-	-	-	-	-0.00	0.02	-0.05-0.04	-0.02	0.861
Relational problems	-	-	-	-	-	0.01	0.05	-0.10 - 0.11	0.01	0.894
Perceived social support	-	-	-	-	-	-0.00	0.02	-0.03-0.03	-0.02	0.851
Lifetime NSSI	-	-	-	-	-	0.38	0.06	0.27-0.50	0.52	0.000*

Only the final step of the regression analyses (step 2 for lifetime NSSI, step 6 for persistent NSSI) including all predictor variables is displayed in this table. See text for change statistics associated with each step. Standard errors (SE) and 95% confidence intervals (95% CI) are for unstandardized coefficients. * $p < 0.05$.

Table 4. Logistic regression for variables predicting self-reported lifetime suicide attempt (n = 516).

Predictor variables	Unadjusted analyses			Adjusted analyses		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Threats	1.95	1.36-2.80	0.000*	1.08	0.57-2.05	0.809
Manipulation	1.22	0.81-1.85	0.348	1.20	0.63-2.27	0.577
Violence	2.52	1.76-3.62	0.000*	2.39	1.27-4.50	0.007*
Unknown perpetrator	2.01	1.17-3.46	0.012*	2.37	1.02-5.53	0.046*
Cumulative maltreatment	1.50	1.26-1.80	0.000*	1.36	1.11-1.67	0.003*

OR = Odds Ratio. 95% CI OR = 95% Confidence Interval for OR. * $p < 0.05$.

suggesting no improved fit of the model. Finally, the addition of the *lifetime non-suicidal self-harm* in the final step added an additional 17.4% of explained variance in the persistent NSSI variable, raising the total explained variance by the model to 58.2% ($F(15,95) = 11.42, p < 0.001$).

In this final model, the variables *lifetime non-suicidal self-harm* ($\beta = 0.516, p < 0.001$), *anxiety symptoms* ($\beta = 0.198, p = 0.027$), *depression symptoms* ($\beta = 0.176, p < 0.044$), *eating disorder symptoms* ($\beta = 0.146, p = 0.043$), and *cumulative childhood maltreatment* ($\beta = 0.151, p = 0.048$) were all positively associated with persistent NSSI, whereas the variable *unknown perpetrator* ($\beta = -0.143, p = 0.028$) was negatively associated with this variable.

3.3.2. Comparison of individuals attempting a new SA versus those who did not

See Table 5 for a comparison of mean scores and frequencies on all study variables for individuals who did versus did not attempt a new suicide during the follow-up period.

Levene's test for equality showed that the variances for the two groups were equal for all variables except

from the lifetime NSSI variable. Compared to those reporting no new SA during the follow-up period, those reporting a new SA had higher scores on *cumulative childhood maltreatment* ($t(128) = -2.36, p = 0.020$), *lifetime NSSI* ($t(20.67) = -2.98, p = 0.007$), *posttraumatic stress symptoms* ($t(120) = -2.15, p = 0.033$), *anxiety symptoms* ($t(135) = -3.88, p < 0.001$), *depression symptoms* ($t(131) = -3.33, p = 0.001$), *insomnia symptoms* ($t(135) = -3.19, p = 0.002$), *nightmare-related distress* ($t(127) = -3.69, p < 0.001$), and *relational problems* ($t(135) = -2.42, p = 0.017$) measured at W1, but not on *eating disorder symptoms* ($t(32) = -0.16, p = 0.875$). They also had lower scores on W1-measured *perceived social support* ($t(129) = 2.13, p = 0.035$). No statistically significant group differences were found in terms of *age at recruitment* ($t(129) = 1.09, p = 0.287$).

Fisher's Exact Test of Independence showed that a higher proportion of those reporting new SA had done a SA in the past ($p < 0.001$, two-sided) and experienced abuse involving physical violence ($p = 0.013$, two-sided), whereas no group differences were found for the proportion reporting abuse involving threats ($p = 0.081$, two-sided), manipulation ($p = 0.588$, two-sided), or an unknown perpetrator ($p = 1.00$, two-sided).

4. Discussion

The present study examined whether abuse- and perpetrator related variables and cumulative childhood maltreatment predicted *lifetime NSSI* and SA in a sample of 516 CSA-survivors recruited from support centres for sexual abuse survivors in Norway. Additionally, follow-up analyses examined predictors of *persistent NSSI* and characteristics of those

Table 5. Comparison of individuals who attempted a new SA versus individuals who did not.

Continuous Variables	New SA (N = 19)		No new SA (n = 119)	
	Mean	SD	Mean	SD
Age at enrolment	40.3	10.9	43.4	11.7
Lifetime NSSI (Lifetime SHI sum score)	9.2	4.1	6.0	3.7
Cumulative maltreatment score (CTQ)	4.8	1.3	3.9	1.4
PTSD (IES-R sum score, W1)	50.9	18.4	39.6	19.7
Anxiety (HADS-Anxiety sum score, W1)	14.7	3.9	10.5	4.4
Depression (HADS-Depression sum score, W1)	9.7	4.9	6.0	4.3
Insomnia (BIS sum score, W1)	29.8	9.0	21.1	11.2
Nightmare distress (NDQ sum score, W1)	42.3	9.9	33.2	9.9
Eating disorder (EDE-Q mean score, W1)	3.5	1.4	2.9	1.2
Perceived social support (MSPSS sum score, W1)	47.4	13.1	54.9	13.9
Relational problems (sum score, W1)	18.1	3.1	15.5	4.3
Categorical Variables	N (%)		N (%)	
Lifetime suicide attempt	16	(84.2%)	45	(38.5%)
Abuse- and perpetrator variables				
Manipulated by perpetrator	15	(78.9%)	84	(70.6%)
Abuse involved physical force/violence	14	(73.7%)	50	(42.0%)
Threatened by perpetrator	11	(57.9%)	43	(36.1%)
Unknown perpetrator	2	(10.5%)	15	(10.9%)

Variables showing statistically significant between-group differences are marked in bold.

W1 = Wave 1. W2 = Wave 2. W3 = Wave 3. M = Mean. SD = Standard Deviation. 95% CI = 95% Confidence Interval. SHI = Self-Harm Inventory. CTQ = Childhood Trauma Questionnaire. IES-R = Impact of Event Scale-Revised. An IES-R score of ≥ 33 indicates clinically significant posttraumatic stress symptoms. HADS = Hospital Anxiety and Depression Scale. HADS-A and HADS-D scores of ≥ 8 and ≥ 11 indicates possible and probable clinically significant anxiety/depression symptoms, respectively. BIS = Bergen Insomnia Scale. NDQ = Nightmare Distress Questionnaire. EDE-Q = Eating Disorder Examination Self-Report Questionnaire. An EDE-Q score of ≥ 4 indicates clinically significant eating disorder symptoms. MSPSS = Multidimensional Scale of Perceived Social Support. Categorical variables: Numbers represent the number/percentage of respondents with affirmative score on the respective variable.

attempting a new SA among 138 individuals who responded to follow-up waves two and four years later. Cumulative childhood maltreatment and having had an unknown perpetrator positively predicted lifetime NSSI scores, whereas cumulative childhood maltreatment, previous NSSI, depression, anxiety, and eating disorder symptoms, and having a known perpetrator, positively predicted persistent NSSI scores. Cumulative childhood maltreatment, violent abuse, and having an unknown perpetrator positively predicted lifetime SA. Compared to individuals with no new SA during the four-year follow-up period, those reporting a new SA during this period scored significantly higher on variables measuring cumulative childhood maltreatment, lifetime NSSI, posttraumatic stress, anxiety, depression, insomnia, nightmare distress, and relational problems measured in the first study wave, and lower on perceived social support. They were also significantly more likely to have attempted SA in the past and to have experienced abuse involving physical violence.

Cumulative childhood maltreatment predicted lifetime NSSI and SA, as well as persistent NSSI in analyses adjusting for previous NSSI and other mental health symptoms. These findings are consistent with studies showing that childhood maltreatment is a strong predictor of NSSI/SA (Liu et al., 2018; Zatti et al., 2017), particularly multiple and repeated maltreatment (Angelakis et al., 2019), in a dose-dependent way (Dube et al., 2001). While the present findings do not reveal the *mechanisms* underlying the associations of childhood maltreatment with NSSI/SA, they underscore the potency of childhood

maltreatment in predicting severe mental health outcomes in adulthood, even decades after experiencing maltreatment. This adds to the literature calling for efforts to prevent childhood maltreatment from occurring and highlights the importance of assessing childhood maltreatment in clinical practice.

The strongest predictors of persistent NSSI were levels of previous NSSI. These findings align with literature at large, showing that the strongest predictors of future NSSI is previous NSSI (Plener, Schumacher, Munz, & Groschwitz, 2015), lending weight to the importance of emphasizing previous NSSI as risk factors for future NSSI in clinical practice.

Violent CSA positively predicted lifetime SA, consistent with past literature indicating that physical and sexual abuse each independently contribute to SA risk, even when adjusting for other forms of abuse/adversity (Joiner et al., 2007). Thus, violent CSA may have a compounding effect on SA likelihood, analogous to the additive risk of multiple forms of childhood maltreatment. More research is needed evaluating whether the unique effects of violence versus sexual abuse are related to different underlying mechanisms contributing to SA.

Having an unknown perpetrator positively predicted lifetime NSSI and SA. This finding is opposed to other studies reporting more severe outcomes (e.g. mental health symptoms, self-harm behaviours) associated with known perpetrators (Edwards, Freyd, Dube, Anda, & Felitti, 2012; Ullman, 2007). It remains unclear whether this association stems from the victim-perpetrator relationship itself (e.g.

abuse by a relative may increase trust betrayal) or differences in abuse characteristics. For example, CSA by a relative is associated with more severe abuse and earlier onset (Ullman, 2007), and higher cumulative childhood adversities have been shown to fully mediate the relation between high-betrayal CSA (i.e. by relatives) and increased suicide risk (Edwards et al., 2012). Given that our analyses account for these potential confounders, our findings may reflect other factors relating CSA by a stranger and increased self-harm risk, such as whether the abuse was perceived as life-threatening, which is more likely if the perpetrator is a stranger (Ullman, 2007). Further studies are needed to better elucidate how the victim–perpetrator relationship relates to SA/NSSI.

Abuse involving manipulation or threats did not predict lifetime NSSI/SA in the adjusted analyses, which could indicate that differences in NSSI/SA among CSA-survivors cannot be understood based on these isolated abuse characteristics. However, the majority of the present sample had experienced very severe CSA, all with early abuse onset, indicating that the sample could be lacking variability in terms of abuse severity. This restricted range in abuse severity could have affected the ability to detect significant effects. Thus, the findings need to be further supported in samples with more variability in these variables before conclusions can be drawn regarding these and other abuse/perpetrator variables.

Higher symptom scores on depression, anxiety, and eating disorders predicted persistent NSSI in the adjusted analyses. CSA predicts both depression and anxiety, both of which have been identified as mediators in the association between CSA and lifetime NSSI (Brown et al., 2018). This could possibly be underlying the present findings too, although no mediation analyses were conducted in the present study. The prediction of NSSI by eating disorders may perhaps reflect shared symptomatology between NSSI and eating disorders, such as emotion regulation difficulties, which has been identified as a transdiagnostic construct present across both eating pathology (Prefit, Căndea, & Szentagotai-Tătar, 2019) and NSSI (Wolff et al., 2019), and as an underlying contributing factor in these two highly overlapping symptom groups (Svirko & Hawton, 2007). Taken together, these findings indicate that multiple symptoms other than previous NSSI may represent proximal predictors of future NSSI, highlighting the importance of broad assessments of potential risk factors, as well as of implementing transdiagnostic treatments that are efficacious across multiple symptom groups (McEvoy, Nathan, & Norton, 2009).

Surprisingly, perceived social support did not predict persistent NSSI, which is inconsistent with previous studies showing negative associations between

social support and NSSI (Wan et al., 2019). One interpretation of this finding is that NSSI may be less responsive to the protective effects of social support. Another possibility is that even in the presence of some relational protective factors, negative aspects of social relationships are more salient factors in NSSI (Joiner et al., 2007). This interpretation aligns with previous studies demonstrating greater predictive validity of negative social reactions over positive social support for long-term mental health outcomes among sexual abuse survivors (Ullman & Relyea, 2016), and also with the present finding that relational problems – negative/difficult aspects of relationships – were more prevalent among those attempting a new SA.

The observed differences on most study variables among those attempting a new SA versus those who did not, align with studies identifying childhood (cumulative) maltreatment (Angelakis et al., 2019; Dube et al., 2001; Liu, Yang, Liu, & Jia, 2020; Zatti et al., 2017), previous SA (Eikelenboom, Beekman, Penninx, & Smit, 2019), lifetime NSSI (Plener et al., 2015), relational problems (Chu et al., 2017; Johnson et al., 2002), lower perceived social support scores (Kleiman & Liu, 2013), and symptoms of posttraumatic stress (Angelakis et al., 2019; Bentley et al., 2016), anxiety (Bentley et al., 2016), depression (Bedi et al., 2011; Hall, Platt, & Hall, 1999), insomnia (Lin et al., 2018), and nightmare-related distress (Liu et al., 2020) as risk factors for SA in general, and indicate that these variables may also prospectively predict SA among adult CSA-survivors specifically. Moreover, as also found for lifetime SA, our findings indicate that abuse involving physical violence may be persistently associated with an increased likelihood of attempting SA among CSA-survivors. Though our findings need replication in larger samples, they highlight the importance of screening for a broad range of distal and proximal factors when evaluating the risk of SA among CSA-survivors.

4.1. Limitations and strengths

This study presents with important limitations. Firstly, both the homogenous study sample, comprising entirely support centre users (mainly female), and the relatively low response rate (32.7% in W1, with only 26.7% of W1 respondents responding to both W2 and W3); limit the generalizability of the findings. Secondly, the relatively small follow-up sample ($n = 138$) may also have affected the power to detect significant differences and could be responsible for some of the inconsistencies in outcomes. Thirdly, the self-report questions used to assess CSA, though descriptive and tangible, may fail to detect CSA taking place very early in life or during dissociative states that may not be a part of the respondents' conscious

memory. Hence, this should be noted as a limitation provided the data collection procedure in the present study. Fourthly, although analyses identified variables associated with NSSI and SA, many known risk factors for NSSI and/or SA (e.g. hopelessness, impulsivity, aggression, barriers to treatment, sense of loss, somatic disease, access to lethal substances) or other factors that could have affected the participants' levels of NSSI and likelihood of new SA (e.g. previous treatment) were not assessed, hence not included, in this study. The explained variance of 14% for lifetime NSSI highlights that the majority of variance in this outcome was explained by factors not measured in the present study. Additionally, the present study neglected to evaluate functions of NSSI (e.g. affect regulation, escaping negative internal states, self-punishment; Taylor, Jomar, Dhingra, Forrester, Shahmalak, & Dickson, 2018), which may differentially predict SA, particularly among trauma-exposed individuals (Roley-Roberts, Zielinski, Hurtado, Hovey, & Elhai, 2017). Future studies should thus consider evaluating NSSI functions among CSA survivors, which may help further distinguish individuals at high risk for SA, and better inform interventions. Lastly, factors such as changes in symptomatology as a result of treatment, medication use, substance abuse, severe stress, loss, traumatic events, and positive life changes, which could have affected persistent/new NSSI and SA between W1 and W3, were not assessed in the present study. Thus, it cannot be ruled out that the present findings are idiosyncratic to the present study sample. Findings should therefore be replicated in larger samples incorporating additional relevant variables.

Despite these limitations, this study, through examining the effects of a wide array of abuse characteristics on subsequent self-harm behaviours in a uniquely large sample of CSA-survivors, contributes to the limited understanding of the relationship between individual differences of childhood sexual abuse experiences and later psychopathology among CSA-survivors, benefitting clinicians working with CSA-survivors.

5. Conclusions

The present study provides preliminary data on distal predictors of lifetime NSSI/SA among 516 CSA-survivors and on both distal and proximal predictors of persistent NSSI and variables associated with new SA in a follow-up sample of 138 CSA-survivors. Cumulative childhood maltreatment and having an unknown perpetrator predicted lifetime NSSI/SA, and violent abuse predicted lifetime SA; however, the explained variance and effect sizes were relatively small, highlighting the role of factors not assessed in the present study in contributing to these outcomes. Previous NSSI/SA were the

strongest predictors of persistent NSSI and of attempting a new SA. Furthermore, preliminary evidence was found for the distal factors, specifically cumulative childhood maltreatment and having had a known perpetrator, and for proximal factors, specifically depression-, anxiety- and eating disorder symptoms, as predictors of persistent NSSI, beyond the predictive value of past NSSI. Finally, findings indicate that previous SA, cumulative childhood maltreatment, violent abuse, severity of mental health symptoms, relational problems, and lower perceived social support levels, may all be risk factors for future SA among adult CSA-survivors. The overall findings highlight the importance of considering a broad range of both distal and proximal factors when assessing NSSI and SA risk among adult CSA-survivors in clinical practice.

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Data availability statement

The dataset supporting the findings of this study is available from the corresponding author, IMS, upon reasonable request.

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