**Title: Nonsuicidal self-injury in community adolescents: a systematic review of prospective predictors, mediators and moderators.**

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***Declaration of interest***

None of the authors have conflict of interest to disclose.

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**Abstract**

Nonsuicidal self-injury (NSSI) usually starts during adolescence and is associated with an array of psychological and psychiatric symptoms and future suicide attempts. The aim of this study is to determine prospective predictors, mediators and moderators of NSSI in adolescent community samples in order to target prevention and treatment strategies. Two team members searched online databases independently. Thirty-nine studies were included in the review. Several variables were seen to prospectively predict NSSI: female gender, family-related variables, peer victimisation, depression, previous NSSI and self-concept. Few studies analysed mediators and moderators. Low self-concept was highlighted as a relevant moderator in the relationship between intra/interpersonal variables and NSSI. Implications of these findings are discussed. The considerable heterogeneity between studies posed a limitation to determine robust predictors of NSSI. Further prospective studies using standardised measures of predictors and outcomes are needed to ascertain the most at risk individuals and develop prevention strategies.

**Keywords: NSSI, adolescence, early intervention, suicide prevention, systematic review.**

**Background**

Nonsuicidal self-injury (NSSI) has been defined as ‘the deliberate, direct, socially unacceptable destruction or alteration of body tissue that occurs in the absence of suicidal intent’ (Nock & Favazza, 2009). This behaviour is a focus of concern in the adolescent period, given that the onset frequently occurs between age 12 and 14 (Jacobson & Gould, 2007) and the rise in prevalence during middle adolescence (Barrocas, Giletta, Hankin, Prinstein, & Abela, 2015). A review showed a NSSI lifetime prevalence of 17.2%, 13.4% and 5.5% in adolescents, young adults and adults respectively (Swannell, Martin, Page, Hasking, & St John, 2014). Some studies have described a lifetime prevalence of up to 23.2% in adolescent community samples (Jacobson & Gould, 2007). NSSI declines substantially over time (Plener, Schumacher, Munz, & Groschwitz, 2015) but there is a group of young people in which it develops into a chronic practice, extending into late adolescence and adulthood (Barrocas et al., 2015). Consequently, adolescence is a key developmental stage for prevention and intervention.

There are several terms used to describe self-injury, and semantic differences exist between countries for similar terms (Hawton, Rodham, Evans, & Weatherall, 2002). Nonsuicidal self-injury has been proposed as a preferred expression to characterise self-injurious behaviours that are performed without a suicidal intent, given the term’s clarity and absence of pejorative meaning (Jacobson & Gould, 2007). NSSI behaviours include cutting/scratching wrists or arms, self-hitting, banging the head against the wall or burning skin. Acts such as overdosing on medication or jumping from height are excluded.

Although research suggests that suicide attempts are associated with more negative outcomes than NSSI, such as higher levels of psychological symptoms and psychosocial risk factors (Brausch & Gutierrez, 2010; Jacobson, Muehlenkamp, Miller, & Turner, 2008; Mars et al., 2014), NSSI is often repetitive and occurs more frequently than suicidal acts (Plener, Libal, Keller, Fegert, & Muehlenkamp, 2009). Moreover, it seems that history of previous NSSI is associated with more adverse psychological symptoms in individuals who have attempted suicide (Guertin, Lloyd-Richardson, Spirito, Donaldson, & Boergers, 2001). NSSI has also been shown to be a predictor of future suicide (Guan, Fox, & Prinstein, 2012; Hawton, Zahl, & Weatherall, 2003). Some previous studies have found no differences in suicidal ideation between self-injury with and without suicidal intent (Jacobson et al., 2008) and in the prediction of completed suicide (Cooper et al., 2005). NSSI behaviours often go unnoticed by the support networks surrounding young people, including their parents (Baetens et al., 2014) and the episodes rarely result in presentation to hospital (Hawton et al., 2002).

Research findings demonstrate strong and consistent associations between NSSI and depression and anxiety symptoms (Jacobson & Gould, 2007), substance use (Hilt, Cha, & Nolen-Hoeksema, 2008), adverse psychological symptoms and behaviours (Barrocas et al., 2015; Tatnell, Kelada, Hasking, & Martin, 2014; You, Lin, & Leung, 2015) and borderline personality disorder (Ferrara, Terrinoni, & Williams, 2012). NSSI has been conceptualised as a maladaptive coping strategy to regulate aversive affect and social situations (Klonsky, 2009; Nock, 2009) in the context of diminished capacity to achieve these objectives through alternative and adaptive means. However, NSSI can also exist independently from other mental health problems (Muehlenkamp, 2005).

The development of prevention strategies for adolescent NSSI is essential given the increasing numbers of young people engaging in the practice (Swannell et al., 2014) and the associated risk. Rates of NSSI are as high as 50% in inpatient adolescents (Glenn & Klonsky, 2013) and this behaviour is often associated with history of suicide attempts and personality disorder (Nock, Joiner  Jr., Gordon, Lloyd-Richardson, & Prinstein, 2006). Identification of NSSI at an earlier stage is fundamental in terms of prevention, but this task is difficult in the community (Baetens et al., 2014), since the majority of cases do not present to services (Hawton, Saunders, & O'Connor, 2012). In recent years there has been an increasing interest in school-based prevention and health promotion programmes (Weare & Nind, 2011), considering schools as preferred settings to identify potential problems and to provide support.

Determining prospective predictors will improve the chances of identifying the most at-risk individuals and will inform prevention strategies for NSSI. Establishing moderators and mediators may also improve the understanding of aetiological factors. Moderators can help ascertain under which circumstances a risk factor may make adolescents more likely to self-harm, whereas mediators will highlight possible internal psychological factors accounting for and explaining relationships between two variables (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001).

Previous studies looking at predictors of adolescent self-harm have determined the importance of depression (Barrocas et al., 2015; Claes, Luyckx, Baetens, Van de Ven, & Witteman, 2015), previous self-injury (Sourander et al., 2006; Wilkinson, Kelvin, Roberts, Dubicka, & Goodyer, 2011), low self-esteem (O'Connor, Rasmussen, & Hawton, 2009; Tatnell et al., 2014), history of sexual abuse (O'Connor et al., 2009; Weierich & Nock, 2008), posttraumatic stress symptoms (Weierich & Nock, 2008) and peer NSSI (Prinstein et al., 2010), amongst other factors. However, studies commonly show contradictory findings and present a number of limitations: heterogeneous conceptualisation of self-harm behaviours lacking consideration of the intent of self-harm (O'Connor et al., 2009; Sourander et al., 2006), use of non-community samples (Wilkinson et al., 2011) and use of cross-sectional designs (Webb, 2002; Weierich & Nock, 2008). Longitudinal methodology is preferred in identifying predictors, since stronger conclusions about causal relationships are possible as well as allowing for more rigorous control of confounders (Kraemer et al., 1997). These limitations pose a barrier to the comparison of studies and formation of consistent conclusions for prevention programmes.

The few existing reviews present similar problems to individual studies: the use of mixed adolescent and adult samples (Fliege, Lee, Grimm, & Klapp, 2009; Fox et al., 2015; Plener et al., 2015), the inclusion of cross-sectional studies (Fliege et al., 2009; Webb, 2002) and the lack of assessment of suicidal intent (Evans, Hawton, & Rodham, 2005; Webb, 2002). Moreover, a considerable number of longitudinal studies on this topic have been published in recent years subsequent to the publication of available reviews (Evans, Hawton, & Rodham, 2004; Fliege et al., 2009; Webb, 2002).

This is the first systematic review with the aim of answering the following question: What are the prospective factors that predict, moderate and mediate NSSI-related outcomes in community adolescents?

**Method**

The review protocol is not registered but it is available upon request to the authors.

*Search strategy*

A literature search was conducted using four databases: Medline, PsycInfo, Embase and Web of Science. The following mesh and free terms were searched for in title and abstract: [“adolescen\*” OR “teen\*” OR “young pe\*”] AND [“nonsuicidal self-injury” OR “non-suicidal self-injury” OR “NSSI” OR “nonsuicidal self-harm” OR “non-suicidal self-harm” OR “self-injur\*” OR “self-cut\*” OR “self-mutilat\*”] AND [“risk factor\*” OR “protective factor\*” OR “mediat\*” OR “predict\*” OR “moderat\*”] AND [“longitudinal\*” OR “prospectiv\*” OR “cohort” OR “wave\*”]. Databases were searched and screened independently by two reviewers. Reference lists were also hand-searched to identify other potential relevant citations.

The last updated search was conducted in January 2017. Once the search was completed, tittles and abstracts were screened and those not meeting inclusion criteria were discarded. Full text was obtained for relevant studies from online resources or direct contact with authors. Consensus was established between the two reviewers after independent analysis of the studies. In case of disagreement, a third member of the team assisted to reach a decision.

*Inclusion and exclusion criteria*

Eligibility criteria included prospective studies in community adolescents aged 10 – 19 years (according to the WHO definition of adolescence (World Health Organization, 2014). Clinical samples were excluded to focus on prevention and early intervention in the community. Studies were required to include the elements of the definition of NSSI by Nock & Favazza (2009), regardless of the use of a different term to describe the behaviour. Different outcomes of NSSI were accepted: presence, onset, continuation, cessation, frequency and severity. Studies were required to include the analysis of predictors, mediators or moderators of NSSI and assessments of this behaviour had to be undertaken specifically in the adolescent period. Publication year was limited from 1990 to January 2017 and language was limited to English.

Studies including suicidal intent, clinical samples, assessment of NSSI after the age of 19, or absence of prospective methodology were excluded from the review. In some cases, data meeting inclusion criteria was extracted from articles also containing excluded data.

*Analysis of studies*

A quality assessment of selected studies was performed using an adapted version of the `Newcastle-Ottawa Quality Assessment Scale Cohort Studies´ (Wells et al., 2000). In the comparability section, previous NSSI was considered the most important factor to control for. In the outcome section, six months was selected as the minimum adequate follow up period. With regards to the retention rate, we established 70% as an acceptable value considering the difficulties with recruiting and retaining adolescents (Cotter, Burke, Stouthamer-Loeber, & Loeber, 2005). Two reviewers performed the quality assessment independently with consensus established by a third member of the team.

Only prospective analyses were considered for the review. Several of the included studies were performed using the same sample of community adolescents and therefore publications were analysed in terms of samples instead of independent studies to prevent over-representation of findings. Given the disparity between NSSI-related outcomes included in the studies (e.g. onset, continuation, presence of NSSI), evidence for predictors was collated without separating different results for different NSSI outcomes.

Meta-analysis was not performed due to insufficient information for most variables and heterogeneity between studies in terms of outcomes assessed and measures used.

Variables investigated in the studies were classified under three themes: sociodemographic, environmental and psychological factors.

**Results**

*Study characteristics*

Thirty-nine studies were included in the review (figure 1). When screening titles and abstracts, citations were excluded for including a non-community sample (n=219), not clarifying the non-suicidal nature of self-injury (n=109), including an age group different from adolescence (n=65), not performing any analyses to predict NSSI (N=47), not using a prospective method (n=39) or using a language other than English (n=3). Full-text articles were excluded for not including the NSSI concept (n=28), not using a prospective methodology (n=11), including an age group different from adolescence (n=10) and not performing any analyses to predict NSSI (n=6).

A description of the studies is presented in Table 1. Several adolescent sample cohorts were used by more than one of the included studies, resulting in 18 samples from 8 different countries.

The sample sizes were generally large (range n=348 to n=13,396) with the exception of one study (n=97) (Hankin & Abela, 2011). Most samples presented an equal distribution between both genders. Females were overrepresented in a minority (Andrews, Martin, Hasking, & Page, 2013, 2014) with one sample assessing only females (Keenan, Hipwell, Stepp, & Wroblewski, 2014). Age ranges of participants were between 11 and 19 years.

Follow up time varied from 5 months (Garisch & Wilson, 2015) to 16 years in some of the ALSPAC cohort studies (Mars et al., 2014; Page et al., 2014). Most designs included a baseline assessment of NSSI and a follow up one to two years later (Andrews et al., 2013; Baetens et al., 2014). Some studies used a multiple-wave design with assessment every few months and analysed different NSSI trajectories over time (Barrocas et al., 2015). Finally, other samples (Chang et al., 2014; Young, Riordan, & Stark, 2011) assessed different predictors from birth and included a one-off assessment of NSSI in adolescence.

There was a wide range in the reported NSSI prevalence. This is likely to be due to the differences in conceptualisation and time frame of reported self-injury. The mean prevalence of studies reporting at least one episode of NSSI in the preceding 12 months was 18.2% (6-33.9%, excluding one outlier from the Spanish sample (Calvete, Orue, & Sampedro, 2017). The mean prevalence reported for lifetime NSSI was 16.4% (5-48.7%).

NSSI outcomes varied between studies. Measures included NSSI presence, frequency, course and severity.

A third of the samples assessed NSSI by means of a validated questionnaire, e.g. the *Self-harm Behaviour Questionnaire* (Gutierrez, Osman, Barrios, & Kopper, 2001) and the *Deliberate Self-harm Inventory* (Gratz, 2001). Remaining samples assessed NSSI with a single item question (Baetens et al., 2014), with several questions to determine presence and intent of self-harm (Chang et al., 2014) or with a question followed by a checklist of NSSI behaviours (Law & Shek, 2013).

All studies investigated prospective predictors of NSSI, but only 18 studies from 11 samples included analyses of moderating factors and four studies from three samples investigated mediating factors.

Quality assessment scores ranged from 2 to 7 and results were categorised under low (0-3), medium (4-6) and high quality (7-9). Within the same sample, different studies presented different levels of strength. Overall, 2 studies presented low quality (L), 29 were of medium quality (M) and 8 were considered high quality (H).

*Evidence of predictors, moderators and mediators*

Results are presented in Table 2.

*- Sociodemographic Variables*

Gender was the most frequently studied sociodemographic variable and demonstrated the strongest evidence as a predictor. The association between female gender and NSSI was replicated in eleven studies from five samples. Male gender predicted NSSI onset in one Australian study (Voon, Hasking, & Martin, 2014) and NSSI frequency in one Chinese study (Barrocas et al., 2015). Analyses of the moderating effect of gender, were contradictory without sufficient replication. Even though a few samples considered age as a variable results were inconclusive. Studies of socioeconomic status (SES), consistently failed to find a relationship with NSSI.

Other sociodemographic variables (maternal education, religious beliefs, family structure, ethnicity and country of birth) received less attention in the literature and the impact of these variables appeared inconclusive (Andrews et al., 2013, 2014).

*- Environmental variables*

Given the large number of factors included in this area, we categorised environmental variables under maltreatment and victimisation, parenting/family factors, peer NSSI, life events and interpersonal relationships.

With regard to maltreatment and victimisation, peer victimisation and bullying were most studied with significant results in five samples. The two samples with non-significant results were of lower quality (Garisch & Wilson, 2015) or used less reliable measures, i.e. not self-report (Heilbron & Prinstein, 2010), which is a preferred method to investigate these experiences (deLara, 2012). Sexual abuse was investigated in two studies which both found a strong longitudinal relationship between past sexual trauma and NSSI (Mars et al., 2014); (Tatnell, Hasking, Newman, Taffe, & Martin, 2016). The same studies demonstrated contradictory findings in relation to physical abuse and NSSI (i.e. positive in Tatnell et al and negative in Mars et al) possibly related to the assessment measure (parent-reported cruelty in the non-significant study rather than adolescent self-report).

Parenting/family factors included a broad range of measures that were not always directly comparable such as family support, family cohesion, parenting behaviours or parental mental health, but demonstrated significant results in eight samples and lack of significance in two samples. Studies varied in terms of informant (parent vs. adolescent-report) (Baetens et al., 2014) and definition of dysfunction (e.g. harsh parenting as anger, ‘telling off’ and coldness (Jutengren, Kerr, & Stattin, 2011) vs. harsh parenting as shouting, yelling and spanking (Keenan et al., 2014). Two samples consistently found a relationship for current or recent parental mental health problems, but not for remote difficulties (Hankin & Abela, 2011; Mars et al., 2014).

The effects of peer NSSI showed evidence of prediction in four samples and two samples found non-significant results. Studies used different assessment procedures varying in the number and closeness of targeted peers and peers´ school attendance. Giletta et al (2015) suggested that differences in the assessment strategy account for discrepant results.

Evidence for life events was limited and inconsistent but studies that included events occurring over a longer time frame or parent-reported measures (Keenan et al., 2014; Voon et al., 2014) found associations. Samples assessing shorter time frames and adolescent-reported typical life events (Calvete et al., 2017; Hankin & Abela, 2011) were non-significant. Life events were seen to have a moderating effect in two samples (Calvete et al., 2017; Hasking, Andrews, & Martin, 2013).

Interpersonal relationships presented contradictory evidence related to the different measures used. They included relationship problems as part of borderline personality features (You, Leung, & Fu, 2012; You et al., 2015), psychological symptoms screening questionnaires (Wan, Xu, Chen, Hu, & Tao, 2015) or family relationships (Hankin & Abela, 2011).

Finally, other variables such as friends’ depressive and impulsive symptoms (Giletta, Burk, Scholte, Engels, & Prinstein, 2013) and school experiences (Kidger et al., 2015) were investigated in one study respectively.

* *Psychological variables*

This category included psychological distress, maladaptive behaviour, psychological processes and psychological strengths.

With regard to psychological distress, depressive symptomatology was the strongest predictor, with 12 samples showing consistent longitudinal associations with NSSI. General psychological distress also appeared to be a consistent predictor. Some measures of general psychological distress, however, included conduct and social problems (i.e. *the Strengths and Difficulties Questionnaire*) (Lundh, Wangby-Lundh, & Bjarehed, 2011), whilst others did not (i.e. *the General Health Questionnaire*) (Andrews et al., 2013, 2014). It remains unclear whether general distress has a mediating effect. Conduct problems consistently predicted NSSI in three samples and the study which did not find associations used a measurement of NSSI that inflated the prevalence (Calvete et al., 2017). Anxiety was a significant predictor in a sample using a DAWBA diagnosis (Mars et al., 2014) but was not when assessing ‘anxiety symptoms’ (Garisch & Wilson, 2015). Different conceptualisations of emotional problems (i.e. negative emotions, emotional dysregulation, emotional suppression), in a limited number of studies led to inconclusive evidence in this area. Negative emotions, however, were shown to mediate the relationship between borderline personality and NSSI in one study (You, Leung, & Fu, 2012). Another study failed to find a moderating effect between life events, psychological distress and NSSI (Voon et al., 2014).

A range of maladaptive behaviours including previous NSSI, impulsivity and substance use were assessed. Previous NSSI was the most important predictor with eight samples demonstrating an association (Andrews et al., 2013; Baetens et al., 2014; Giletta et al., 2013). Contradictory findings in the area of impulsivity were related to different conceptualisations and measures. Samples assessing binge eating or physical fights as behavioural manifestations of impulsivity, showed significant results (You, Lin, Fu, & Leung, 2013; You et al., 2015), whereas samples assessing impulsive personality traits or responses (not necessarily of a pathological nature) did not (Jutengren et al., 2011). Impulsivity was seen to be a moderator between intrapersonal factors and NSSI (You et al., 2013; You et al., 2015), but not between environmental factors and NSSI (Jutengren et al., 2011). Studies focusing on substance use showed contradictory findings, with non-significant results possibly explained by the use of the concept of substance use (vs. abuse) (Garisch & Wilson, 2015) or the inclusion of an inflated measure of NSSI (Calvete et al., 2017).

Psychological processes assessed included different cognitive factors not necessarily of a dysfunctional nature. Self-concept related variables most consistently predicted NSSI, with four samples demonstrating a positive effect on NSSI reduction. Two samples failed to find a predictive effect but showed a moderating effect of self-concept on borderline personality, negative emotions and NSSI (You, Leung, Lai, & Fu, 2012) and self-compassion on peer victimisation and NSSI (Jiang et al., 2016). One sample determined a mediating effect of self-esteem and self-efficacy on attachment anxiety and NSSI (Tatnell et al., 2014). Cognitive style was demonstrated to predict NSSI in samples assessing cognitive reappraisal (Andrews et al., 2013), rumination (Barrocas et al., 2015) and negative cognitive style (Hankin & Abela, 2011). The non-significant result of rumination in another sample was related to the conceptualisation of this factor as a general cognitive style (vs. a response to negative emotions) (Voon et al., 2014). One sample reported a mediating effect of cognitive reappraisal (Tatnell et al., 2014), but no moderating effect of this variable (Voon et al., 2014).

With regard to psychological strengths, the following factors were shown to predict a decrease in NSSI: problem solving (Andrews et al., 2013, 2014), self-control (Keenan et al., 2014), assertiveness (Keenan et al., 2014), acting with awareness (Calvete et al., 2017) and positive youth development (defined as healthy life attitudes and coping) (Law & Shek, 2016). None of these findings have been replicated.

Other psychological variables investigated in single studies included the following positive predictors: psychotic experiences (Martin, Thomas, Andrews, Hasking, & Scott, 2015), poor sleep (Lundh, Bjarehed, & Wangby-Lundh, 2013), increased IQ (Chang et al., 2014), and some of which were not found to be associated: perinatal variables (Young et al., 2011), gender dysphoria (Young et al., 2011), hyperactivity-inattention symptoms (Lundh, Wangby-Lundh, & Bjarehed, 2011) and previous suicide attempt (Hasking et al., 2013).

**Discussion**

This is the first systematic review to analyse predictors, mediators and moderators of NSSI in community adolescents from a prospective longitudinal perspective. Studies were drawn from 18 cohorts in 8 countries giving an overview of adolescent NSSI internationally. Predictive factors were widely examined amongst studies included in the review.

Significantly less attention was paid to moderators and mediators. Most studies looked at risk factors with few assessing protective factors. There has been little growth in the evidence available for mediators, moderators and protective factors in the literature subsequent to previous reviews (Fliege et al., 2009; Webb, 2002).

Within the category of sociodemographic factors, the evidence for the predictive value of female gender was strongest, a consistent finding in the literature (Fliege et al., 2009; Plener et al., 2015). Socioeconomic status showed no effect on NSSI, differing from inconsistent reports from literature regarding adolescent suicidality, with an earlier review failing to find a relationship (Evans et al., 2004) and a subsequent one confirming it (Hawton et al., 2012). In terms of age, previous reviews not limiting the search to adolescence have highlighted a stronger effect for this age group (Fliege et al., 2009; Fox et al., 2015). Reviews focused exclusively on adolescents, however, have not reported the impact of age within the adolescence age range (Evans et al., 2004; Webb, 2002), although Plener et al (2015) have shown that the longitudinal course of NSSI is characterised by an increase of NSSI rates in younger adolescents and a decrease in older ones. These trends might explain inconsistencies in rates found between community samples in our study, and differ from a steady increase seen from age 12 to 18 in those who present to hospital with deliberate self-harm (including suicide attempts) (Hawton, Hall, et al., 2003).

With regard to environmental factors, there was evidence for the impact of family-related variables, notwithstanding the high heterogeneity within this subcategory. The association between family factors and self-harm has been consistently demonstrated in existing reviews, also showing considerable heterogeneity (Evans et al., 2004; Fliege et al., 2009; Hawton et al., 2012; Plener et al., 2015; Webb, 2002). We found an effect of current but not of remote parental mental health on NSSI. This had not been highlighted in previous reviews, so it might be a specific factor for adolescent NSSI. It should be noted, however, that standardised family function observations were not used.

Maltreatment variables were insufficiently studied, except for peer victimisation which has shown consistent prediction. The scarce data available indicated a strong predictive effect of previous sexual abuse as in Evans et al (2004) and Fliege et al (2009) but not in the meta-analysis by Klonsky (2009). This may be explained by the wider age range (adolescents and adults) and type of samples included in the meta-analysis (not exclusively recruited in the community). We found peer NSSI to be a predictor, similar to results from a previous review looking at risk factors for suicidality (Evans et al., 2004). Of note, no prospective studies analysed the effects of social media, either as a direct (more access to self-harm practices) or as an indirect (facilitator of peer NSSI awareness) influence.

Depressive symptoms most conclusively predicted NSSI within the category of psychological factors, as in previous reviews addressing NSSI and suicidality (Evans et al., 2004; Fliege et al., 2009; Plener et al., 2015; Webb, 2002), confirming this as a potentially important modifiable risk factor for prevention. Despite pre-existing evidence for depression, concerns about the limitations of establishing a causal link with cross-sectional studies had been raised (Evans et al., 2004). The effect of general psychological distress, conduct problems, previous NSSI and self-concept related variables was shown to be significant, again confirming findings in existing reviews (Evans et al., 2004; Fliege et al., 2009; Fox et al., 2015; Plener et al., 2015; Webb, 2002). The finding in relation to previous NSSI raises the challenge of secondary prevention, i.e. better early detection of new cases and the need for interventions that prevent recurrence.

Evidence for the remaining variables was generally inconclusive and contradictory. For several variables, the intensity or severity of the predictor (e.g. anxiety, impulsivity and substance misuse) was a relevant factor explaining discrepant results. The limited strength of predictors of NSSI has been highlighted elsewhere (Fox et al., 2015). Moreover, specific characteristics of study design have been seen to moderate results (i.e. measurement type, study population) (Fox et al., 2015; Liu, Cheek, & Nestor, 2016).

Mediators and moderators, which are key variables to understand the complex relation between predictors and outcomes, were insufficiently studied. Detailed comparison of analyses within this review and with previous reviews was not possible due to lack of replication. However when comparing different predictor-NSSI relationships, some possible consistencies emerged. Findings suggested that the effect of risk factors might be modified by gender, previous negative experiences, impulsivity and intrapersonal variables like low self-concept. Intrapersonal factors seemed to have a mediating effect between intra/interpersonal factors and NSSI. Taken together, these findings indicate the importance of assessing individual facilitators for NSSI in the presence of risk factors, a current gap in the existing evidence base. This also serves as a reminder that clinicians should focus not only on behavioural and environmental factors, but also on inter and intrapersonal variables that might be underpinning NSSI.

Studies included in this systematic review provided information about adolescent NSSI in different cultures. Contradictory results were not accounted for differences in the cultural background of the sample of study.

*Strengths and limitations*

This review systematically addresses a very important question and investigates a prevalent problem with serious implications. The focus on community adolescents (rather than clinical samples) is most appropriate since most adolescents with NSSI do not present for help. The review also focuses on separating NSSI from suicidal acts, allowing us to study specific risk factors for this frequent and rarely noticed behaviour. The inclusion of only prospective studies is a particular strength, improving validity with implications for the direction of the relationship between variables. The overall quality of studies was good using a ratified quality analysis scale.

The limitations of the review lie mainly in the considerable heterogeneity between studies in terms of methodology including design, measures (of NSSI and risk factors) and range of outcomes (presence, frequency, cessation). This impeded our ability to collate findings between studies. Some studies failed to control for baseline NSSI, precluding determination of the direction of the relationship (Geulayov, Metcalfe, Heron, Kidger, & Gunnell, 2014; Mars et al., 2014). Finally, the conclusions of the review depend upon factors that have been previously studied and as such might be biased by the interests of the researchers. Studies that met the inclusion criteria did not sufficiently investigate all factors previously associated with NSSI such as sexual abuse, and none investigated posttraumatic stress symptoms (associated with NSSI in cross sectional studies) (Weierich & Nock, 2008) or more recent concerns, those regarding the impact of social media.

*Implications*

These findings have several practical implications for professionals and policy makers. The consistently high prevalence of adolescent NSSI within all population-based samples underlines the gravity of the issue and importance of active enquiry to inform prevention and early intervention strategies. Despite the complexity of extrapolating from apparent risk factors to causal links, there are a number of variables to consider when developing NSSI prevention programmes. Standardised tools should be used to investigate presence of depressive symptoms, general psychological distress, previous NSSI, past abuse, peer victimisation, low self-concept or family conflict as key risk factors. Primary prevention programmes should address these specific risks with particular attention to girls and with early management of acute NSSI to prevent the development of a more chronic practice of self-injury.

*Future research*

Results from this review could lead to the development of a brief screening tool including the most significant risk factors, highlighted above in the implications section. Having previously identified the most at risk adolescents, future research should assess the efficacy of prevention programmes.

In terms of under-investigated predictors, there is a need for controlled studies focusing on the effects of social media, family psychiatric history and trauma. Also, cross-cultural analyses could help to ascertain different risk factors for NSSI in different countries.

To fully understand the development of NSSI in order to develop preventative interventions, research clarifying moderating and mediating effects is needed, and should include analysis of protective factors.

Future studies should include a standardised approach to definition and measures of assessment as well as clarification of levels of severity (e.g. pathological vs. normative substance use) to allow for the future possibility of meta-analysis.

Finally, contradictory results indicate that there is a complex interplay between predictors, moderators and mediators in this field, suggesting the importance of using mixed methods for elaboration and interpretation of quantitative data (Johnson, Onwuegbuzie, & Turner, 2007).

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**Potentially relevant citations** identified through **reference lists search** (n=6)

**Irrelevant citations excluded** after screening titles and abstracts (n=343; sample n=219; NSSI concept n=109; age n=65; no NSSI prediction n=47; method n=39; language n=3\*)

**Irrelevant studies excluded** after detailed assessment of full text (n=64; NSSI concept n=28; method n=11; sample n=10; age n=10; no NSSI prediction n=6\*)

**Identification of potentially relevant citations** from searching of electronic databases (Medline=351); (PsycInfo=99); (Embase=291); (Web of Science=155).

**Studies included in the systematic review** (n=39)

**Citations screened** after removing duplicates(n=440)

**Full text articles examined for eligibility** (n=103)

Figure 1. Study selection flow chart.

\* Numbers do not add up since articles could be excluded for multiple reasons.

Table 1. *Description of studies.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **Reference** | **N for longitudinal analyses**  **(follow-up retention rate)** | **NSSI prevalence** | **Age** | **Follow-up time/ waves** | **Assessment of NSSI** |
| Australia, schools (HEALing project) | (Andrews et al., 2013) | 1973 (75%) | Lifetime prevalence (baseline)= 8.2 -8.4% | 12-18 years | 1 year/2 waves | SHBQ |
| (Andrews et al., 2014) |
| (Hasking et al., 2013) |
| (Tatnell et al., 2014) |
| (Martin et al., 2015) | 1896 (75%) | Lifetime prevalence (two acts, baseline)=6% |
| (Tatnell et al., 2016) | 1848 (T2, 70%)  1740 (T3, 66%) | Lifetime prevalence (baseline)=9.4% | 2 years/3 waves |
| (Voon et al., 2014) | 2383 (80%) | Lifetime prevalence (baseline)=8.1% |
| China (Mainland), schools – sample 1 | (Barrocas et al., 2015) | 617 (99%) | NSSI in the past three months (T1)= 24% | 15-17 years at baseline | 2 years/8 waves | Checklist of NSSI behaviours |
| (Giletta et al., 2015) | 565 (90.5%) |
| China (Mainland), schools – sample 2 | (Wan et al., 2015) | 13,396 (T1, 91.6%)  11,816 (T2, 80.8%)  11,441 (T3, 78.3%) | NSSI in the past 12 months (baseline)= junior students 19.6 %, senior students 20.4%. | 12-17 years | 9 months/4 waves | Checklist of NSSI behaviours |
| China (Mainland), private school–sample 3 | (Jiang et al., 2016) | 525 (64.6%) | NSSI in the past year (baseline)= 29% | 12 – 16 years | 1 year/2 waves | Checklist of NSSI behaviours |
| England, community (ALSPAC study) | (Chang et al., 2014) | 3560 (25.8%) | Lifetime prevalence (follow up)= 12.6-13% | 16-17 years at follow up | Predictors assessed at variable ages from pregnancy. NSSI measured at 16-17 years, with no baseline assessment. | Single item question with subsequent question(s) regarding intent |
| (Geulayov et al., 2014) | 6937 (50.3%) |
| (Kidger et al., 2015) | 3939 (28.5%) |
| (Mars et al., 2014) | 4799 (35%) |
| (Page et al., 2014) | 2067 (15%) |
| Flanders (Belgium), community (JOnG! study) | (Baetens et al., 2014) | Adolescent report= 827 (T2, 59,2%), 754 (T3, 54%).  Parent report= 936 (T2, 65%), 790 (T3, 54.9%). | Lifetime prevalence (baseline)=5% | 12-15 years | 2.5 years/3 waves | Single item question |
| (Baetens et al., 2015) |
| Hong Kong, schools – sample 1 | (You, Leung, & Fu, 2012) | 2435 (81.6%) | NSSI in the past year (baseline)= 24.9% | 11-18 years | 6 months/2 waves | Checklist of NSSI behaviours |
| (You et al., 2013) | 5787 (84.7%) | NSSI in the past 6 months (baseline)= 12.7% | 12 – 18 years | 6 months/2 waves |
| (You et al., 2015) | 3600 (66.4%) | NSSI in the past 6 months (baseline)= 10.3% | 1 year/3 waves |
| Hong Kong, schools – sample 2 | (You, Leung, Lai, et al., 2012) | 4782 (77%) | NSSI in the past 2 years (T2)= 15% | 11 – 19 years | 1 year/2 waves | DIB-R including five NSSI items |
| (You & Leung, 2012) |
| Hong Kong, schools – sample 3 | (Law & Shek, 2016) | 2032 (unknown follow up rate) | NSSI in the past year (wave 6)= 15.3% | 10 – 16 years at baseline | 6 years/6 waves | Checklist of NSSI behaviours |
| New Zealand, schools | (Garisch & Wilson, 2015) | 495 (42.6%) | Lifetime prevalence (baseline) = 48.7% | 16-18 years | 5 months/2 waves | DSHI-s |
| Scotland, schools | (Young et al., 2011) | 1256 (48.5%) | Lifetime prevalence (follow up)= 7.1% | 11-19 years | 8 years/4 waves | One question with subsequent question about method |
| Spain, schools | (Calvete et al., 2017) | 818 (65.1%) | NSSI in the past year (baseline)= 67.3% | 14 – 18 years | 1 year/2 waves | FASM |
| Sweden, schools –  sample 1 | (Jutengren et al., 2011) | 880 (unknown follow up rate) | NSSI in the past 6 months (baseline)=34% | 12-15 years at T1 | 1 year/2 waves | DSHI-9 |
| (Marshall, Faaborg-Andersen, Tilton-Weaver, & Stattin, 2013) | 513 (at least 2 waves) (94%) | NSSI in the past 6 months (baseline)=40% | 2 years approx./ 3 waves |
| (Marshall, Tilton-Weaver, & Stattin, 2013) | 506 (at least 2 waves) (93%) |
| Sweden, schools –  sample 2 | (Lundh, Wangby-Lundh, & Bjarehed, 2011) | 879 (83.6%) | NSSI in the past 6 months (baseline)=41.6% | 13 - 16 years | 1 year/2 waves | DSHI-9r |
| (Lundh, Wangby-Lundh, Paaske, Ingesson, & Bjarehed, 2011) |
| (Lundh et al., 2013) | 881 (84%) |
| Northeastern USA, schools | (Prinstein et al., 2010) | 377 (92%) | NSSI in the past year (baseline)=7.4% | 12 – 15 years at T1 | 11 months/2 waves | Single item question |
| (Heilbron & Prinstein, 2010) | 520 (T2, 87%)/493(T3, 82%) | NSSI in the past year (baseline)=6.4% | 11-14 years at T1 | 2 years/3 waves |
| Pittsburgh, USA, community (Pittsburgh Girls Study) | (Keenan et al., 2014) | 2180 (89%) | NSSI in the past year (follow up)=6% | 13-14 years at follow- up | Predictors assessed from age 8-12. NSSI assessed at age 13-14. | Single item question  (parent or child report of self-harm) |
| Southeastern USA, schools | (Giletta et al., 2013) | 348 (90 - 99%) | NSSI in the past year (baseline)= 28.8% | 14 – 18 years at baseline | 1.5 years/4 waves | Checklist of NSSI behaviours |
| (Glenn, Kleiman, Cha, Nock, & Prinstein, 2016) | 662 (74.3%) | NSSI in the past year (baseline)= 33.9% | 2 years/3 waves |
| Chicago, USA, community | (Hankin & Abela, 2011) | 97 (94%) | NSSI in the past year (baseline)=8% | 11 – 14 years at baseline | Depression assessed every six months during two and a half years. Other predictors assessed after two years. NSSI assessed at baseline and at the two and a half years follow up. | FASM |

Key: SHBQ (Self-Harm Behaviour Questionnaire), DIB-R (Diagnostic Interview for Borderlines, revised), DSHI (Deliberate Self-Harm Inventory), FASM (Functional Assessment of Self-Mutilation).

Note. Sample size of studies conducted in the same sample might vary due to different reasons: missing cases in specific variables of study, use of different waves of data, inclusion of new participants in subsequent assessment waves.

Table 2. *Overview of evidence of predictors, moderators and mediators of NSSI.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Reference (Quality level)** | **Findings** | |
| **Sociodemographic factors** | | | |
| Gender | (Andrews et al., 2013, 2014; Voon et al., 2014)(H)/(Hasking et al., 2013; Tatnell et al., 2016; Tatnell et al., 2014) (M) | | As predictor: Five samples (H-M) found significant results for female gender. Two studies from two different samples (Australian and Chinese samples) showed a predictive effect of male gender on NSSI frequency and onset. Four samples (H-M) found non-significant results for gender.  As moderator: Seven samples (M) found a moderating effect of gender with different variables and five (H-M) did not. Five of the significant samples showed stronger associations in girls and three found stronger relationships for males. Three moderation analyses for gender were replicated in several samples, with inconsistent results: 1) Peer NSSI and individual NSSI, 2) Depression and NSSI, 3) Conduct symptoms and NSSI. |
| (Baetens et al., 2014) (M) | |
| (Barrocas et al., 2015; Giletta et al., 2015)(M) | |
| (Chang et al., 2014; Mars et al., 2014) (M) | |
| (Giletta et al., 2013) (M) | |
| (Glenn et al., 2016) (M) | |
| (Hankin & Abela, 2011) (H) | |
| (Jiang et al., 2016)(M) | |
| (Jutengren et al., 2011; Marshall, Tilton-Weaver, et al., 2013) (M) | |
| (Law & Shek, 2016) (M) | |
| (Lundh, Wangby-Lundh, & Bjarehed, 2011)(M) | |
| (Prinstein et al., 2010) (M) | |
| (Wan et al., 2015) (H) | |
| (You & Leung, 2012) (M) | |
| (You et al., 2013) (M) | |
| (Young et al., 2011)(M) | |
| Age | (Andrews et al., 2013, 2014; Voon et al., 2014)(H) / (Hasking et al., 2013; Tatnell et al., 2016; Tatnell et al., 2014)(M) | | As predictor: Three samples (H-M) showed no effect. In one study, age was predictive of NSSI in a subpopulation of abused adolescents.  As moderator: One sample (M) found a moderating effect of age (stronger effect of peer NSSI for younger participants) and three samples (H-M) did not show moderation. |
| (Jiang et al., 2016) (M) | |
| (Prinstein et al., 2010) (M) | |
| (Wan et al., 2015) (H) | |
| (You et al., 2013) (M) | |
| Socioeconomic status (SES) | (Andrews et al., 2013, 2014) (H) | | As predictor: Four samples (H-M) found no significant effect for SES variables. |
| (Law & Shek, 2016) (M) | |
| (Mars et al., 2014; Page et al., 2014) (M) | |
| (Young et al., 2011) (M) | |
| Religious beliefs | (Andrews et al., 2013, 2014) (H) | | As predictor: One sample (H) found significant impact of not being religious on onset but not on continuation and another sample (M) did not find an association. |
| (Young et al., 2011) (M) | |
| **Environmental factors** | | | |
| ***Maltreatment*** | | | |
| Physical abuse | (Mars et al., 2014) (M) | As predictor: one sample (M) found that parental cruelty was a not predictor and the other one (M) found a significant and strong association between physical abuse and NSSI. | |
| (Tatnell et al., 2016)(M) |
| Sexual abuse | (Mars et al., 2014) (M) | As predictor: both samples (M) found a significant association between past sexual abuse and NSSI, one of them showing an increase of 7-8 times the odds of NSSI in those with history of sexual abuse. | |
| (Tatnell et al., 2016)(M) |
| Peer victimisation | (Giletta et al., 2015) (M) | As predictor: Five samples (M) found significant results, two samples (M-L) found no effect. | |
| (Jiang et al., 2016) (M) |
| (Garisch & Wilson, 2015) (L) |
| (Heilbron & Prinstein, 2010) (M) |
| (Jutengren et al., 2011; Marshall, Faaborg-Andersen, et al., 2013) (M) |
| (Keenan et al., 2014) (M) |
| (Mars et al., 2014) (M) |
| ***Parenting/***  ***family factors*** | (Andrews et al., 2013, 2014) (H)/(Tatnell et al., 2014) (M) | As predictor: Eight samples (H-M) found significant associations between NSSI and the following factors: parent-reported parenting behaviours, support, maternal self-harm, onset of maternal depression during the study, harsh parenting, family invalidation, family non-intactness and lack of parental care. Seven samples (H–M) did not find significant results for the following variables: perceived parenting behaviours, past parental suicide attempt, harsh punishment, family cohesion, family functioning and parental control. Two samples (H-M) found a predictive effect of current and recent parental mental health problems but no evidence for past mental health problems. There were discrepancies within samples and within studies depending on the specific family-related variable.  As moderator: family cohesion did not moderate the relationship between peer victimisation and NSSI. | |
| (Baetens et al., 2014, 2015) (M) |
| (Jiang et al., 2016) (M) |
| (Law & Shek, 2016) (M) |
| (Geulayov et al., 2014; Mars et al., 2014) (M) |
| (Hankin & Abela, 2011) (H) |
| (Jutengren et al., 2011) (M) |
| (Keenan et al., 2014) (M) |
| (You & Leung, 2012) (M) |
| (Young et al., 2011) (M) |
| ***Peers´ NSSI*** | (Giletta et al., 2013) (M) | As predictor: Four samples (M) showed significant results although one of them failed to find differences for the outcomes NSSI frequency and onset. Results differed depending on the specific variable studied (best friend´s NSSI vs. group of friends´ NSSI). Two samples (M) did not show a significant association of NSSI and peers´ NSSI. | |
| (Giletta et al., 2015) (M) |
| (Hasking et al., 2013) (M) |
| (Mars et al., 2014) (M) |
| (Prinstein et al., 2010) (M) |
| (You et al., 2013) (M) |
| ***Life events*** | (Hankin & Abela, 2011) (H) | As predictor: Two samples (H-M) found significant results, except for the outcome severity in one of the studies. Two samples (H-M) found non-significant results.  As moderator: Two samples (M-H) found a moderating effect of higher levels of adverse life events between peer NSSI and individual NSSI and between acting with awareness and NSSI. | |
| (Calvete et al., 2017) (M) |
| (Voon et al., 2014) (H),(Hasking et al., 2013) (M) |
| (Keenan et al., 2014) (M) |
| ***Interpersonal relationships*** | | | |
| Attachment | (Tatnell et al., 2016; Tatnell et al., 2014) (M) | As predictor: One sample (M) found significant results for attachment. Two samples (H-M) found significant effect of support and another one (H-M) did not. Regarding relationship problems, two samples (H-M) showed a significant association (except for unstable relationships in one of them) and three samples (H-M) did not show significant effects. | |
| Support | (Andrews et al., 2013, 2014)(H) /(Tatnell et al., 2014) (M) |
| (Giletta et al., 2015) (M) |
| (Hankin & Abela, 2011) (H) |
| Relationship problems | (Hankin & Abela, 2011) (H) |
| (Lundh, Wangby-Lundh, & Bjarehed, 2011) (H) |
| (Wan et al., 2015) (H) |
| (You, Leung, Lai, et al., 2012) (M) |
| (You, Leung, & Fu, 2012; You et al., 2015)(M) |
| **Psychological factors** | | | |
| ***Psychological distress*** | | | |
| Depression | (Barrocas et al., 2015; Giletta et al., 2015) (M) | As predictor: Eleven samples (H-M-L) found significant results, although three of them (M) failed to find an association with specific NSSI outcomes.  As moderator: One sample (M) found that depressive symptoms did not moderate the relationship between implicit NSSI self-identification and NSSI. | |
| (Garisch & Wilson, 2015) (L) |
| (Giletta et al., 2013; Glenn et al., 2016) (M) |
| (Hankin & Abela, 2011) (H) |
| (Calvete et al., 2017) (M) |
| (Heilbron & Prinstein, 2010; Prinstein et al., 2010)(M) |
| (Keenan et al., 2014) (M) |
| (Mars et al., 2014) (M) |
| (Marshall, Tilton-Weaver, et al., 2013) (M) |
| (Lundh, Wangby-Lundh, Paaske, et al., 2011) (H) |
| (You & Leung, 2012) (M) |
| (You et al., 2013) (M) |
| General psychological distress | (Andrews et al., 2013, 2014; Martin et al., 2015; Voon et al., 2014) (H) /(Hasking et al., 2013) (M) | As predictor: Four samples (H-M) found a significant relationship. The only non-significant result was for the outcome NSSI continuation in one of these samples.  As mediator: One sample (H) showed no mediation in the relationship between psychosocial variables and NSSI onset. | |
| (Baetens et al., 2014) (M) |
| (Lundh, Wangby-Lundh, & Bjarehed, 2011) (M) |
| (Wan et al., 2015) (H) |
| Conduct problems | (Keenan et al., 2014) (M) | As predictor: Three samples (H-M) found significant associations between conduct problems and NSSI and one sample (M) did not. | |
| (Lundh, Wangby-Lundh, & Bjarehed, 2011) (H) |
| (Calvete et al., 2017) (M) |
| (Wan et al., 2015) (H) |
| Anxiety | (Garisch & Wilson, 2015) (L) | As predictor: One sample (M) found a significant association of DAWBA-diagnosed anxiety disorders and NSSI and another sample (L) did not show an association between anxiety symptoms and NSSI. | |
| (Mars et al., 2014) (M) |
| Emotional problems | (Andrews et al., 2013, 2014; Voon et al., 2014) (H)/ (Tatnell et al., 2016; Tatnell et al., 2014)(M) | As predictor: Four samples (H-M-L) found significant relationships between emotional problems and NSSI (except for NSSI onset and frequency in two samples) and two samples (H-M) did not.  As moderator: One sample (H) failed to show a moderation effect in the relationship between life events, psychological distress and NSSI.  As mediator: One sample (M) determined that negative emotions mediated the relationship between BP features and NSSI. | |
| (Wan et al., 2015) (H) |
| (Lundh, Wangby-Lundh, & Bjarehed, 2011) (H) |
| (Garisch & Wilson, 2015) (L) |
| (You, Leung, & Fu, 2012; You et al., 2015)(M) |
| (You, Leung, Lai, et al., 2012)(M) |
| Borderline personality features | (You, Leung, Lai, et al., 2012) (M) | As predictor: Two samples (M) found significant results, except for the outcome NSSI frequency in one of them. | |
| (You et al., 2015) (M) |
| ***Maladaptive behaviour*** | | | |
| Previous NSSI | (Andrews et al., 2013) (H) / (Hasking et al., 2013; Tatnell et al., 2014) (M) | As predictor: Eight samples (M-L) found significant results but two of them failed to show an association for specific outcomes related to previous NSSI nature (baseline lethality) and for NSSI at specific time points. | |
| (Baetens et al., 2014, 2015) (M) |
| (Garisch & Wilson, 2015) (L) |
| (Calvete et al., 2017) (M) |
| (Jiang et al., 2016)(M) |
| (Giletta et al., 2013; Glenn et al., 2016) (M) |
| (Jutengren et al., 2011) (M) |
| (You, Leung, & Fu, 2012; You et al., 2013; You et al., 2015)(M) |
| Impulsivity | (Garisch & Wilson, 2015)(L) | As predictor: Three samples (M) found a significant effect, except for NSSI discontinuation in one of them. Two samples (M-L) found no effect of impulsivity.  As moderator: One sample (M) showed that impulsivity did not moderate the relationship between environmental factors and NSSI and another sample (M) determined that impulsivity moderated the relationship between negative emotions and NSSI and the relationship between NSSI at different waves. | |
| (Giletta et al., 2013) (M) |
| (Jutengren et al., 2011)(M) |
| (Mars et al., 2014) (M) |
| (You & Leung, 2012; You, Leung, Lai, et al., 2012)(M) |
| (You et al., 2013; You et al., 2015)(M) |
| Substance use | (Garisch & Wilson, 2015) (L) | As predictor: Two samples (M) found significant results for smoking, heavy drinking and cannabis use (one of them only for smoking and NSSI severity) and two samples (M-L) showed no associations. | |
| (Calvete et al., 2017) (M) |
| (Hasking et al., 2013) (M) |
| (Mars et al., 2014)(M) |
| ***Psychological processes*** | | | |
| Self-concept related variables | (Andrews et al., 2013, 2014)(H)/(Tatnell et al., 2014) (M) | As predictor: Four samples (H-L) found significant results (except for NSSI continuation in one of them) and two samples (M) did not.  As moderator. One sample (M) showed that self-compassion moderated the relationship between peer victimisation and NSSI (higher levels if low self-compassion). Another sample (M) determined that self-criticism moderated the relationship between BP features and NSSI, negative emotions and NSSI and between NSSI at different time points.  As mediator: One sample (M) found that self-esteem and self-efficacy mediated the relationship between attachment anxiety and NSSI. | |
| (Jiang et al., 2016) (M) |
| (Glenn et al., 2016) (M) |
| (Garisch & Wilson, 2015) (L) |
| (Lundh, Wangby-Lundh, Paaske, et al., 2011)(H) |
| (You et al., 2015) (M) |
| Cognitive style | (Andrews et al., 2013, 2014; Voon et al., 2014) (H)/ (Tatnell et al., 2016; Tatnell et al., 2014) (M) | As predictor: Three samples (H-M) found significant effects of cognitive reappraisal (CR), negative attributional style, negative cognitive style and rumination. Another study from one of these samples (H) did not replicate the results in the repeated self-harm group, at the 24-month follow up and for rumination.  As moderator: One sample (H) failed to show a moderation effect of CR in the relationship between life events, psychological distress and NSSI.  As mediator: One sample (M) found a mediation effect of CR in the relationship between attachment anxiety and NSSI. | |
| (Barrocas et al., 2015) (M) |
| (Hankin & Abela, 2011) (H) |
| *Psychological strengths* | (Andrews et al., 2013, 2014)(H) | As predictor: Four samples (H-M) found significant effects of problem solving, self-control, acting with awareness, positive attributes and general positive youth development on NSSI reduction. Four samples (H-M-L) did not find a significant association with type of coping strategies, resilience, mindfulness, cognitive-behavioural competencies, positive identity and adaptive use of emotions.  As moderator: One sample (M) showed that self-regulation skills did not moderate the relationship between environmental factors and NSSI. | |
| (Law & Shek, 2016) (M) |
| (Garisch & Wilson, 2015) (L) |
| (Calvete et al., 2017) (M) |
| (Jutengren et al., 2011) (M) |
| (Keenan et al., 2014) (M) |

Key. H=High quality study, M=medium quality study, L=low quality study. DAWBA= Developmental And Well-Being Assessment. BP= Borderline Personality.