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The association between nonsuicidal self-injury and the emotional disorders: A meta-analytic review

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HIGHLIGHTS

- We review the magnitude of associations between NSSI and the emotional disorders.
- The risk of NSSI is higher among individuals with emotional disorders than without.
- NSSI is most strongly related to panic disorder and post-traumatic stress disorder.
- The risk of NSSI does not significantly differ across the emotional disorders.
- Findings support a relationship between NSSI and the emotional disorders.

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ABSTRACT

Existing research supports a relationship between nonsuicidal self-injury (NSSI) and the emotional disorders (i.e., anxiety, mood, and related disorders). The aim of this investigation was to conduct a meta-analysis of the associations between NSSI and the emotional disorders, and evaluate the quality of evidence supporting this relationship. A literature search was conducted from database inception through June 2014, and two reviewers independently determined the eligibility and quality of studies. A total of 56 articles providing data on engagement in NSSI among individuals with and without emotional disorders met eligibility criteria. Compared to those without an emotional disorder, individuals with an emotional disorder were more likely to report engagement in NSSI (OR = 1.75, 95% CI: 1.49, 2.06). This increase of risk of NSSI was shown for each disorder subgroup, with the exceptions of bipolar disorder and social anxiety disorder. The largest associations were observed for panic and post-traumatic stress disorder; however, the risk of NSSI did not differ significantly across disorders. The quality of evidence was variable due to inconsistent methodological factors (e.g., adjustment for confounding variables, NSSI assessment). Overall, these findings provide evidence for a relationship between NSSI and the emotional disorders, and support conceptualizations of NSSI as transdiagnostic.

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1. Introduction

The phenomenon of self-injury has received increasing attention over the past several decades (Nock, 2010). An important distinction has been made between suicidal behavior and nonsuicidal self-injury (NSSI), with the latter referring to the direct and deliberate destruction of one's own body tissue without suicidal intent (Nock & Favazza, 2009). NSSI is a maladaptive behavior that can result in heightened negative affect, severe injuries, hospitalization, and even death (Briere & Gil, 1998; Klonsky, 2009). Research has also shown that NSSI is a strong predictor of future suicide attempts (e.g., Asarnow et al., 2011; Bryan, Bryan, Ray-Sannerud, Etienne, & Morrow, 2014; Klonsky, May, & Glenn, 2013; Wilkinson, Kelvin, Roberts, Dubicka, & Goodyer, 2011), and that among both adults and adolescents who engage in NSSI, the risk of suicidal behavior is higher than their non-self-injuring counterparts (e.g., Andover & Gibb, 2010; Andover, Morris, Wren, & Bruzzese, 2012; Brausch & Gutierrez, 2010; Martin, Swannell, Hazell, Harrison, & Taylor, 2010).

NSSI can present in a number of forms, some of which include cutting, scratching, and burning the skin, inserting objects under the skin, and hitting oneself. Although cutting is most commonly reported, most individuals utilize multiple methods of NSSI (Klonsky, 2007, 2011; Nock, 2010). Prevalence rates of NSSI vary significantly across studies; for example, estimates of lifetime prevalence have ranged from 13% to 45% of community-based adolescents and adults (Briere & Gil, 1998; Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007; Plener, Libal, Keller, Fegert, & Muehlenkamp, 2009; Ross & Heath, 2002; Shaffer & Jacobson, 2009; Swannell, Martin, Page, Hasking, & St. John, 2014) and 19% to 60% of clinical samples (Briere & Gil, 1998; Darche, 1990; DiClemente, Ponton, & Hartley, 1991). Among samples of individuals with borderline personality disorder (BPD) specifically, rates have been shown to exceed 50% (e.g., Dulit, Fyer, Leon, Brodsky, & Frances, 1994; Shearer, 1994). One explanation for such wide variation in prevalence rates is the fact that terms used to capture this behavior are inconsistent across the literature (e.g., self-mutilation, deliberate self-harm, parasuicide). Despite difficulties in comparing prevalence rates across studies, findings generally suggest that NSSI occurs more frequently than a number of widely studied mental disorders, such as anorexia nervosa, panic disorder (PD), obsessive–compulsive disorder (OCD), and BPD (American Psychiatric Association, 2013).

In prior iterations of the Diagnostic and Statistical Manual of Mental Disorders (DSM; e.g., DSM-IV-TR; APA, 2000), "self-mutilating behavior" was included only as one of the nine diagnostic criteria for BPD, which may partially explain the elevated rates of NSSI in BPD-specific samples. However, accumulating findings show that NSSI often presents in the absence of BPD (e.g., Muehlenkamp, Erlelt, Claes, & Miller, 2011; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Selby, Bender, Gordon, Nock, & Joiner, 2012) and can co-occur with a variety of psychological disorders, including eating disorders, substance use, unipolar and bipolar depression, post-traumatic stress disorder (PTSD), generalized anxiety disorder (GAD), social anxiety disorder (SOC), and OCD (e.g., Briere & Gil, 1998; Claes, Klonsky, Muehlenkamp, Kuppens, & Vandereycken, 2010; Evren, Sar, Evren, & Dalbudak, 2008; Jacobson, Muehlenkamp, Miller, & Turner, 2008; Klonsky, Oltmanns, & Turkheimer, 2003; Nock et al., 2006; Zlotnick, Mattia, & Zimmerman, 1999). In response to growing conceptualizations of NSSI as a transdiagnostic phenomenon, rather than a symptom of a single disorder (e.g., Bentley, Nock, & Barlow, 2014; Selby et al., 2012; Wilkinson & Goodyer, 2011), numerous calls have been made for the reclassification of NSSI (e.g., Muehlenkamp, 2005; Shaffer & Jacobson, 2009). These proposals resulted in the inclusion of NSSI disorder as an area in need of further study (Section 3) in the recently published DSM-5 (APA, 2013) and emerging research continues to support classifying NSSI as a distinct clinical syndrome (e.g., Andover, 2014; Glenn & Klonsky, 2013; In-Albon, Ruf, & Schmid, 2013; Lengel & Mullins-Sweatt, 2013; Selby et al., 2012).

Given increasing evidence that NSSI commonly presents with disorders other than BPD, as well as enduring uncertainty about where to place NSSI disorder in the DSM (e.g., McKay & Andover, 2012), a more precise understanding of the relationship between NSSI and the range of psychiatric conditions is needed. The "emotional disorders" are one disorder grouping that may warrant particular attention in this line of research. According to Sauer-Zavala and Barlow (2014), emotional disorders refer to psychopathology characterized by "frequent and intense negative emotions, strong aversive reactions to negative emotions, and efforts to avoid or escape these emotional experiences" (p. 118; Barlow, 1991; Brown & Barlow, 2009). Conditions historically thought to fall under the emotional disorder umbrella include the range of DSM-5 (APA, 2013) depressive and anxiety disorders, and obsessive–compulsive and trauma- and stress-related disorders (Barlow, 2002); however, any disorder determined to fit the aforementioned definitional characteristics through functional analysis may be considered within this group.

This definition of emotional disorders demonstrates clear conceptual overlap with the phenomenon of NSSI. As noted above, emotional disorders are characterized by the frequent experience of negative emotions (e.g., fear, anxiety, sadness), which in turn are maintained and exacerbated by the use of maladaptive avoidant strategies (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010; Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014; Tull & Roemer, 2007; Weiss et al., 2012). Although a variety of models exist to explain why NSSI occurs, there is consensus that NSSI is most often used to regulate affect, and more specifically, to reduce or escape from aversive affective states, such as anxiety, sadness, or guilt (Chapman, Gratz, & Brown, 2006; Klonsky, 2007; Nock & Prinstein, 2004, 2005). Thus, NSSI often serves functions equivalent to the attempts to avoid negative emotional experiences that maintain the emotional disorders. Indeed, the association of avoidant coping strategies characteristic of emotional disorders (e.g., rumination, thought suppression) with engagement in and severity of NSSI is now well-established (e.g., Bentley, Sauer-Zavala, & Wilner, in press; Borrill, Fox, Flynn, & Roger, 2009; Hilt, Cha, & Nolen-Hoeksema, 2008; Howe-Martin, Murrell, & Guarnaccia, 2012; McKay & Andover, 2012; Najmi, Wegner, & Nock, 2007; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Voon, Hasking, & Martin, 2014).

There is also ample evidence to support the presence of similar higher-order constructs underlying the emotional disorders and NSSI. Neuroticism, or the tendency to experience negative emotions accompanied by a sense of the uncontrollability of these emotional experiences (Barlow, Sauer-Zavala, et al., 2014; Clark, 2005), has been established as an important trait contributing to the development and maintenance of emotional disorders (e.g., Barlow, Ellard, Sauer-Zavala,

Bullis, & Carl, 2014; Brown, 2007; Brown & Barlow, 2009; Kessler et al., 2011). Emerging findings also suggest that levels of neuroticism distinguish self-injuring from non-self-injuring individuals (e.g., Allrogen et al., 2014; Baetens, Claes, Muehlenkamp, Grietens, & Onghena, 2012; Claes, Muehlenkamp, et al., 2010; Claes, et al., 2010; MacLaren & Best, 2010; Mullins-Sweatt, Lengel, & Grant, 2013). Considering this body of empirical literature, it is no surprise that studies have shown emotional disorders and NSSI to frequently co-occur (e.g., Jacobson et al., 2008; Klonsky et al., 2003), and that individuals who engage in NSSI exhibit elevated levels of anxiety and depression compared to those who do not (e.g., Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005; Brunner et al., 2013; Kirkcaldy, Brown, & Siefen, 2007; Prinstein et al., 2010).

Given shared funcionality between NSSI and the avoidant coping strategies that maintain emotional disorders, the purpose of the present review is to examine the magnitude of relationships between these two phenomena. Although other conditions (e.g., somatic symptom disorders, eating disorders, substance use disorders) may fit the definitional guidelines of emotional disorders following idiosyncratic functional analysis, the present study focuses on the prototypic emotional disorders (i.e., mood, anxiety, obsessive–compulsive, trauma and stressor-related disorders) for two reasons. First, these disorders are *almost always* characterized by the avoidant, maladaptive strategies for coping with strong emotions that both define emotional disorders and evidence functional similarity to NSSI for affect regulation. This is not to say, however, that NSSI *only* co-occurs with emotional disorders, nor that improving our understanding of NSSI as it presents across "non-emotional" disorders is unimportant. Thus, the second reason is that it was beyond the scope of this review to conduct a meta-analysis of all cross-sectional and longitudinal studies reporting any diagnostic information for self-injuring and non-self-injuring individuals. Despite the limitations associated with focusing on one category of psychopathology, this synthesis of available literature on NSSI and emotional disorders serves as a logical starting point toward advancing our understanding of the relationship between NSSI and all mental disorders, as well as other potentially informative constructs.

Although recent evidence suggests that BPD may be best conceptualized as an emotional disorder (e.g., Sauer-Zavala & Barlow, 2014), we do not extend the current meta-analysis to examining the relationship between this particular diagnosis and NSSI. Given that "self-mutilating behavior" is a diagnostic criterion for BPD, this disorder should inherently evidence a particularly strong relationship with NSSI. Thus, quantifying the association of NSSI with this disorder (and comparing it to other emotional disorders) has the potential to introduce criterion contamination. Although some recent research has addressed this issue by removing self-injurious behavior as a BPD symptom (e.g., Glenn & Klonsky, 2011), the vast majority of studies reporting rates of psychiatric diagnoses among individuals with and without NSSI have not; accordingly, we focus primarily on those emotional disorders in which NSSI is not embedded in the diagnostic criteria. In light of the clear relevance of BPD to research on the diagnostic context of NSSI, as well as high comorbidity between BPD and the anxiety and mood disorders (Grant et al., 2008), however, we utilize several analytic strategies to attend to the potential impact of BPD on our findings.

In sum, increasing empirical attention directed toward the transdiagnostic nature, classification, and functionality of NSSI underscores the importance of understanding the relationship between this phenomenon and psychiatric disorders other than BPD, including the emotional disorders. To our knowledge, a quantitative synthesis of available literature on this particular topic does not yet exist; thus, the purpose of this meta-analytic review is to estimate the magnitude of the associations of engagement in NSSI with a variety of emotional disorders. An equally critical aim is to evaluate the quality of evidence supporting a relationship between NSSI and the emotional disorders, which may identify potential areas for refinement of future empirical investigations.

2. Method

This review complies with the reporting standard set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA; Moher, Liberati, Tetzlaff, & Altman, 2009).

2.1. Inclusion and exclusion criteria

Eligible studies met the following criteria: 1) reported diagnostic information regarding the prevalence of at least one of the following emotional disorders: unipolar mood disorders (i.e., major depressive disorder (MDD), dysthymic disorder (DYS), depressive disorder not otherwise specified (DDNOS), bipolar disorders (i.e., bipolar I, bipolar II, bipolar disorder NOS), anxiety disorders (i.e., GAD, PD, agoraphobia (AG), SOC, specific phobia (SP), OCD, and PTSD), 2) the sample included both self-injuring and non-self-injuring individuals, and 3) the definition of NSSI clearly stated that damage to the body was nonsuicidal in nature. Studies that referenced "deliberate self-harm" or used other ambiguous terminology were carefully reviewed and only included if prevalence of *nonsuicidal* self-injury was explicitly stated. Studies were excluded if they: 1) did not provide a clear definition of NSSI, 2) did not include a *diagnostic* measure of at least one of the emotional disorders examined (e.g., studies using cut-scores on symptom-based measures not tied to DSM criteria to establish diagnostic status were excluded), 3) did not provide sufficient data to calculate an association between NSSI and an emotional disorder, 4) did not include original data (i.e., review papers, editorials, letters), 5) only examined individuals with intellectual impairments, and 6) were not available in English. We also excluded studies in which the only non-self-injuring individuals were selected healthy controls (i.e., by definition, were without psychiatric disorders). Finally, we excluded studies that used the "index episode" approach, which assesses the most recent episode of self-injury, when it was not clearly stated whether NSSI had occurred before the most recent suicidal self-injurious episode.

2.2. Search strategy

We conducted a comprehensive literature search of PubMed, PsychInfo, and ProQuest Dissertations and Theses for all studies published from the earliest inclusive dates until June 30, 2014. We searched these databases with possible permutations of terms related to the emotional disorders of interest (e.g., anxiety, anxious, depression, depressive, mood, dysthymic, dysthymia, generalized, obsessive compulsive, OCD, social, phobia, post-traumatic stress, PTSD, panic, agoraphobia) with terms related to NSSI (e.g., self-injury, NSSI, self-harm, self-mutilation). Additionally, we examined all relevant publications by prominent researchers in the field of NSSI. Finally, we searched the reference sections of every coded article to identify potential articles that the original search may have missed. Additional details of the literature searches are available from the first author upon request.

2.3. Study selection and data abstraction

Three reviewers (K.B., C.C., L.V.) took part in the process of study selection and data abstraction. One reviewer independently reviewed and determined each study's eligibility based first on the title, then the abstract, and finally, the full text. After establishing relevant articles, two reviewers independently extracted data from each eligible study using a predefined coding strategy, and compared the results of data abstraction at consensus meetings. The agreement rate was 90%; all disagreements between reviewers were resolved by detailed discussion.

2.4. Study quality

In order to assess the quality of the included studies, we adapted the Newcastle–Ottawa Quality Assessment Scale (Wells et al., 2010) by

evaluating the following items for case–control studies: 1) ascertainment of emotional disorder diagnosis (i.e., was this assessed by validated, clinician-rated assessment?), 2) method of emotional disorder ascertainment (i.e., was the same method used for self-injuring and non-self-injuring individuals?), 3) ascertainment of NSSI (i.e., was engagement in NSSI verified by clinician-rated interview?), 4) representativeness of cases (i.e., was there bias in the sample selection?), 5) adjustment for confounding variables (e.g., BPD diagnosis, age, gender, depressive symptom severity), 6) selection of self-injuring individuals (i.e., were they selected from the same population as non-self-injuring individuals?), and 7) definition of non-self-injuring individuals (e.g., no lifetime NSSI, no NSSI during study time period of interest). For cohort studies, the adapted Quality scale evaluated the following items: 1) representativeness of exposed cohort (i.e., were individuals with an emotional disorder diagnosis representative of the average population), 2) selection of non-exposed cohort (i.e., were individuals without an emotional disorder diagnosis drawn from the same population as those with such a diagnosis?), 3) ascertainment of emotional disorder diagnosis, 4) demonstration that NSSI was not present in the entire sample at the start of study, 5) adjustment for confounding variables, 6) ascertainment of NSSI, and 7) adequacy of follow-up period.

A study received one point for using the most stringent method of any item on the scale (e.g., employed a validated, clinician-rated measure to assess the presence of emotional disorders). Summing the items of the quality scale yielded an overall quality score (maximum score of 7). Two reviewers independently extracted data from each eligible study. The agreement rate for the quality scale was 84%, and any disagreements were resolved by discussion.

2.5. Statistical analyses

The outcome of interest was past or present engagement in NSSI. From each study, we extracted or calculated relative association measures comparing engagement in NSSI between individuals with and without an emotional disorder and the 95% confidence interval (CI). All relevant associations reported in publications were converted to odds ratios (ORs) using standard procedures for studies in which effect sizes were reported in another metric or no effect size was reported but sufficient information was provided to calculate an OR (e.g., percentage of individuals with and without an emotional disorder who reported engagement in NSSI). When multiple useable effect sizes were reported, but one effect size was adjusted for potential confounding variables (e.g., BPD diagnosis or symptoms, history of suicide attempts, age, gender), we chose the most adjusted estimate.

For publications that met all inclusion criteria and either reported findings in the text without corresponding data (e.g., stating that more self-injuring individuals were diagnosed with an anxiety disorder than non-self-injuring individuals) or only the percentage of individuals with an emotional disorder collapsed across self-injuring and non-self-injuring individuals, we contacted 9 authors for the additional data. Necessary data were obtained from 5 authors, 1 author responded indicating that these data were unavailable, and 3 authors did not respond after two attempts to contact.

All meta-analytic calculations were conducted using the software Comprehensive Meta-Analysis (CMA, Version 2, Borenstein, Hedges, Higgins, & Rothstein, 2005) and random-effects models (Field, 2001; Hedges & Olkin, 1985; Hedges & Vevea, 1998). The assumption of random-effects models is that reported effect sizes for included studies represent a random sample of studies distributed about a mean effect size for the population; thus, this type of model does not assume that the true effect size in the population is the same across the included samples. We estimated the overall effect sizes by pooling ORs from the included studies. In addition to computing an overall effect size for any emotional disorder, we also conducted subgroup analyses for any mood disorder (i.e., any unipolar or bipolar mood disorder), any bipolar disorder, any depressive disorder, any anxiety disorder (i.e., GAD, PD, SOC, AG, SP, or any grouping of anxiety disorders as defined in the study), and the following individual disorders: MDD, DYS, GAD, PD, SOC, OCD, and PTSD. Disorder-specific analyses were not conducted for DDNOS, bipolar I, bipolar II, bipolar NOS, AG, or SP due to the small number of effect sizes identified for these disorders.

In order to assess for potential publication bias, we calculated Rosenthal's (1979) fail-safe *N*, which provides an estimate of the number of missing or unpublished studies with null effect sizes that would be needed to bring statistically significant effects to the point of nonsignificance ($p > .05$). For any emotional disorder, any mood disorder, and any anxiety disorder groupings, we generated funnel plots, which present the standard error of included studies on the vertical axis and corresponding effect size magnitude on the horizontal axis. An asymmetrical distribution of studies about the combined effect size estimate suggests publication bias, whereas a symmetrical distribution indicates that all relevant studies were captured by the meta-analysis. We also used Duval and Tweedie's trim and fill analysis in order to estimate the number of unpublished studies that would be needed to make the funnel plot symmetrical.

The heterogeneity of effect sizes was examined using the I^2 statistic to determine whether the characteristics of individual studies moderated observed associations between NSSI and emotional disorder diagnosis. An I^2 statistic >50% suggests high variance in the effect sizes (Higgins, Thompson, Deeks, & Altman, 2003), thus indicating that moderators should be explored. For any emotional disorder, as well as any mood disorder and any anxiety disorder subgroups, we examined a number of demographic characteristics and methodological factors as potential moderators: (a) sample type (recruited from clinical versus nonclinical settings), (b) age of sample (adolescent versus adult), (c) gender (majority female versus majority male), (d) race (majority Caucasian versus majority non-Caucasian), (e) study location (USA versus international), (f) mode of emotional disorder assessment (self-report versus clinician-rated), (g) timeframe of NSSI assessment (past year versus lifetime), (h) mode of NSSI assessment (self-report versus clinician-rated interview), (i) study quality, and (j) sample rates of BPD. We used categorical models to examine moderators (a) through (h); for continuous variables (i.e., study quality ratings and BPD rates), we employed unrestricted maximum likelihood meta-regression. Finally, in addition to examining BPD as a potential moderator among studies that included a BPD diagnostic assessment, we re-ran overall effect size analyses without "heavily" BPD samples (i.e., ≥90% diagnosed with BPD) and without majority BPD samples in order to determine if the strength of our findings significantly changes when these studies are excluded.

3. Results

3.1. Description of included studies

The study selection process for this meta-analytic review is presented in Fig. 1. Our initial searches yielded a total of 5659 unique publications. Based on examining titles and abstracts, 237 articles were identified as eligible for further review, of which 56 met inclusion criteria for the meta-analysis. When two publications employed the same sample, we chose the study that was either a peer reviewed journal article (versus a dissertation) or reported more useable effect sizes. The majority of studies meeting our inclusion criteria were peer reviewed journal articles ($k = 50$), and the remaining studies were dissertations ($k = 6$). Included studies yielded a total of 59 samples, as three publications reported data from two distinct samples (i.e., Esposito-Smythers et al., 2010; Nada-Raja & Skegg, 2011; Victor & Klonsky, 2013). Among these 59 samples, 43 were predominantly or exclusively female, and 11 were predominantly or exclusively male; 5 studies did not report the gender breakdown for participants included in the present analyses. With regard to age of included participants, 35 samples were exclusively adult, 16 exclusively adolescent, and 1

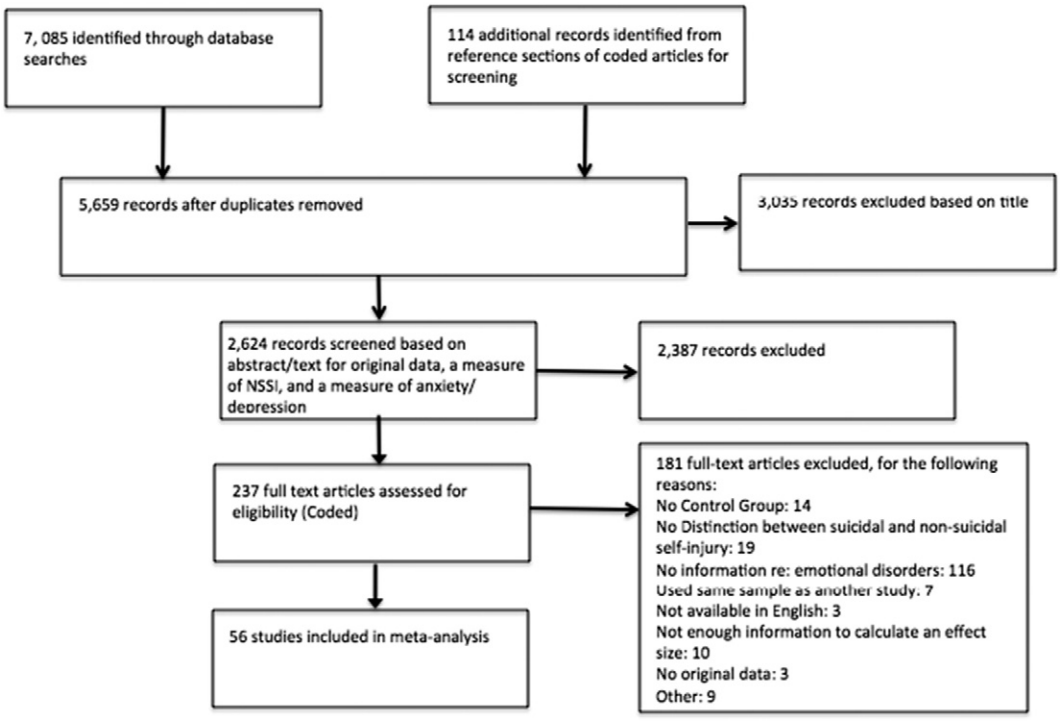

Fig. 1. Flow diagram of the literature search process.

exclusively child, whereas 7 samples included some combination of adult, adolescent, and/or child participants.

The majority of studies were conducted in North America ($k = 42$). Studies recruited from international locations included Finland ($k = 3$), New Zealand ($k = 3$), Turkey ($k = 2$), Germany ($k = 1$), Norway ($k = 1$), Netherlands ($k = 1$), Poland ($k = 1$), Japan ($k = 1$), Switzerland ($k = 1$), Belgium ($k = 1$), and Upper Bavaria ($k = 1$); one study recruited participants from both Switzerland and Germany (In-Albon et al., 2013). Included studies were also conducted across a range of nonclinical and clinical settings. With regard to nonclinical settings, 13 studies utilized entirely community-based participants, 4 used incarcerated (e.g., jail, community corrections) individuals, and 7 were conducted in school settings (e.g., high school, college, graduate school); one study used a combination of community-based and undergraduate participants (Selby, Franklin, Carson-Wong, & Rizvi, 2013). With regard to clinical settings, 21 studies were conducted in inpatient settings and 10 in outpatient settings. Two studies used inpatient and outpatient individuals, and finally, one study used a combination of outpatient, inpatient, *and* community-based participants (Bolognini, Plancherel, Laget, Stephan, & Halfon, 2003). The primary (i.e., most common) diagnosis of included samples spanned a range of emotional and non-emotional disorders, including MDD or another mood disorder ($k = 19$), BPD ($k = 10$), any substance use disorder ($k = 8$), any anxiety disorder ($k = 4$), bipolar disorder ($k = 3$), any psychotic disorder ($k = 3$), PTSD or adjustment disorder ($k = 2$), attention-deficit hyperactivity, disruptive, or conduct disorder ($k = 2$), any affective disorder ($k = 1$), eating disorder ($k = 1$), conduct disorder ($k = 1$), and somatoform disorder ($k = 1$). For more descriptive information regarding the included studies, see Table 1.

3.2. Quality of included studies

The quality of studies was variable and is shown in Table 2; total quality scores gleaned from the adapted Newcastle–Ottawa Scale ranged from 3 to 6. The mean quality score across included studies was 5.0 ($SD = 0.9$). Ascertainment of emotional disorder diagnoses was adequate (i.e., used a validated, clinician-rated or self-report diagnostic measure) in most studies ($k = 49$), whereas 10 studies used other methods (e.g., unstructured clinical interview, chart review, questions based on diagnostic criteria). With regard to ascertainment of engagement in NSSI, however, only about 19% of studies used a validated, clinician-rated interview specifically targeting assessment of NSSI, and approximately 36% of all included studies captured NSSI via only self-report methods. Studies conducted in clinical settings were more likely to use some form of clinician interview (validated or unvalidated) to assess NSSI engagement than those conducted in nonclinical settings, as 78% of studies in clinical settings assessed NSSI via clinician interview compared to less than half (46%) of studies in nonclinical settings. There was also considerable variation in the period of time for which NSSI was assessed (i.e., ranging from past two weeks to lifetime) and the majority of studies ($k = 34$) did not control for potentially confounding variables (e.g., BPD, prior self-injury, age).

3.3. Overall effect sizes

Pooled ORs and 95% confidence intervals for all analyses are summarized in Table 3. Individuals diagnosed with any of the emotional disorders investigated (i.e., mood disorders, anxiety disorders, PTSD, OCD) were significantly more likely to report engagement in NSSI than those without an emotional disorder (OR = 1.75, 95% CI: 1.49, 2.06). This increase in risk of NSSI was also observed for each subgroup analysis with the exception of bipolar disorder and SOC. For example, individuals with any mood disorder were significantly more likely to have engaged in NSSI than those without a mood disorder (OR = 2.09, 95% CI: 1.69, 2.59), and those with any anxiety disorder were more likely to report NSSI than those without an anxiety disorder (OR = 1.76, 95% CI: 1.45, 2.14). Of note, in order to be consistent with DSM-5 classification, PTSD or OCD were not included in our any anxiety disorder grouping. With regard to disorder-specific diagnostic variables, the largest observed association was between NSSI and PD (OR = 2.67, 95% CI: 1.74, 4.09), followed by PTSD (OR = 2.06, 95% CI: 1.39, 3.05). An examination of the confidence intervals of pooled ORs indicated that observed associations were not significantly different from one another,

Table 1
Description of included studies.

Author, year	Pub type	N[a]	Female (%)	Age (years)	Ethnicity/country	Emotional disorder(s)[b]	Primary diagnosis (%)[c]	Source of population/ sample type
Andover and Gibb, 2010	Peer Rev JA	117	61.54	$M = 39.45$ $SD = 12.84$	74.4% Caucasian	Bipolar, MDD, DDNOS, mood NOS	Bipolar (27.4%)	Inpatient
Asarnow et al., 2011	Peer Rev JA	327	69.72	$M = 15.9$ $SD = 1.6$	83.2% Caucasian	Anxiety, PTSD, DYS	Anxiety disorder (incl. PTSD; 35.9%)	Outpatient
Bolognini et al., 2003	Peer Rev JA	308	60.39	$M = 20.6$ $SD =$ n/r	Switzerland	MDD, DYS, AG, PD, SOC, PTSD, GAD, OCD	MDD (49.7%)	Outpatient, inpatient, community
Chartrand et al., 2012	Peer Rev JA	13,070	n/r	18+	n/r	AG, PD, PTSD, SOC, GAD, anxiety, mood	n/r	Community
Chen et al., 2009	Peer Rev JA	135	100	$M = 30$ $SD = 7.6$	72% Caucasian, 6.5% black, .6% Mexican-American/ Mexican/Chicano, 1.8% Asian, .6% Hispanic/Latino, .6% native American/ Alaskan	Mood, anxiety	BPD (100%)	Outpatient
Claes, Muehlenkamp, et al., 2010	Peer Rev JA	128	75	$M = 35.62$ $SD = 13.04$	Belgium	MDD, bipolar, anxiety, GAD, AG, OCD, DYS, PTSD, DDNOS	Adjustment disorder (37.5%)	Inpatient
Cox et al., 2012	Peer Rev JA	352	n/r	$M = 17.9$ $SD = 6.7$	n/r	MDD	n/r	Offspring of mood disorder probands
Dulit et al., 1994	Peer Rev JA	124	79.03	$M = 32.8$ $SD = 9.2$	78% Caucasian, 10% black, 9% Hispanic, 3% Asian/ other	Bipolar, MDD, DYS, PD, AG, SOC, SP, OCD	BPD (100%)	Inpatient
Durret, 2006	Diss	4352	100	$M = 21.7$ $SD = 2.75$	78.8% Caucasian, 12.8% African American, .6% other	MDD, SOC, PD	Depressive disorder (20.6%)	Community
Esposito-Smythers et al., 2010 (a)	Peer Rev JA	193	35.23	$M = 9.02$ $SD = 1.47$	84% Caucasian	Anxiety	Bipolar (100%)	Community
Esposito-Smythers et al., 2010 (b)	Peer Rev JA	239	55.23	$M = 14.68$ $SD = 1.64$	79.5% Caucasian	Anxiety	Bipolar (100%)	Community
Evren, Kural, and Cakmak, 2006	Peer Rev JA	112	0	$M = 33.75$ $SD = 10.2$	Turkey	MDD, DYS, PD, AG, SOC, SP, GAD, PTSD	Substance dependence (100%)	Inpatient
Evren et al., 2011	Peer Rev JA	156	0	$M = 44.2$ $SD = 8.2$	Turkey	PTSD	Alcohol dependence (100%)	Inpatient
Fliege et al., 2009	Peer Rev JA	194	76.80	$M = 40$ $SD = 14.8$	Germany	Mood, anxiety, OCD	Mood (54%)	Inpatient
Garrison et al., 1993	Peer Rev JA	444	56.08	11–18	76% Caucasian, 23.6% black	MDD, OCD, SP	n/r	Middle and high school students
Glenn and Klonsky, 2010	Peer Rev JA	168	70.83	$M = 19.5$ $SD =$ n/r	n/r	MDD, GAD	MDD (11.9%)	Undergraduate
Glenn and Klonsky, 2011	Peer Rev JA	167	71.86	$M = 19.5$ $SD = 2$	44.3% Caucasian	MDD, GAD	Alcohol abuse (23.9%)	Undergraduate
Glenn and Klonsky, 2013	Peer Rev JA	198	74.24	$M = 15.13$ $SD = 1.38$	64% Caucasian, 14% Hispanic, 10% African American, 12% other/ mixed ethnicity	Anxiety, Mood	ADHD/disruptive behavior disorder (69.6%)	Inpatient
Goldman-Mellor et al., 2013	Peer Rev JA	86	n/r	3–38	New Zealand	MDD, anxiety	MDD (30.2%) and Substance dependence (30.2%)	Community
Gollust, Eisenberg, and Golberstein, 2008	Peer Rev JA	2843	48.01	18+	60.6% Caucasian, non-Hispanic, 6.3% African American, 3.5% Hispanic, 19.9% Asian, 5.4% multi-ethnic, 3.6% other	MDD, mood, PD, GAD, anxiety	MDD (47.1%)	Undergraduate + graduate
Guerry and Prinstein, 2010	Peer Rev JA	130	72.31	$M = 13.51$ $SD = 0.75$	75% Caucasian, 4% Latino, 3% African American, 17% mixed	SOC, PTSD, MDD	MDD (33.6%)	Inpatient
Gunter, Chibnall, Antoniak, Philibert, and Hollenbeck, 2011	Peer Rev JA	337	35.01	$M = 34$ $SD =$ n/r	75% Caucasian, 21% African American, 4% other	PD	Substance use (91%)	Community corrections
Hankin and Abela, 2011	Peer Rev JA	97	n/r	$M = 12.63$ $SD = 1.25$	49% Caucasian, 32% African American, 5% Asian, 12% Hispanic, 5% other	Mood	Depressive disorder (24%)	Community
Herpertz, Sass, and Favazza, 1997	Peer Rev JA	120	77.5	$M = 27.9$ $SD = 7.4$	n/r	Mood, anxiety	BPD (29.2%)	Inpatient
Hintikka et al., 2009	Peer	82	100	$M = 15.2$	Finland	MDD, anxiety	MDD (35.4%)	Community

(continued on next page)

Table 1 (*continued*)

Author, year	Pub type	N[a]	Female (%)	Age (years)	Ethnicity/country	Emotional disorder(s)[b]	Primary diagnosis (%)[c]	Source of population/ sample type
	Rev JA			*SD* = 1.5				
Hoyt, 2003	Diss	1941	62.13	18+	87.7% Caucasian, .5% African American, 2.1% Asian, 4.2% Hispanic, .4% Native American, 5.2% other	MDD	Eating disorder (28.8%)	Undergraduate
In-Albon et al., 2013	Peer Rev JA	70	100	*M* = 16.1 *SD* = 1.52	Switzerland/Germany	MDD, SOC, PTSD, SP, DYS, OCD, Ag, PD, GAD	MDD (64.2%)	Inpatient
Jacobson et al., 2008	Peer Rev JA	227	67.84	*M* = 15.08 *SD* = 1.72	4% Caucasian, 69% Hispanic, 20% African American, 4% other	MDD, DYS, DDNOS, PTSD, anxiety	MDD (52%)	Outpatient
Jaquier, Hellmuth, and Sullivan, 2013	Peer Rev JA	178	100	18+	n/r	PTSD	PTSD (33.5%)	Community
Kohlboeck, Quadflieg, and Fichter, 2011	Peer Rev JA	224	47.77	*M* = 33.8 *SD* = 3.4	Upper Bavaria	Mood	Anxiety disorder (14.7%)	Community
Lanes, 2009	Peer Rev JA	264	0	n/r	42.8% Caucasian, 48.9% African American, 5.3% Latino/Hispanic, 1.5% native American, 1.5% other	Mood, anxiety	Mood disorder (19.7%)	Incarcerated
Langbehn and Pfohl, 1993	Peer Rev JA	120	65	*M* = 30.2 *SD* = 12.15	n/r	MDD, DYS, bipolar	Substance abuse (27.5%)	Inpatient
Matsumoto, Azekawa, Yamaguchi, Asami, and Iseki, 2004	Peer Rev JA	65	100	*M* = 23.6 *SD* = 5.1	Japan	DYS, MDD, DDNOS, SOC, PD, GAD, OCD, PTSD, mood, anxiety	Mood disorder (41.5%)	Outpatient
McReynolds and Wasserman, 2011	Peer Rev JA	220	100	*M* = 16 *SD* = n/r	n/r	MDD, anxiety	n/r	Incarcerated
Mork et al., 2013	Peer Rev JA	251	41.83	*M* = 30.1 *SD* = 9.8	82% European Origin; Norway	MDD	Schizophrenia (100%)	Inpatient + outpatient
Nada-Raja and Skegg, 2011 (a)	Peer Rev JA	467	0	*M* = 26 *SD* = n/r	>90% New Zealand European; New Zealand	Anxiety, mood	Substance Dependence (22.9%)	Community
Nada-Raja and Skegg, 2011 (b)	Peer Rev JA	449	100	*M* = 26 *SD* = n/r	>90% New Zealand European; New Zealand	Anxiety, mood	Anxiety Disorder (27.6%)	Community
Nijman et al., 1999	Peer Rev JA	54	48.15	*M* = 37.5 *SD* = 12.4	Netherlands	Mood, bipolar	Psychotic disorder (41%)	Inpatient
Pontrelli, 1996	Diss	51	100	*M* = 30.9 *SD* = 8.2	86.2% Caucasian, 23.5% African American, 19.6% Asian, 23.5% Hispanic	MDD, bipolar	BPD (100%)	Outpatient
Power, 2012	Diss	150	100	*M* = 35.7 *SD* = 10.7	54% Caucasian, 37.3% aboriginal, 8.7% other/Canada	MDD, PD, PTSD, GAD, OCD	Substance use disorder (71.3%)	Incarcerated
Riala, Juutinen, Hakko, and Rasanen, 2011	Peer Rev JA	344	n/r	12–17	Finland	Mood, anxiety	Conduct disorder (50%)	Inpatient
Russ, Campbell, Kakuma, Harrison, and Zanine, 1999	Peer Rev JA	56	100	*M* = 29.9 *SD* = 8	75% Caucasian	Anxiety, OCD	Affective (73.6%)	Inpatient
Selby et al., 2012	Peer Rev JA	547	52.10	*M* = 27.5 *SD* = 9.5	75.5% Caucasian, 9.1% Hispanic, 6.9% African American, 1.6% Native American	Mood, DYS, anxiety, bipolar	Depressive disorder (26.7%)	Outpatient
Selby et al., 2013	Peer Rev JA	47	65.96	*M* = 24.51 *SD* = 8.87	19% African American, 6% Asian, 2% native American, 9% Hispanic	PTSD, MDD	MDD (29.8%)	Undergraduate + community
Serras, Saules, Cranford, and Eisenberg, 2010	Peer Rev JA	5689	61.84	18+	69.4% Caucasian, 10.4% Asian, 4.7% African American, 5.4% Hispanic, 9.6% multiracial	MDD	n/r	Undergraduate + graduate
Stanley, Gameroff, Michalsen, and Mann, 2001	Peer Rev JA	53	79.25	*M* = 29.9 *SD* = 10	89% Caucasian	MDD	BPD (94%)	Inpatient
Stanley et al., 2010	Peer Rev JA	29	68.97	*M* = 35.5 *SD* = 9.1	79% Caucasian	MDD	BPD (89.7%)	Inpatient
Stewart, Baiden, and Theall-Honey, 2014	Peer Rev JA	2013	44.51	*M* = 17.73 *SD* = 1.05	5.9% Aboriginal; Canada	Mood, anxiety	Mood (50.1%)	Inpatient + outpatient
Tuisku et al., 2006	Peer Rev JA	141	80.90	13–19	Finland	Anxiety	MDD (100%)	Outpatient
Uth, 2013	Diss	189	71.43	12–18	84.1% Caucasian	PTSD	BPD (36%)	Inpatient
Velez, 2008	Diss	176	62.50	*M* = 32.3 *SD* = 9.7	85.2% Caucasian	MDD, DYS, bipolar, anxiety	BPD (100%)	Outpatient

Table 1 (*continued*)

Author, year	Pub type	N[a]	Female (%)	Age (years)	Ethnicity/country	Emotional disorder(s)[b]	Primary diagnosis (%)[c]	Source of population/ sample type
Victor and Klonsky, 2013 (a)	Peer Rev JA	84	71.43	$M = 23.3$ $SD = 5.1$	28.6% Caucasian, 54.8% East Asian, 6% South Asian, 6% Other/multi-racial, 2.4% Hispanic, 1.2% Middle Eastern, 1.2% African/ Canada	Mood, anxiety	Anxiety disorder (27.3%)	Undergraduate
Victor and Klonsky, 2013 (b)	Peer Rev JA	92	64.13	$M = 30.3$ $SD = 11.05$	66.3% Caucasian, 12% biracial/other, 7.6% African American, 5.4% east Asian, 4.3% Hispanic, 3.3% south Asian, 1.1% middle eastern	MDD, mood, PD, anxiety	Somatoform disorder (17.3%)	Community
Warzocha, Pawelczyk, and Gmitrowicz, 2010	Peer Rev JA	187	68.98	$M = 16.59$ $SD =$ n/r	Poland	Mood	Psychotic disorders (36.9%)	Inpatient
Weismoore and Esposito-Smythers, 2010	Peer Rev JA	185	71.35	$M = 15.07$ $SD = 1.32$	84% Caucasian, 9.2% Hispanic, 2.7% African American, 2.2% Asian, 3.2% Native American, 7.6% other	MDD, GAD, DYS, DDNOS, bipolar, PD, SOC, PTSD, anxiety	MDD (64.9%)	Inpatient
Whipple and Fowler, 2011	Peer Rev JA	133	100	$M = 30.2$ $SD = 9.6$	96% Caucasian, 2.3% Asian, 1.5% African American	MDD, PTSD	BPD (100%)	Inpatient
Wilkinson et al., 2011	Peer Rev JA	163	70.55	$M = 14.3$ $SD = 1.2$	n/r	Anxiety	MDD (100%)	Outpatient
Wolff et al., 2014	Peer Rev JA	186	72.04	$M = 15.03$ $SD = 1.31$	84.4% Caucasian, 2.7% African American, 2.2% Asian, 3.2% Native American, 5% other	MDD, DYS, bipolar, GAD, SOC, PTSD	MDD (65.1%)	Inpatient
Zanarini, Laudate, Frankenburg, Reich, and Fitzmaurice, 2011	Peer Rev JA	290	80.34	$M = 26.9$ $SD = 5.8$	87.2% Caucasian	MDD	BPD (100%)	Outpatient

AG = agoraphobia; Anxiety = any grouping of anxiety disorders as defined in study; BPD = borderline personality disorder; DDNOS = depressive disorder not otherwise specified; Diss = dissertation; DYS = dysthymic disorder; GAD = generalized anxiety disorder; MDD = major depressive disorder; Mood = any grouping of mood disorders as defined in study; NOS = not otherwise specified; n/r = not reported; OCD = obsessive–compulsive disorder; PD = panic disorder; Peer Rev JA = peer reviewed journal article; PTSD = post-traumatic stress disorder; SOC = social anxiety disorder; SP = specific phobia.

[a] *N* listed reflects the number of individuals (self-injuring and non-self-injuring) used for the present analyses (i.e., may not reflect the total *N* used in study).

[b] Emotional disorder(s) examined in study.

[c] Primary diagnosis refers to the most common diagnosis in the sample used for the present analyses.

suggesting that the risk of engaging in NSSI did not differ across distinct emotional disorders.

With regard to publication bias, the fail-safe *N* values for most diagnostic variables were above the threshold for missing studies (see Table 3 for details), suggesting robust results that are unlikely to be due to unpublished data. For bipolar disorder, DYS, SOC, and OCD, however, the fail-safe *N* values indicate that publication bias may have been present for these disorder-specific analyses. We also generated funnel plots for broad emotional disorder groupings. The funnel plot of effect sizes for any emotional disorder and NSSI engagement appeared symmetrical (see Fig. 2), and Duval and Tweedie's trim and fill analysis showed that only one study below the mean effect size was missing. Similarly, funnel plots for any mood disorder and any anxiety disorder groupings also appeared symmetrical; Duval and Tweedie's trim and fill test provided no evidence of missing studies below the mean for either analysis. These results further suggest that publication bias did not significantly impact our overall meta-analytic findings.

3.4. Moderator analyses

Heterogeneity analyses indicated significant variance in almost all of the pooled outcomes ($I^2 > 50\%$), which suggests that potential moderators of observed associations between emotional disorders and NSSI should be examined. Moderator analyses were conducted for any emotional disorder, any mood disorder, and any anxiety disorder subgroups. With regard to sample type, a dichotomous variable was created to reflect clinical versus nonclinical status; samples recruited from outpatient and inpatient settings were designated clinical ($k = 33$), whereas samples recruited from the community, school settings, and correctional facilities were designated nonclinical ($k = 25$). The one study utilizing a combination of clinical and nonclinical participants (Bolognini et al., 2003) could not be discretely classified, so was removed from this analysis. Results showed that sample type (clinical versus nonclinical) moderated the association between any emotional disorder, as well as both mood and anxiety disorder subgroups, and engagement in NSSI. The association between any emotional disorder diagnosis and NSSI was significantly larger in nonclinical samples (OR = 2.61, 95% CI: 2.01, 3.38) than clinical samples (OR = 1.21, 95% CI: 0.95, 1.55); this finding was also observed for any mood disorder and NSSI (nonclinical: OR = 3.26, 95% CI: 2.31, 4.59; clinical: OR = 1.38, 95% CI: 1.01, 1.90), as well as any anxiety disorder and NSSI (nonclinical OR = 2.45, 95% CI: 1.96, 3.08; clinical OR = 1.25, 95% CI: 1.00, 1.55).

We also found that study location moderated the observed effect sizes between any emotional disorder and NSSI, with studies conducted in the USA reporting significantly stronger associations (OR = 2.03, 95% CI: 1.65, 2.49) than those conducted internationally (OR = 1.28, 95% CI: 0.94, 1.74); in fact, the association between any emotional disorder and NSSI did not reach the level of statistical significance among international studies ($p = .12$). This moderation effect was not observed, however, for mood or anxiety disorder subgroups. Mode of emotional disorder assessment also moderated the association between any anxiety disorder and NSSI engagement, with studies using self-report methods to assess anxiety diagnoses reporting significantly higher

Table 2
Quality of included studies.

Author, year	Study design[a]	Ascertainment of NSSI	Period of time NSSI[b]	Ascertainment of emotional disorder	Period of time disorder	Adjustment[c]	Total quality score[d]
Andover and Gibb, 2010	Cross-sectional	Suicidal Behaviors Questionnaire	Lifetime	Chart review	Current	Yes (BPD symptoms)	4
Asarnow et al., 2011	Cross-sectional	KSADS	Lifetime	KSADS	Lifetime	No	6
Bolognini et al., 2003	Cross-sectional	MINI	Lifetime	MINI	Current	No	6
Chartrand et al., 2012	Cross-sectional	Unvalidated questions	Lifetime	WMH-CIDI	Lifetime	Yes (mood/anxiety disorder symptoms)	6
Chen et al., 2009	Cross-sectional	SASII	Past year (2+ acts)	SCID	Current	Yes (BPD diagnosis, age, type of Axis I disorder, current eating disorder)	6
Claes, Muehlenkamp, et al., 2010	Cross-sectional	Self-Injury Questionnaire (SIQ-TR)	Lifetime	Chart review	Lifetime	Yes (bipolar diagnosis)	5
Cox et al., 2012	Longitudinal	Self-injury behavior scale	Lifetime	SCID/KSADS	Current	No	3
Dulit et al., 1994	Cross-sectional	Unvalidated questions	Lifetime	SCID	Current	Yes (age and sex)	6
Durret, 2006	Longitudinal	Suicidal thoughts & behaviors interview	5 year follow-up	Semi-structured interview for assessment of genetics of alcoholism	Lifetime	No	6
Esposito-Smythers et al., 2010 (a)	Cross-sectional	KSADS	Lifetime	KSADS	n/r	No	5
Esposito-Smythers et al., 2010 (b)	Cross-sectional	KSADS	Lifetime	KSADS	n/r	No	5
Evren et al., 2006	Cross-sectional	Unvalidated questions	Lifetime	SCID	Current	No	6
Evren et al., 2011	Cross-sectional	Self-mutilative Behaviors Questionnaire	Lifetime	CAPS	Lifetime	No	6
Fliege et al., 2009	Cross-sectional	Rating scale for the assessment of self-destructive behavior	Lifetime	CIDI	Current	No	5
Garrison et al., 1993	Cross-sectional	KSADS	Past year	KSADS	Past year	Yes (gender and race)	6
Glenn and Klonsky, 2010	Cross-sectional	ISAS + brief structured interview	Lifetime	PHQ	Current	No	5
Glenn and Klonsky, 2011	Cross-sectional	ISAS + brief structured interview	Lifetime	PHQ	Current	No	5
Glenn and Klonsky, 2013	Cross-sectional	ISAS	Met DSM-5 criteria for NSSI disorder (5+ days in past year)	MINI-KID	Current	Yes (BPD diagnosis)	4
Gollust et al., 2008	Cross-sectional	One question developed for study	Past 4 weeks	PHQ	Current	Yes (age, sex, race and ethnicity, international student status, sexual orientation, year in school, graduate student status, family's past financial status, relationship status, positive screens for depression and anxiety, positive screens for eating disorders)	4
Goldman-Mellor et al., 2013	Longitudinal	Diagnostic Interview Schedule	Lifetime	Diagnostic Interview Schedule	Ages 26–38	Yes (history of suicide attempts, anxiety disorder, conduct disorder, sex)	6
Guerry and Prinstein, 2010	Cross-sectional	Suicide Ideation Questionnaire	Past year	DISC-adolescent	Current	No	4
Gunter et al., 2011	Cross-sectional	Hare Psychopathology Checklist	Lifetime	SSAGA-II	Current	No	5
Hankin and Abela, 2011	Longitudinal	FASM	2.5 year follow-up	KSADS	Past 2.5 years	No	5
Herpertz et al., 1997	Cross-sectional	SCID	At least 3 lifetime acts	SCID	Current	No	5
Hintikka et al., 2009	Cross-sectional	Unvalidated questions	Lifetime	SCID	Current	Yes (age and gender)	6
Hoyt, 2003	Cross-sectional	Impulsive behavior scale	Lifetime	10 questions based on DSM-IV criteria	Current	No	5
In-Albon et al., 2013	Cross-sectional	DSM-5 criteria for NSSI disorder	Past year	Kinder-DIPS	Lifetime	No	5
Jacobson et al., 2008	Cross-sectional	Lifetime Parasuicide Count (LPC)	Lifetime	KSADS	Current	No	6
Jaquier et al., 2013	Cross-sectional	DSHI	In current relationship	PDS	Current	Yes (SES)	4
Kohlboeck et al., 2011	Longitudinal	Structured Mannheimer Interview	n/r	CIDI	Past year	Yes (age and gender)	6
Lanes, 2009	Cross-sectional	Chart review	2+ acts within 12 month period during prison term	Chart review	Lifetime	No	3
Langbehn and Pfohl, 1993	Cross-sectional	Chart review	Lifetime	Chart review	Lifetime	No	4
Matsumoto et al.,	Cross-sectional	Unstructured clinical	More than 10 lifetime	Unstructured	Current	Yes (age)	4

Table 2 (*continued*)

Author, year	Study design[a]	Ascertainment of NSSI	Period of time NSSI[b]	Ascertainment of emotional disorder	Period of time disorder	Adjustment[c]	Total quality score[d]
2004		interview	acts	interview			
McReynolds and Wasserman, 2011	Cross-sectional	VISA	Lifetime	V-DISC	Current	No	4
Mork et al., 2013	Cross-sectional	Unvalidated clinical interview	Lifetime	SCID	Lifetime	No	6
Nada-Raja and Skegg, 2011 (a)	Longitudinal	Unvalidated questions	Past year	Modified version of DIS	Past year (at age 21)	No	4
Nada-Raja and Skegg, 2011 (b)	Longitudinal	Unvalidated questions	Past year	Modified version of DIS	Past year (at age 21)	No	4
Nijman et al., 1999	Cross-sectional	Unvalidated clinical interview	Lifetime	Unstructured interview	n/r	No	4
Pontrelli, 1996	Cross-sectional	Self-injury behaviors interview	Past 3 months	SCID	Current	Yes (BPD diagnosis)	6
Power, 2012	Cross-sectional	Offendor SIB inventory + semi-structured interview	Lifetime	SCID	Current	No	6
Riala et al., 2011	Cross-sectional	KSADS	Past year (4+ times)	KSADS	Current	No	5
Russ et al., 1999	Cross-sectional	Clinical interview	Past 6 months (5+ episodes ever; most recent past six months)	SCID	Current	Yes (age)	5
Selby et al., 2012	Cross-sectional	Chart review	Met DSM-5 criteria for NSSI disorder (5+ acts in past year)	MINI	Lifetime	No	4
Selby et al., 2013	Longitudinal	Unvalidated questions on PDA	2 weeks of monitoring	MINI	Current	No	3
Serras et al., 2010	Cross-sectional	Unvalidated question	Past year	PHQ-9	Current	No	3
Stanley et al., 2001	Cross-sectional	Schedule for Interviewing Borderlines	Lifetime	SCID	Current	Yes (history of suicide attempts)	6
Stanley et al., 2010	Cross-sectional	Schedule for Interviewing Borderlines	Lifetime 2+ acts	Clinical interview	Current	Yes (history of suicide attempts)	6
Stewart et al., 2014	Cross-sectional	RAI-MH	Past year	RAI-MH	Current	Yes (age, gender, sexual abuse, Rx misuse, alcohol, adjustment disorders, personality disorders, depressive symptom severity, # psychiatric admissions)[e]	6
Tuisku et al., 2006	Cross-sectional	KSADS	Lifetime	KSADS	Current	Yes (depressive symptoms)	5
Uth, 2013	Cross-sectional	KSADS	Lifetime	KSADS	Current	No	6
Velez, 2008	Cross-sectional	Self-Injury Inventory	Past 3 months	SCID	Lifetime	Yes (BPD diagnosis)	5
Victor and Klonsky, 2013 (a)	Cross-sectional	ISAS	Past six months	SCID	Current	Yes (history of suicide attempts)	5
Victor and Klonsky, 2013 (b)	Cross-sectional	ISAS	Past six months	PHQ	Current	Yes (history of suicide attempts)	4
Warzocha et al., 2010	Cross-sectional	Deliberate self-harm evaluation questionnaire	Lifetime	Diagnosed with ICD-10 criteria	Current	No	5
Weismoore and Esposito-Smythers, 2010	Cross-sectional	KSADS	Past year	KSADS	Current	No	6
Whipple and Fowler, 2011	Cross-sectional	Review of nursing records + lethality of suicide attempt rating scale	2 acts within 6 weeks following test administration	DSM-IV criteria	Current	Yes (BPD diagnosis)	4
Wilkinson et al., 2011	Longitudinal	KSADS	28 week follow-up	KSADS	Current	Yes (MDD)	5
Wolff et al., 2014	Cross-sectional	KSADS	Past year	KSADS	n/r	No	5
Zanarini et al., 2011	Longitudinal	DIPD-R	10 year follow-up	SCID	Lifetime	Yes (BPD diagnosis)	5

BPD = Borderline Personality Disorder; CAPS = Clinician-administered PTSD scale; CIDI = Composite Internet Diagnostic Interview; DIPD-R = Diagnostic Interview for DSM-III-R Personality Disorders; DIS = Diagnostic Interview Schedule; DSHI = Deliberate Self-Harm Inventory; FASM = Functional Assessment of Self-Mutilation; ISAS = Inventory of Statements about Self-Injury; KSADS = Kiddie-Schedule for Affective Disorders and Schizophrenia; MDD = Major Depressive Disorder; MINI = Mini International Neuropsyhiatric Interview; SASII = Suicide Attempt Self-Injury Interview; SCID = Structured Clinical Interview for DSM Disorders; SIDP = Structured Interview for DSM-IV Personality-Borderline Personality Disorder Module; SSAGA-II = Semi-Structured Interview for the Assessment of the Genetics of Alcoholism (Revised); V-DISC = Voiced Diagnostic Interview Schedule for Children; VISA = Voiced Index of Self-Injurious Actions; WMH-CIDI = World Mental Health Composite International Diagnostic Interview.

[a] Study design refers to the study design from which data was extracted, not the overall design of the study (i.e., if only the cross-sectional data from a longitudinal study was used, the study is listed as "cross-sectional").

[b] Period of time NSSI refers to the period of time for which the researchers assessed NSSI history.

[c] Adjustment refers to statistically controlling for potential confounding variables with engagement in NSSI.

[d] Quality scores were obtained by summing scores on an adapted Newcastle–Ottowa Quality Assessment Scale.

[e] Adjustments were made only for the mood disorder effect size (not anxiety).

Table 3
Pooled odds ratios and Rosenthal's fail-safe *N* for diagnostic variables.

	# of included effect sizes[a]	Pooled OR	95% CI	*p* value	I^2 (50%)	Tolerance for # of missing studies[b]	# of missing studies for $p > .05$
Any emotional disorder	59	1.75	1.49–2.06	<.001	80.9	305	3533
Any mood disorder	50	2.09	1.69–2.59	<.001	90.2	260	4615
Any depressive disorder	35	1.86	1.47–2.36	<.001	90.1	185	2542
MDD	33	1.90	1.48–2.45	<.001	91.4	175	2568
DYS	13	1.60	1.15–2.22	.006	54.7	75	42
Any bipolar disorder	10	1.05	0.62–1.77	.849	54.6	60	0
Any anxiety disorder	40	1.76	1.45–2.14	<.001	66.61	210	849
GAD	12	1.94	1.40–2.69	<.001	55.2	70	82
PD	12	2.67	1.74–4.09	<.001	70.1	65	187
SOC	10	1.44	0.95–2.20	.086	78.3	60	42
OCD[c]	9	1.94	1.05–3.60	.036	38.9	55	7
PTSD[c]	17	2.06	1.39–3.05	<.001	71.4	95	178

Any anxiety disorder = GAD, PD, SOC, agoraphobia, specific phobia, or any grouping of anxiety disorders as defined in the study; any bipolar disorder = bipolar I, bipolar II, bipolar disorder NOS, or any grouping of bipolar disorders as defined in the study; any depressive disorder = MDD, DYS, DDNOS, or any grouping of depressive disorders as defined in the study; any mood disorder = MDD, DYS, DDNOS, bipolar I, bipolar II, bipolar disorder NOS, or any grouping of mood disorders as defined in the study; DYS = dysthymic disorder; GAD = generalized anxiety disorder; MDD = major depressive disorder; OCD = obsessive-compulsive disorder; PD = panic disorder; PTSD = post-traumatic stress disorder; SOC = social anxiety disorder.

[a] For studies with multiple outcomes under a diagnostic subgroup, the mean of selected outcomes was used as the effect size.

[b] Rosenthal (1979) suggests setting a tolerance level for missing studies needed to nullify observed results at $5k + 10$ (k = number of included studies).

[c] Reported effect sizes for OCD and PTSD were not included in the "any anxiety disorder" subgroup to be consistent with DSM-5.

effect sizes (OR = 2.81, 95% CI: 1.73, 4.57) than those using some form of clinician interview (OR = 1.62, 95% CI: 1.33, 1.99); of note, only 5 studies included in this analysis utilized self-report methods, compared to 35 that employed clinician-rated measures. This effect was not significant for any emotional disorder or the any mood disorder subgroup.

With regard to timeframe of NSSI assessment, we created a dichotomous variable to classify studies in which NSSI was assessed within the past year ($k = 23$) and those that only captured lifetime (or otherwise before past year) prevalence ($k = 35$). Although the combined effect size for any emotional disorder and NSSI engagement was larger for studies that assessed past year NSSI (OR = 2.10, 95% CI: 1.60, 2.76) versus lifetime NSSI (OR = 1.55, 95% CI: 1.24, 1.93), this difference was not statistically significant ($p = .09$). Similarly, NSSI assessment timeframe did not significantly moderate associations for mood or anxiety disorder subgroups. There was no evidence that age, gender, race, or mode of NSSI assessment moderated associations between emotional disorders and NSSI. Of note, however, information about gender and race was not available for all studies, and only 11 studies and 6 studies included samples that were majority male and majority non-Caucasian (respectively). Findings from both meta-regression and categorical moderation analyses also did not suggest that effect sizes varied as a function of study quality ($p = .21$).

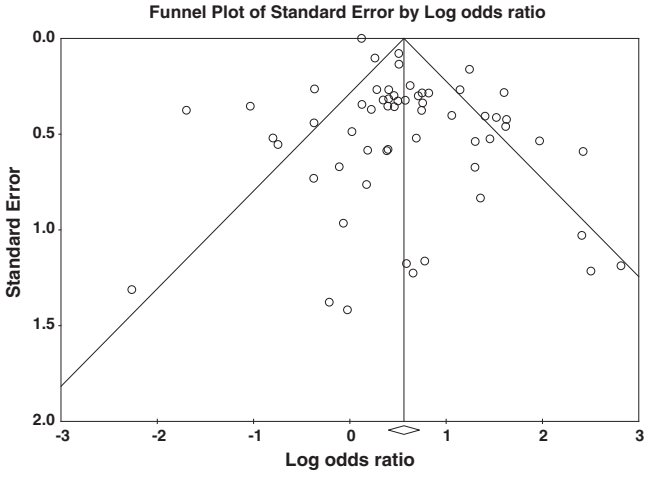

Fig. 2. Funnel plot of studies included in overall association of emotional disorders and NSSI.

Finally, we conducted several analyses to examine the potential influence of variable BPD rates on our combined effect sizes. First, we tested whether rates of BPD moderated the association between emotional disorders and NSSI engagement among the subset of articles reporting BPD diagnostic information ($k = 22$). Results from categorical models (in which studies were classified as ≤25% BPD, 25–50% BPD, 50–75% BPD, and ≥75% BPD) and meta-regression analyses for any emotional disorder, any mood disorder, and any anxiety disorder indicated that sample BPD rates did not impact observed associations. Although ORs for any emotional disorder and NSSI engagement decreased slightly as BPD rates increased, this trend did not reach the level of statistical significance ($p = .52$). Second, we removed studies with heavily (≥90%) BPD samples ($k = 7$) and re-ran overall effect size analyses for any emotional disorder, any mood, and any anxiety groups. The resultant ORs did not significantly differ from our original effect sizes, evidencing fully overlapping confidence intervals. For example, after removing heavily BPD samples, the OR for any emotional disorder and NSSI engagement was 1.81 (95% CI: 1.51, 2.15), just slightly higher than the corresponding OR for all included studies (see Table 3). We also computed overall effect sizes after removing studies with majority BPD samples ($k = 9$) and similarly, results did not significantly change; for any emotional disorder and NSSI, the resultant OR was 1.82 (95% CI: 1.53, 2.17).

4. Discussion

The present meta-analysis was designed to examine the relationship between NSSI and a range of emotional disorders (i.e., psychopathology characterized by frequent and intense negative emotions, as well as strong aversive reactions and efforts to escape or avoid such emotions; Barlow, 1991; Sauer-Zavala & Barlow, 2014). Our findings are generally consistent with the increasing literature on the transdiagnostic nature of NSSI, particularly among disorders containing strong emotional components and conceptual overlap with NSSI. Specifically, results showed that individuals with an emotional disorder (other than bipolar disorder and SOC) are more likely to report engagement in NSSI than those without such a diagnosis. The magnitude of associations did not significantly differ across emotional disorder subgroups or individual disorders. These results provide quantitative support for the transdiagnostic relevance of NSSI across the emotional disorders examined.

Although PD and PTSD evidenced the strongest associations with NSSI, the corresponding effect sizes were not significantly different from other disorders in this meta-analysis. Accordingly, future research may seek to determine whether these conditions are more closely related to NSSI than other emotional disorders. Compared to the less

circumscribed symptoms associated with other emotional disorders such as GAD (e.g., pervasive worry about multiple domains) or dysthymia (e.g., persistent, stable depressed mood), it is possible that the recurrent, acute panic attacks characterizing PD are more conceptually similar to the episodic nature of NSSI, which often occurs when individuals are experiencing intense negative thoughts and emotions in response to stressful events (e.g., Nock, Prinstein, & Sterba, 2009). It has also has been suggested that NSSI can play an important role in coping with trauma-related symptoms (e.g., Connors, 1996; Smith, Kouros, & Meuret, 2013), as individuals with PTSD may use NSSI as a means of escape or distraction from intrusive memories, or for feeling generation during episodes of numbing or dissociation (e.g., Smith et al., 2013). However, whether NSSI engagement and efforts to avoid or dampen the experience of panic- and/or trauma-related symptoms specifically share more functional overlap than coping strategies used to manage symptoms associated with other emotional disorders remains unknown.

Of note, the associations between NSSI and both bipolar disorder and SOC did not reach the level of statistical significance. However, the confidence intervals for these disorders overlapped with those for all other emotional disorders examined, suggesting that findings may have been obscured by the relatively small number of included studies ($k = 10$) that reported rates of these particular emotional disorders among self-injuring and non-self-injuring individuals. In fact, other than OCD, bipolar and SOC represented the disorders with the fewest effect sizes available for inclusion in our meta-analytic analyses. Clarifying the nature of the relationship between these two emotional disorders and NSSI represents an important avenue for future studies examining the diagnostic context of NSSI.

It is important to acknowledge that although the majority of emotional disorders evidenced statistically significant associations with NSSI, this does not necessarily imply clinical utility. For example, the highest OR produced in our meta-analysis was 2.09 for any mood disorder, indicating that individuals with a mood disorder have over twice the odds of engaging in NSSI compared to those without this diagnosis; however, one must take into account the relatively low base rate of NSSI when interpreting these findings. Recent epidemiological data suggest that the odds of any American adult engaging in NSSI in a given year are .009, based on an observed 12-month prevalence rate of 0.9% (Klonsky, 2011). Even when these odds are multiplied by 2.09 for individuals with a mood disorder (as our meta-analysis would suggest), the resultant odds would indicate that an individual with a mood disorder still has only a 1.9% chance of engaging in NSSI over a year-long period. As such, the practical implications for researchers and clinicians seeking to identify individuals at risk of NSSI based on the presence of an emotional disorder are limited. Despite this, the effect sizes generated in this meta-analysis are largely comparable to those reported for other widely studied correlates and risk factors of NSSI, including sex, age, emotion dysregulation, and impulsivity (Andrews, Martin, Hasking, & Page, 2013; Franklin, Puzia, Lee, & Prinstein, 2014; Glenn & Klonsky, 2011; Janis & Nock, 2009; Tatnell, Kelada, Hasking, & Martin, 2013; Whitlock et al., 2011; Wilcox et al., 2012). Although stronger and more consistent results have been observed for prior NSSI (Chapman, Derbidge, Cooney, Hong, & Linehan, 2009; Franklin et al., 2014; Tuisku et al., 2014), there is an urgent need for continued research aimed to determine the most clinically useful factors to identify individuals at-risk of NSSI.

As we have described, relationships between engagement in NSSI and emotional disorders were stronger in nonclinical compared to clinical samples. These results may be partially due to the fact that a number of studies classified as clinical only utilized patients with some form of prior self-injury, with or without suicidal intent. Thus, in these investigations, patients with a history of NSSI were compared to those with a history of *suicidal* self-injurious behavior in terms of emotional disorder diagnostic status. Given that emotional disorders, and particularly mood disorders, are strongly associated with suicidal behavior (e.g., Kanwar et al., 2013; Kessler, Berglund, Borges, Nock, & Wang, 2005; Nock et al., 2013), comparisons from these particular studies may have biased our results by reducing the relative strength of associations between the presence of emotional disorders and specifically *nonsuicidal* self-injurious behavior, when compared to only self-injury with suicidal intent. In summary, patients who we designated as "non-self-injuring" (i.e., no NSSI) in these studies were likely to still evidence relatively high rates of emotional disorder diagnoses, given their previous engagement in suicidal behaviors.

Another potential explanation for these findings is the fact that studies from school or community settings were more likely to use only self-report methods to assess NSSI engagement relative to those conducted in clinical settings (see Tables 1 and 2). Thus, it is possible that the number of individuals categorized as engaging in NSSI in nonclinical studies was artificially inflated due to NSSI checklists including behaviors such as hair pulling, skin picking, or nail biting (Swannell et al., 2014), whereas in clinical settings, distinguishing carefully between NSSI and more habitual, common behaviors was possible due to clinician interview. Moderator analyses showing that type of diagnostic assessment did *not* significantly influence the overall effect size for any emotional disorder and NSSI engagement, however, do not necessarily support this hypothesis. Finally, these findings may reflect low base rates of emotional disorders in nonclinical relative to clinical samples. Specifically, a majority (53%) of included studies from clinical settings reported that over half of the sample was diagnosed with an emotional disorder, compared to only 15% of studies from nonclinical settings. It is possible that in clinical settings, where mood and anxiety disorders are relatively common (e.g., Brown, Campbell, Lehman, Grisham, & Mancill, 2001; Kunik et al., 2005; Sundström, Bixo, Björn, & Åström, 2001), a more substantial proportion of individuals may seek help for anxiety and mood symptoms but have no NSSI history. In comparison, in school or community settings, where emotional disorders may be less prevalent (e.g., Alonso et al., 2004), a smaller proportion of individuals may meet anxiety or mood disorder diagnostic criteria but deny prior NSSI.

Interestingly, stronger associations were observed between any emotional disorder and NSSI in the United States as compared to other countries; however, these differences were no longer statistically significant when diagnostic variables were split into anxiety or mood disorder subgroups. As we have noted, in order to remain consistent with the diagnostic categories delineated in DSM-5, we did not include PTSD in our anxiety disorder subgroup analysis. Thus, it is possible that higher prevalence rates of PTSD in the United States (APA, 2013), combined with the relatively strong association between PTSD and NSSI observed in this investigation, are driving these findings. As previously noted, studies using self-report diagnostic measures reported stronger associations between any anxiety disorder and NSSI engagement than those using clinician-rated interviews; however, this moderation effect was not observed for any emotional disorder or any mood disorder. The very small number of studies included in the anxiety-specific analysis that employed self-report diagnostic measures ($k = 5$) and relatively large confidence interval around the corresponding overall effect size must also be taken into account when drawing conclusions from these results. Regardless, in light of the limitations associated with using self-report methods to establish anxiety diagnoses (e.g., Brown, Moras, Zinbarg, & Barlow, 1993), future research in this area should utilize clinician-rated assessment whenever possible to maximize accuracy of diagnostic impressions.

4.1. Implications for classification and treatment

Our results are consistent with increasing evidence that NSSI occurs across varied diagnostic contexts, rather than occurring specifically with one disorder or disorder subgroup (e.g., Glenn & Klonsky, 2013; In-Albon et al., 2013; Selby et al., 2012). Accordingly, the present findings provide indirect support for proposals to reclassify of NSSI as a distinct entity rather than as a symptom exclusive to BPD (APA, 2013;

Shaffer & Jacobson, 2009). Although our meta-analysis does not help identify a particular disorder category in which NSSI disorder should be placed, results may align with emerging proposals for classification systems that emphasize common dimensions relevant across a range of disorders, rather than disorder-specific criteria sets (e.g., Brown & Barlow, 2009; Maser et al., 2009; Rosellini, Boettcher, Brown, & Barlow, 2015). According to such approaches, NSSI engagement could be captured by elevated levels of dimensional indicators with functional relevance to the behavior (e.g., avoidance, depressed mood). Conceptualizing NSSI according to these cross-cutting phenotypes may not only better reflect its complex and transdiagnostic nature, but also preclude the need to confine NSSI to a narrow disorder category. As the field moves toward dimensional and functional approaches to classification (Insel et al., 2010; National Institute of Mental Health, 2011), continued research on how to best capture NSSI within emerging systems remains a priority.

Our findings may also inform NSSI treatment development research. The importance of conducting a functional analysis during treatment for many forms of psychopathology, including anxiety and depression, is well-established (e.g., Barlow, 2002; Dimidjian et al., 2006); in recent years, researchers and clinicians alike have acknowledged the value of functional approaches when addressing NSSI (e.g., Klonsky & Muehlenkamp, 2007; Nock, 2009, 2010). As we have discussed, the same fundamental processes that drive the development and maintenance of emotional disorders (i.e., maladaptive reactions to negative emotions that provide relief in the short-term but paradoxically increase their frequency and intensity in the long-term; Barlow, Sauer-Zavala, et al., 2014) also tend to reinforce engagement in NSSI (e.g., Bentley et al., 2014; Nock & Prinstein, 2004). Although the present study did not test functionality, pre-existing knowledge of these functional similarities coupled with current findings that NSSI and emotional disorders are significantly related may warrant testing of functionally driven therapeutic strategies for emotional disorders on NSSI. Indeed, interventions developed specifically for self-injury such as emotion regulation group therapy (Gratz & Gunderson, 2006) and Dialectical Behavior Therapy (Linehan, 1993) incorporate many of the same core principles (e.g., emotional acceptance, approach versus avoidance) and strategies (e.g., cognitive flexibility, mindfulness, exposure) as transdiagnostic cognitive-behavioral treatment for emotional disorders (Barlow et al., 2011). Isolating the components that effectively and efficiently target NSSI as it occurs transdiagnostically is an important direction for future research; to this end, research using single-case design methodology to test the effects of two emotion-focused, transdiagnostic treatment components (Barlow et al., 2011) on NSSI is ongoing.

4.2. Limitations and future directions

The present study had a number of methodological limitations that must be acknowledged. First, only a minority of the included studies (39%) used a diagnostic assessment of BPD. Among this subset of studies, we did not find quantitative evidence to suggest that BPD rates impacted associations between NSSI and the emotional disorders; however, given that over 60% of all studies included in this meta-analysis did not report rates of BPD, we were unable to examine BPD rates across the majority of studies. Thus, the possibility remains that variable BPD prevalence still biased our observed estimates. We also did not set out to quantify the magnitude of association between NSSI and BPD in this meta-analysis because of concerns regarding criterion contamination (e.g., "self-mutilating behavior" as a diagnostic criterion of BPD) that would inflate the strength of such an effect. As a result, we could not compare the strength of associations between NSSI and the emotional disorders examined versus BPD, the condition traditionally linked with NSSI. Given the very high comorbidity rates between BPD and the emotional disorders examined in our study (e.g., Grant et al., 2008), as well as recent conceptualizations of BPD as an emotional disorder (Sauer-Zavala & Barlow, 2014), this is a critical limitation to acknowledge. As such, the conclusions we can make from the present findings regarding the *unique* relations between NSSI and emotional disorders are tempered. For example, does an emotional disorder diagnosis contribute incremental risk of NSSI over and above that of BPD? Further, does having an emotional disorder confer a similarly meaningful vulnerability to engagement in NSSI among individuals with, as opposed to without, BPD? Especially given accumulating evidence that NSSI often presents in the absence of a BPD diagnosis (e.g., Glenn & Klonsky, 2013; In-Albon et al., 2013; Selby et al., 2012), research that can provide answers to questions such as these is important to continue pursuing.

Second, due to our focus on the core, functional similarities underlying NSSI and the emotional disorders, as well as practical considerations regarding the scope of a single meta-analysis, we did not attend to the relation between NSSI and "non-emotional" disorders. We also did not investigate other conditions with strong emotional components that can be considered emotional disorders following functional analysis (e.g., somatic symptom disorders, eating disorders). This rendered us unable to compare the overall effect size estimates between NSSI and the emotional disorders examined to those with other disorder groupings. Given a large body of evidence suggesting that NSSI and other psychiatric disorders often co-occur, particularly eating disorders (e.g., Claes, Klonsky, et al., 2010; Stein, Lilenfeld, Wildman, & Marcus, 2004), psychotic disorders (e.g., Mork et al., 2012, 2013), and substance-related disorders (e.g., Evren, Dalbudak, Evren, Cetin, & Durkaya, 2011; Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008), studies that seek to identify the relative risk of engagement in NSSI across heterogeneous categories of psychopathology is warranted. This line of work would also be the most consistent with conceptualizations of NSSI as transdiagnostic (e.g., Bentley et al., 2014; Selby et al., 2012). Although this review serves as a reasonable starting point, expanding future research on NSSI to encompass the full range of clinical (and nonclinical) presentations is likely the best approach toward improving our current knowledge base, especially with regard to mechanisms underlying this complex, multifactorial phenomenon.

Third, confidence in our estimated magnitude of associations may be limited by the unstandardized (and often unvalidated) methodology used to assess NSSI across included studies (see Table 2). It is important to note that our moderation analyses did *not* suggest that mode of NSSI assessment (i.e., self-report versus clinician-rated) accounted for significant variance in overall effect sizes across studies. Given findings from a recent meta-analysis indicating that estimates of NSSI prevalence vary as a function of measurement tool (Swannell et al., 2014), however, it is still recommended that NSSI researchers employ standardized, reliable assessment procedures to glean more accurate epidemiological data and aggregate findings across the literature. In a similar vein, we chose to include studies that utilized validated, diagnostic self-report inventories (e.g., PHQ) to establish emotional disorder diagnoses and/or did not explicitly report reliability of diagnostic tools (e.g., studies using chart review). Limiting our inclusion criteria to only those studies employing validated, clinician-rated interviews with high reliability may have strengthened confidence in diagnostic data; however, we made this decision to maximize the number of included studies and thereby result in more stable overall effect sizes. As previously noted, type of diagnostic measure accounted for significant variance in observed associations between anxiety disorders and NSSI engagement; these findings suggest that variation in diagnostic assessment across studies may be especially important to consider when interpreting our anxiety-specific analyses.

Fourth, the lack of differentiation between emotional disorders subgroups in many included studies contributed to the small numbers of effect sizes in certain disorder categories (e.g., OCD) and rendered us unable to conduct some disorder-specific analyses (e.g., SP, AG). In a related vein, although we separated OCD and PTSD from the anxiety disorders grouping in our analyses to be more consistent with DSM-5 classification, it is likely that studies conducted prior to DSM-5 included

OCD and/or PTSD in any reported estimates for "anxiety disorders" (e.g., Chartrand, Sareen, Toews, & Bolton, 2012; Chen et al., 2009; Fliege, Lee, Grimm, Fydrich, & Klapp, 2009). Thus, our pooled estimate for "any anxiety disorder" may in fact capture effect sizes reported by some studies in which these two conditions were considered anxiety disorders.

The varying assessment timeframe for NSSI is another factor to consider in this meta-analysis; for example, individuals who engaged in NSSI five years ago may have been categorized as self-injuring in studies assessing lifetime NSSI, whereas studies assessing past year NSSI may have classified such individuals as non-self-injuring. However, our moderation analyses did not indicate that overall estimates were influenced by inconsistent categorization of individuals across included studies. In a related vein, however, given that very few studies reported the *frequency* of lifetime engagement in NSSI among individuals with and without emotional disorders, we were unable to take into account the number of NSSI episodes when examining the relationship between NSSI and emotional disorders. Given the importance of considering frequency and severity when characterizing NSSI (e.g., Whitlock, Muehlenkamp, & Eckenrode, 2008), the strength of the present findings, which relied on a dichotomous classification of NSSI, are somewhat limited.

We also excluded studies that used the "index episode" approach and did not clearly state whether the participants classified as recently engaging in *suicidal* self-injury had used NSSI in the past (e.g., Ougrin et al., 2012); although this helped standardize group selection across included studies, we may have left out articles that could have changed our meta-analytic calculations to some degree. Finally, our analyses relied primarily on cross-sectional studies, which prevented us from determining whether NSSI functions as a predictor, correlate, or consequence of having an emotional disorder; future research must utilize longitudinal designs to examine how engagement in NSSI and emotional disorder symptomatology interact over time.

5. Conclusions

Despite these limitations, this meta-analytic review had numerous strengths, such as a comprehensive, systematic literature search, a strict definition of NSSI, safeguards to protect against bias (e.g., requiring inter-reviewer agreement), and attention to quality of included studies. Overall, our findings contribute incremental quantitative support to existing theoretical literature suggesting that NSSI is a transdiagnostic phenomenon, and specifically, that it occurs across a range of emotional disorders. It will be important for future research initiatives to continue advancing our understanding of the relationship between NSSI and the full range of diagnostic categories, as well as other potential predictors, in order to refine the classification, assessment, prevention, and treatment of this pervasive behavior.

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Contributors

Ms. Bentley designed the study. Ms. Bentley, Ms. Cassiello-Robbins, and Ms. Vittorio conducted the literature search and coded relevant studies. All authors assisted in drafting and have approved the manuscript.

Conflict of interest

The authors have no conflicts of interest to disclose for the present manuscript.

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