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Self-criticism As a Transdiagnostic Process in Nonsuicidal Self-injury and Disordered Eating: Systematic Review and Meta-Analysis

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Abstract

Overview—Nonsuicidal self-injury (NSSI) and disordered eating (DE) are highly comorbid and may be regarded as belonging to spectrum of self-harm behaviors. We investigated self-criticism as a transdiagnostic correlate of these behaviors, in keeping with etiological theories of both NSSI and DE.

Methods—We reviewed the literature and meta-analyzed the relation of self-criticism to both NSSI (15 studies; 17 effect sizes) and DE (24 studies; 29 effect sizes).

Results—Results showed equivalent, moderate-to-large effects for the relation of self-criticism to NSSI ($r = .38$; CI: .29 – .46) and DE ($r = .40$; CI: .34–.45). The relation of NSSI to self-criticism generalized across multiple potential moderators. DE behavior type moderated the relation of self-criticism to DE, with a stronger relation emerging for purging than restriction.

Conclusions—Findings support self-criticism as a possible candidate for transdiagnostic pathways to self-harm.

Keywords

meta-analysis; self-harm; disordered eating; self-criticism

The term “self-harm” evokes images of direct actions against one’s own body, potentially rendering visible injury. At first glance, behaviors such as overeating, food restriction, or purging seem distinct from directly harmful acts such as cutting, burning, or attempts against one’s life; however, researchers have noted conceptual similarities between indirect behaviors (including disordered eating) and direct acts of self-harm (e.g., Firestone & Seiden, 1990; Nock, 2010; Skegg, 2005). Hooley and St. Germain (2012) observed that certain indirect behaviors may exact extensive physical damage through their sequelae and argued that we should consider these to be indirect forms of self-harm when certain criteria are met.¹ Empirical evidence indicates that self-harm and disordered eating frequently cluster together (e.g., Cucchi, et al., 2016; Svirko & Hawton, 2007). When pathological

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¹These included when the behavior is repeated, clinically significant, causing “serious concern” to the individual or others, and can lead to physical damage over time.

behaviors co-occur, identifying common underlying processes can be invaluable to prevention and intervention efforts. This paper examines self-criticism as one such process underlying both nonsuicidal self-injury (a prototypical form of direct self-harm behavior) and disordered eating (a prototypical indirect self-harm behavior).

Nonsuicidal self-injury (NSSI) is defined as direct destruction of body tissue without intent to die and is distinct from socially sanctioned behaviors such as tattooing or piercing (Nock, 2009). A recent meta-analysis estimated NSSI lifetime prevalence among adolescents as 17.2 percent and among young adults as 13.4 percent (Swannell et al., 2014). Among college students, the prevalence may be slightly higher (Swannell et al., 2014; Whitlock, Eckenrode, & Silverman, 2006). Disordered eating (DE) is also widespread in this population. Approximately 13 percent of college students reported fasting, using laxatives, purging, or another unhealthy type of weight control method on a weekly basis (White et al., 2011). Anorexia nervosa and bulimia nervosa both have one-year incidence of 1% in college student populations (American College Health Association, 2014).

Researchers have begun to study NSSI and DE conjointly, in part because they are both forms of self-harm focused on the body and because these two behaviors often co-occur (Claes & Muehlenkamp, 2014). In the first substantive systematic review of NSSI-DE comorbidity, Svirko and Hawton (2007) reported that 13.6 to 68.1 percent of DE patients engaged in NSSI, with higher rates occurring among those who engaged in purging. Rates of DE among individuals with NSSI ranged from 54% to 61% (Svirko & Hawton, 2007); however, as their review focused primarily on female inpatients, the results may not generalize to other populations. More recently, Cucchi et al. (2016) meta-analyzed results from 29 studies of inpatient, outpatient, and community participants. They estimated a 27.3% overall prevalence of NSSI among DE patients with significantly greater rates of NSSI among patients with bulimia nervosa compared those with anorexia nervosa.

Svirko and Hawton (2007) proposed a model that combines precursors (e.g., trauma, cultural factors, family environment) and pathological processes (e.g., self-criticism, affect dysregulation) to produce the association between NSSI and DE (p. 418). The model by Claes and Muehlenkamp (2014) invokes distal individual and social factors (e.g., perfectionism, exposure to trauma/victimization) which then operate through specific risk factors (e.g., self-criticism, emotion dysregulation, body disregard) to produce the target behaviors when an individual experiences a stressful life event. The similarities between these models offer opportunities for empirical study. In the current paper, we focus on the proximal role of self-criticism in producing NSSI and DE. We concentrate on this construct for three reasons. First, self-criticism directly degrades positive attitudes about oneself, potentially an important barrier to self-harm (Franklin & Hooley, 2015; Hooley & St. Germain, 2014). Second, theoretical conceptualization of the construct frames self-criticism and acts of self-harm as varied expressions of the same underlying construct (although the latter is obviously more severe; Horney, 1950). Finally, and perhaps most importantly, self-criticism is modifiable through available psychotherapy (e.g., Beck, 1979), thus offering opportunities for intervention.

Self-Criticism, NSSI, and DE

Both theoretical and empirical support exists for a role of self-criticism in NSSI and DE. Nock's (2010) integrated theoretical model for the etiology of NSSI offers "high aversive cognitions" (e.g., such as self-critical thoughts) as a potential vulnerability factor for NSSI (and other maladaptive behaviors). The theory highlights self-criticism and the drive for self-punishment as specific vulnerabilities. Glassman, Weierich, Hooley, Deliberto, and Nock (2007) examined child maltreatment and past-year NSSI in a sample of 86 adolescents recruited from clinical and community settings. The authors found cross-sectional evidence of self-criticism as a mediator of the relation between childhood emotional abuse and past-year NSSI; however, compelling methodological work indicates that cross-sectional methods rarely reflect longitudinal mediation processes (Cole & Maxwell, 2003; Maxwell & Cole, 2007; Maxwell, Cole, & Mitchell, 2011). More generally, however, evidence of the overall relation between self-criticism and NSSI has been replicated in other samples of adolescents using a variety of measures of both constructs (Baetens et al., 2014; Burke et al., 2014; Harkess-Murphy, MacDonald, & Ramsay, 2013; Guerreiro, Figuero, Cruz, & Sampaio, 2015; You & Lin, 2015). Other work has shown significant relations between NSSI and the related concept of low self-esteem among adolescents (Cawood & Huprich, 2011; Claes, Houben, Vandereycken, Bijttebier, & Muehlenkamp, 2010).

Among adults, evidence of a relation between NSSI and self-criticism has been accumulating across clinical and community samples (e.g., Flett, Goldstein, Hewitt, & Weckerle, 2012; Gilbert et al., 2010; Hooley, Ho, Slater, & Lockshin, 2010; Itzhaky, Shahar, Stein, & Fennig, 2015). Additionally, Hooley et al. (2010) conducted *post hoc* analyses of self-criticism in their study of pain perception and NSSI and found significantly higher levels of self-criticism among those who self-injured compared to healthy controls. Self-criticism also predicted pain endurance levels in their sample (Hooley et al., 2010). Later work examined self-criticism among participants who engaged in cutting, indirect forms of self-injury (e.g., substance abuse, disordered eating), and controls with no history of self-injury (Hooley & St. Germain, 2014; St. Germain & Hooley, 2012). People in the direct and indirect self-injury groups scored higher on self-criticism than did healthy controls. The 50 participants who directly self-injured also showed significantly higher self-criticism than the 38 who engaged in only indirect forms of self-injury. The authors cited this as evidence that direct self-injury should be considered distinctly from indirect forms of self-harm, including disordered eating. Although intriguing and important, their findings merit further investigation for two main reasons. First, the sample included only individuals who actively engage in self-cutting (thus excluding other forms of NSSI). Second, the measure used to assess disordered eating focuses predominantly on attitudes surrounding food and body image, rather than specific behaviors. Thus, further investigation is warranted to understand how self-criticism functions in NSSI compared to DE.

Theoretical conceptualizations of DE highlight the role of self-criticism and the closely related construct of clinical perfectionism in etiology and maintenance of these behaviors. Heatherton and Baumeister (1991) focused exclusively on binge eating and posited that a key function of the behavior was to divert awareness from critical views of the self. Fairburn (1997) argued that criticism related to one's body fueled the cycle of restriction, binge eating

and purging characteristic of bulimia nervosa. Fairburn, Cooper, and Shafran (2003) later argued that low self-esteem and intense perfectionism (both constructs closely related to self-criticism) to disorder severity and persistence regardless of the specific DE behavior. More recently, Munro, Randell, and Lawrie (2016) argued that “a potent set of self-critical shame-based core beliefs” form the core of anorexia nervosa (p. 11).

Quantitative investigations of the self-criticism-DE relation began in the 1970s using small samples from clinical and community settings in the United States (Lehman & Rodin, 1989). Research accelerated after 2000 and found support for the relation of these constructs in adolescents (e.g., Berghold & Lock, 2002; Boone et al, 2014; Duarte et al., 2015; Fennig et al., 2008) and adults (e.g., Bers et al., 2013; Costa et al., 2015; Duarte et al., 2015b; Feinson & Meir, 2014; Noordenbos et al., 2014, & Shanmugan, Jowett, & Meyer, 2011). In both adolescents and adults, researchers found evidence for the association of self-criticism across multiple forms of DE behavior. In one of the few studies comparing self-criticism levels across participants with different DE behaviors, Fennig et al. (2008) found significantly higher self-criticism among patients with bulimia nervosa versus anorexia nervosa. Some of the most extensive research on the topic comes from Sweden, where data from patients across 26 DE treatment facilities were available from the national registry. Mantilla et al. (2014) examined self-criticism, assessed using the Self-Hate subscale from the Structural Analysis of Social Behavior self-report instrument (Benjamin, 1996) data on 855 young adolescents (ages 13–15) treated at these DE facilities. They found significantly higher self-criticism in the clinical group compared to non-DE adolescents. Mantilla and Birgegard (2015) identified similarly elevated levels of self-criticism among 2,295 older adolescents (ages 16–18) and 4,089 young adults (ages 19–25) seen in the DE treatment network compared with healthy controls.

Goals

Three main goals motivated our literature reviews. In keeping with a major tenet of etiological models, our first goal was to examine the relation of self-criticism to NSSI and DE. Discovering associations of self-criticism to both NSSI and DE would constitute preliminary support for the hypothesis that self-criticism is a transdiagnostic process for these behaviors. Toward this goal, we summarized qualitative studies (see Appendices B and D) and meta-analyzed quantitative studies addressing these issues. Second, we compared the magnitudes of these effects. A third goal of our meta-analyses was to explore possible moderators of the relation of self-criticism to NSSI and DE. In line with work by Fox et al. (2015), we examined type of measure (continuous versus dichotomous; number of NSSI episodes versus number of methods) as moderators. We examined clinical versus community status and sample age as potential moderators, based on results reflecting possible differences by demographic (e.g., Fox et al., 2015; Swannell, Martin, Page, Hasking & John, 2014). Previous research also suggested the comorbidity of NSSI with DE may be greater for bulimia nervosa than anorexia nervosa-purging (Cucchi et al., 2016; Svirko & Hawton, 2007). If self-criticism functions as a key transdiagnostic construct linking these disparate forms of self-harm, we might expect a stronger relation of self-criticism to DE, depending on the subtype of DE. We thus tested DE behavior as a moderator of the self-criticism/DE relation.

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines served as the framework for article selection and data extraction in this review. Article identification proceeded in two phases for both the NSSI literature and the disordered eating literature. First, the lead author (RZ) conducted a database search using controlled vocabulary within PsycInfo, PubMed, and Embase. See Table 1 for search terms used for each construct and Appendix A for further information about measures of self-criticism identified through the search. The Boolean operator “OR” separated individual search terms within constructs; the operator “AND” linked separate constructs. Then, the lead author reviewed abstracts and reference lists to identify papers for full-text retrieval. In both searches (NSSI and DE), articles were screened out if they were not in English, involved populations with developmental disabilities or psychosis, or did not present empirical data. Articles were selected for inclusion in meta-analysis.

NSSI article selection

An initial database search for NSSI and self-criticism (through May 2016) produced 147 titles; 114 remained after removing duplicates. Based on the review of abstracts and reference lists, the first author selected 41 documents for full-text retrieval. The second author was consulted if there was uncertainty about whether to retain or discard a particular article. Thirteen articles were then included in the meta-analysis. Articles were screened out if they examined self-criticism in response to specific incident (i.e., as a coping mechanism as opposed to a general trait; $n = 11$), presented qualitative data or case studies ($n = 2$), included non-NSSI behaviors in the definition of self-harm or did not quantify self-harm in the sample ($n = 5$), if authors did not respond to requests for data ($n = 2$), or presented duplicate data (e.g., a dissertation and peer-reviewed publication based on the same data; $n = 3$). In the final case, the document with the most complete information was selected for inclusion. Three additional studies were screened out because either self-criticism or NSSI was not actually measured. We then updated the literature review to include relevant titles through November 2016, adding two publications to the review.

DE Article Selection

Article selection for the disordered eating component of the meta-analysis proceeded in the same fashion. The initial database search yielded 206 titles (138 after duplicate removal). Abstract and reference list review identified 69 articles for full-text retrieval. Questions about whether to retain an article were resolved through consensus. The final meta-analysis included 22 papers. Articles were screened out if they examined self-criticism as a coping strategy in response to a specific incident or if the criticism focused on the individual’s DE symptoms ($n = 12$)², presented only qualitative data or case studies ($n = 4$), did not assess any actual disordered eating behaviors (e.g., only examined body dissatisfaction; $n = 9$); presented data from duplicate samples ($n = 2$), did not assess self-criticism ($n = 6$), or if authors did not respond to requests for data ($n = 11$). As with the NSSI search, we updated

²This was to maintain our focus on a general, trait-like tendency to engage in self-criticism. We also note that in order for self-criticism to act as a transdiagnostic risk factor for DE behaviors, it cannot be a sequelae of the behaviors themselves. We did not identify any papers in which the self-criticism regarding one’s NSSI was assessed, thus the focus on DE symptoms.

the DE literature review to include relevant titles published through November 2016, resulting in an additional two publications added to the review.

Coding and analytic strategy—The first author coded each article using a scheme developed in accordance with PRISMA guidelines (see Appendices C and E). A graduate research student double-coded eight NSSI articles (47%) and eight DE (33%) articles to ensure accuracy. Interrater reliability was excellent ($K=1.0$). Additional key parameters included self-harm assessment type (dichotomous vs. continuous; method count vs. episode count), assessment period (lifetime vs. past year), sample type (clinical vs. community), age group (adolescent vs. adult), and type of DE (restriction, bingeing, or purging). Studies that strictly compared a DE group versus control were characterized based on the primary DE diagnosis (i.e., anorexia nervosa was characterized as “restriction,” bulimia nervosa as “purging,” binge eating disorder as “bingeing.”) Diagnostically-mixed samples and those which included participants diagnosed with eating disorder-not otherwise specified were coded as “all.”

Guidelines by Lipsey and Wilson (2001) suggest that only one effect size be collected from each study to preserve independence of effect sizes between studies. This generated two main coding/analytical dilemmas. The first concerned self-criticism measures that generated multiple subscales (i.e., the Inadequate Self and the Hated Self from the Forms of Self-Criticism and Reassuring Scale, Gilbert, Clarke, Hempel, Miles, & Irons, 2004). In this case, data from both subscales were coded. The primary analyses include the Hated Self subscale, based on evidence of its incremental utility over Inadequate Self in relation to self-harm (Gilbert et al., 2010). In a secondary analysis, we used both subscales, despite the consequent nonindependence. The second analytical dilemma concerned potential non-independence of disordered eating symptoms within studies. We first conducted analyses using only the most commonly reported behavior within a study (i.e., if a study reported both purging and restriction symptoms, only the behavior with the largest n was included in the meta-analysis). We then present findings that include all behaviors regardless of dependence within study.

All effect sizes for NSSI and DE were converted to correlation coefficients using Comprehensive Meta-Analysis, Version 3 (Biostat, 2006–2016).

Results

NSSI Meta-analytic Results

The NSSI literature review identified 15 studies suitable for the meta-analysis, which yielded 17 samples (i.e., independent subgroups) and a total N of 9,248 participants. Appendix C details the population characteristics, measures, and outcomes assessed in each study. As the table shows, research on NSSI and SC is still relatively nascent: all studies were published after 2000. The samples are international but heavily concentrated in Westernized, developed countries. Only one study (You & Lin, 2015) examined participants from a non-Western country, and this sample derived from a highly urbanized setting. Community samples predominated, specifically university-based ($n = 6$) and primary/secondary school-based ($n = 5$). One study (Glenn et al., 2014) drew from both community

and clinical populations. The total samples were roughly balanced between adolescents ($n = 8$), adults ($n = 8$), and adult/adolescent ($n = 1$) with ages 11–69 represented across all participants. All study subsamples were cross-sectional.

The I^2 value for the overall sample was 93.35, indicating high heterogeneity among studies. We thus adopted a random-effects model for all subsequent analyses. Based on this model, the point estimate for the relation of SC and NSSI was .38, a moderate-to-large and statistically significant effect ($z = 7.82$, $p < .001$; 95% CI: .29 – .46).² Figure 2 (Panel A) shows a forest plot depicting each individual subsample and the overall effect estimate. We then used several methods to test for publication bias with somewhat conflicting results. Figure 3 (Panel A) presents a funnel plot of the NSSI studies. Visual inspection of the plot reveals a slightly asymmetrical distribution of studies around the overall effect estimate, suggesting possible risk that a disproportionate number of smaller studies with larger effect sizes were published. Egger's test of the intercept suggested a trend toward possible publication bias ($b = 2.34$, $s.e. = 1.31$, p (one-tailed) = .05). Duval and Tweedie's Trim and Fill method suggested no change in overall effect size estimate if missing studies were imputed, however. Similarly, Orwin's fail-safe N test indicated that an additional 3,533 studies with an average correlation of .099 would be required to reduce the overall effect size estimate to .10 (reflecting a small effect), suggesting a relatively robust effect.

Possible moderators—We first tested for systematic differences in the NSSI-SC relation in clinical versus community samples. The overall sample included three studies that recruited from clinical settings; all others were conducted in schools, universities or other general community settings. The study by Glenn et al. (2014) included 79 adolescents recruited from community, outpatient, and clinical settings. Results were presented for the sample as a whole rather than by recruitment site; thus, we omitted this study for the clinical-community moderator test. The remaining clinical samples included two samples recruited from an eating disorder speciality unit at a children's hospital in Israel (Itzhaky et al., 2015) and one sample recruited from an adult inpatient psychiatric unit (diagnostically mixed, but the authors note that only 1% of their sample had an eating disorder diagnosis; Gilbert et al., 2010). A between-groups comparison of the SC-NSSI effect size revealed an effect size estimate of .47 (95% CI: .33 – .59) in the clinical samples versus .36 (95% CI: .25 – .45) in the community sample. Overlapping confidence intervals for the two groups failed to support the hypothesis that the SC-NSSI relation differs in clinical vs. community samples. We next tested age group (adults versus adolescents) as a moderator of the relation between NSSI and SC. Overlap between these confidence intervals did not support age group as a moderator of the NSSI-SC relation. None of the measurement characteristics examined (i.e., lifetime versus past-year assessment of NSSI, dichotomous versus continuous measures of behavior) significantly moderated the SC-NSSI relation.^{3,4}

³Most study subgroups represented independent samples (e.g., males vs. females), allowing us to treat study subgroup as the unit of analysis without violating independence assumptions. There were a few key exceptions. First, the study by You et al. (2015) included data from three timepoints, separated by six months. Because including data from all three waves would have violated independence assumptions for the meta-analysis, we included only data from the first wave. Burke et al. (2015) reported the correlation between self-criticism and lifetime NSSI and past-year NSSI for the same participants. We included only lifetime NSSI in the meta-analysis reported in the main text but also ran the analysis using only the past-year NSSI estimate. Finally, St. Germain and Hooley (2012) presented a comparison of self-criticism levels among those who engage in NSSI versus healthy controls and those who engage in NSSI versus an indirect form of self-injury (e.g., disordered eating, substance abuse, etc.). Since the overarching goal of the study was

DE Meta-analytic Results

The DE literature review identified 24 studies suitable for the meta-analysis, which yielded 27 independent samples and a total N of 13,700 participants. Appendix E details the population characteristics, measures, and outcomes assessed in each study. The earliest work was published in 1989 (Lehman & Rodin), and citations accelerated after 2002. All studies took place in Westernized, developed nations. Female samples overwhelmingly predominated. Thus, generalizability to non-female, non-Western populations is limited. Only six studies focused on adolescents, although these included 5,545 individuals. Thirteen of the studies focused on clinical samples. One study was longitudinal (Boone et al., 2014), examining the relation of self-critical perfectionism (and need satisfaction/frustration) to binge eating symptoms in a group of Belgian adolescents over an 18-month period.

The I^2 value for the overall sample was 92.53. As in the NSSI analyses, this value indicated high heterogeneity among studies. We thus adopted a random-effects model for all analyses. The correlation coefficient for the overall relation of DE and SC was .40, a moderate-to-large and statistically significant effect ($z = 12.14$, $p < .001$, 95% CI: .34–.45).³ Figure 4 shows a forest plot for each individual study and the overall correlation coefficient. Orwin's failsafe N test supported the robustness of this effect; an additional 6,341 studies with an average correlation of .099 would be required to reduce the overall effect size estimate to .10 (a small effect size). A funnel plot of the included studies shows a slightly asymmetrical distribution of studies around the overall point estimate (Figure 3, Panel B). Egger's test of the intercept was also significant, $\beta = 3.06$, 95% CI: 0.99 – 5.13, $t_{(27)} = 3.03$ ($p < .01$). Duval and Tweedie's trim and fill test estimated no missing studies to the left of the mean but three missing studies to the right of the mean effect size estimate. Imputing these studies slightly increased the estimate of the overall correlation to .42.

Possible moderators—We hypothesized that DE behavior type would moderate the association between self-criticism and DE, with a stronger relation evident for bingeing and purging. Results supported behavior type as a moderator of the self-criticism-DE relation ($Q = 16.87$, $df = 4$, $p < .01$). The relation was highest for self-criticism and purging ($k = 6$, $r = .51$, 95% CI: .42 – .58, $z = 9.86$, $p < .001$). Bingeing and self-criticism was next highest ($k = 5$, $r = .38$, 95% CI: .33 – .43, $z = 13.23$, $p < .001$), and restriction was lowest ($k = 9$, $r = .32$, 95% CI: .24 – .39). Mixed diagnostic groups showed an intermediary effect size ($k = 16$, $r = .44$, 95% CI: .35 – .52). Non-overlapping confidence revealed that the relation of self-criticism to purging was larger than the relation of self-criticism to restriction.⁵

to compare effect sizes for the relation of self-criticism to NSSI versus its relation to DE, we included only the NSSI-vs.-healthy control estimate in the main meta-analysis to ensure a “clean” sample.

⁴Including all subsamples from each study, i.e., disregarding potential dependence among subsamples, had little effect on the point estimate and associated confidence interval ($r = .40$, $z = 14.78$, $p < .001$, 95% CI: .35–.45).

⁵We were able to examine the correlation of self-criticism with DE behaviors only (i.e., separating responses about DE behaviors from DE-related cognitions) for participants in the Mantilla et al. (2015) study. Among this sample, which consisted of patients diagnosed with anorexia nervosa, bulimia nervosa, or eating disorder-not otherwise specified who presented for treatment at eating disorder specialty clinics across Sweden, the point estimate for the overall DE-self-criticism correlation was .25 (95% CI: .18–.31). Between-groups comparisons revealed a statistically significant difference in the relation by DE behavior ($Q = 30.76$, $p < .001$). Restriction showed the strongest relation ($r = .41$, 95% CI: .33–.48) whereas purging and bingeing showed roughly comparable point estimates ($r = .14$, 95% CI: .08–.19 vs. $r = .18$, 95% CI: .14–.21), respectively.

We also examined whether the relation between self-criticism and DE varied by sample type (clinical versus community), age group, and DE measure type (dichotomous versus continuous). The estimated correlation among clinical samples was .43 compared to .33 among the community samples; however, confidence intervals around each estimate overlapped, failing to support a significant difference between the two sample types. No moderation effects emerged for age group either. The estimated correlation among adolescents was .33 ($k = 8$, 95% CI: .22–.39) and .42 among adults ($k = 25$, 95% CI: .36 – .48). Finally, DE measure type (dichotomous vs. continuous) did not appear to moderate the relation of self-criticism to DE. The estimated correlation for studies using dichotomous measures was .39 ($k = 16$, 95% CI: .32 – .46) versus .40 for studies using continuous measures ($k = 17$, 95% CI: .32 – .47).

Comparison of NSSI and DE Results

As shown in Table 2, both NSSI and DE showed roughly equivalent relations to self-criticism. The relations of self-criticism to specific DE behaviors (i.e., purging, bingeing, and restricting) also showed overlapping confidences with its relation to NSSI.

Discussion

Our goal was to examine the relation of self-criticism to NSSI and DE, two frequently co-occurring and highly pernicious behaviors. Three key points emerged: First, correlations of self-criticism with NSSI and DE were markedly similar. Both forms of pathology showed large and significant relations to the self-criticism. Second, although pronounced heterogeneity existed among studies of NSSI and self-criticism, none of the tested moderators accounted for significant portions of that. Finally, the relation of self-criticism to DE varied significantly from one form of DE to another. We elaborate on these results and their implications below.

First, both NSSI and DE showed significant and similar associations with self-criticism. To our knowledge, only one study has examined differences in self-criticism among those who engage in direct versus indirect self-harm. St. Germain and Hooley (2012) found a small-to-medium effect for the relation of self-criticism to indirect self-harm and a medium effect for the relation of self-criticism to direct self-harm; these estimates differed significantly from each other. Based on this finding, St. Germain and Hooley called for a distinction between direct and indirect forms of self-harm. By focusing specifically on NSSI and DE, our meta-analysis extends their findings in that self-criticism appears to be equally related to NSSI and DE. One possible explanation for the divergence of our results is that their sample included only those who reported self-cutting within the past month whereas studies in the meta-analysis included those with past-year and lifetime histories of NSSI (and thus might reflect clinically less-severe participants). St. Germain and Hooley (2012) also included several forms of indirect self-harm behaviors (e.g., risky sexual behaviors, substance abuse) in addition to DEs, which may have impacted their results. An important next step will be to extend this meta-analysis to examine the association of self-criticism to other forms of direct self-harm (e.g., suicidal behavior) and indirect self-harm behaviors (e.g., substance use or risky sexual behavior).

Our results support etiological models of NSSI and DE comorbidity that emphasize the importance of self-criticism as a transdiagnostic risk factor (e.g., Claes & Muehlenkamp, 2014; Svirko & Hawton, 2007). Nolen-Hoeksema and Watkins (2011) characterized proximal transdiagnostic risk processes as “intrapersonal risk factors that (a) directly precede symptoms (relative to distal risk factors), and/or (b) directly influence symptoms” (p. 594). Although self-criticism may qualify as a stable personological factor, evidence of longitudinal, not merely correlational, association is necessary to satisfy Nolen-Hoeksema and Watkins’ (2011) definition. Only two studies have examined self-criticism and either NSSI or DE longitudinally. Longitudinal studies assessing self-criticism, NSSI, and DE would represent an important next step for the field. Such studies would enable researchers to answer several key questions. First, does self-criticism prospectively relate to both behaviors? Longitudinal work, especially using daily diary sampling or ecological momentary assessment, could allow researchers to identify participants within a specific age range and track episodes within a given time frame, rather than relying on retrospection. Second, longitudinal work could help establish whether self-criticism predicts engagement in self-harm or results from the same (or both).

Another important question concerns whether self-criticism increases risk for engaging in any self-harm *at all*, if increases in self-criticism enhance the risk of engaging in multiple forms of self-harm, and/or if increased self-criticism results in greater severity within a particular self-harm behavior. Claes and Vanderyecken (2007) identified significantly greater levels of self-criticism among eating disorder patients with histories of sexual abuse who also endorsed nonsuicidal self-injury versus those who did not engage in NSSI. Similarly, Itzhaky et al. (2015) found significant associations between NSSI and self-criticism in two samples of Israeli adolescents hospitalized for eating disorders. These findings offer preliminary support for the idea that increased self-criticism relates to risk of engaging in multiple forms of self-harm. To our knowledge, however, no studies have compared self-criticism among individuals engaging in NSSI with and without DE. St. Germain and Hooley (2012) collected data on both DE symptoms and NSSI, but the study was not designed to examine differences *within* the NSSI group. Additionally, their measure of DE symptoms focused almost exclusively on attitudes/cognitions associated with DE rather than actual behaviors. Thus, the literature has yet to establish whether self-criticism simply prompts an individual to cross the threshold for engaging in any self-harm, if it predicts how severely someone engages the behavior, and/or if it influences the number of types of self-harm behavior in which someone engages. To this end, studies examining self-criticism in relation to both NSSI and DE within the same sample (along with co-occurring NSSI and DE) will be critical.

The second major result pertained to generalizability of the relation between self-criticism and NSSI. Despite evidence of significant variability in this relation across studies, our analyses suggest that the relation of self-criticism to NSSI did not differ as a function of age (adolescents versus adults), clinical status, choice of self-criticism measure, assessment of lifetime versus past-year NSSI, and the use of dichotomous versus continuous NSSI measurement. To a degree, these findings contrast with work by Fox et al. (2015), which examined a variety of possible risk factors for NSSI (albeit, not self-criticism). They found significantly larger effect sizes in studies of adults versus adolescents, continuous versus

binary measures of NSSI, and continuous versus binary predictor variables. Several factors may account for the discrepancy with the current results. As noted, Fox et al. did not examine self-criticism, the primary focus of our study. Second, their study focused on longitudinal studies, whereas the present analysis focused almost exclusively on cross-sectional designs (due to the dearth of longitudinal studies examining NSSI and self-criticism). Third is power. Despite our large sample size, the total number of studies was relatively modest, a factor that can increase confidence intervals around moderation effect size estimates (Higgins & Green, 2011). As the field grows, it will be important to reassess how factors such as sample type, assessment timeframe, and NSSI measurement influence these effect size estimates. Future research should also assess whether self-criticism varies by type of NSSI (e.g., cutting versus burning). Most measures of NSSI sum across a variety of behaviors, precluding more fine-grained analysis. Researchers should capture and analyze data about specific NSSI behaviors to assess for differences.

Our third major finding concerned variation in the relation of self-criticism to different DE behaviors. In the main analysis, self-criticism was most highly correlated with purging (although see Footnote 4). The second strongest correlation was with a mixed diagnostic group, representing bingeing, purging, and restriction. The smallest (although still significant correlations) were with bingeing and restriction. This is intriguing in light of more recent theoretical conceptualizations of DE (e.g., Munro, Randell, and Lawrie's (2016) integrative bio-psycho-social theory of anorexia nervosa and Fairburn, Cooper, and Shafran's (2003) reformulation of their transdiagnostic theory of eating disorders.) Such conceptualizations have highlighted the role of self-criticism in anorexia nervosa and treatment-resistant DE, respectively. Gordon, Kwan, Minnich, and Carter (2014) posited that Heatherton and Baumeister's escape theory (1991) explains the relation of NSSI and bingeing DE behaviors. In their conception, these pathological behaviors offer an escape from "aversive self-awareness" (p. 61). Self-criticism could be conceptualized as both cause and consequence of aversive self-awareness. The current findings support the idea that self-criticism may be especially relevant depending on the specific behavior exhibited. However, given the contrasting findings here, additional research is necessary to ascertain whether purging or restriction is most closely associated with self-criticism.

Other studies support the unique role of purging within DE insofar as it relates to other forms of self-harm. For example, Foulon et al. (2007) identified switching from the restriction subtype of anorexia nervosa to the binge/purging subtype as a significant risk factor for later suicide attempt. Still others have emphasized the autonomic negative reinforcement function of bingeing and purging (e.g., Wedig & Nock, 2010). Collectively, these results suggest that researchers should investigate self-critical thoughts as triggers for purging in particular, as these may represent a potent clinical target. Most recently, Cucchi et al. (2016) identified significantly higher rates of lifetime NSSI among individuals diagnosed with bulimia nervosa (a diagnosis for which purging marks a defining characteristic) compared with those diagnosed with anorexia nervosa. The correspondence between Cucchi et al.'s findings and the present results is striking. We propose further examination into self-criticism as a possible mechanism driving the particular association of NSSI and purging.

Certain limitations of the present meta-analysis deserve mention. First, as in any meta-analysis, it is possible that we omitted studies or relevant data. We strove to minimize this by using three separate search engines and contacting authors for data when we were unable to extract necessary information from their publications. Nevertheless, omissions may have occurred. The myriad terms used to refer to self-criticism contribute to the problem.⁶ We have carefully defined our use of the term in our inclusion/exclusion criteria; however, relevant articles may have used alternative vocabulary to reference the same construct. Second, in our efforts to test key moderators of the SC-NSSI or SC-DE relations, we were compelled to use the same set of comparison groups in some cases (e.g., patients with bulimia nervosa and anorexia nervosa compared to the same group of healthy controls). This technically violates the meta-analytic assumption of independence among studies/samples. Including or excluding dependent subsamples did not change the results appreciably. Still, future efforts could attempt model statistical dependence among subgroups. A third limitation concerns the lack of longitudinal studies in the literature. Although cross-sectional research represents an important first step in any investigation, we must guard against over-interpretation of the results as predictors or risk factors, evidence for both of which requires longitudinal designs. Such studies should also examine whether dynamic fluctuations in self-criticism (i.e., state self-criticism) relate more strongly to NSSI or DE than trait self-criticism. Fourth, we note that the studies reviewed here relied exclusively on self-reports (particularly in the assessment of NSSI), the limitations of which are well-known. Within the DE section of the review, distinguishing DE behaviors from their associated cognitions was also difficult for similar reasons. Finally, we note that all but one of the studies took place in developed nations. Caucasian, female samples predominated and no attention was given to subgroups with heightened risk of NSSI or DE, such as individuals who experienced childhood maltreatment, sexual minorities, or transgender individuals (e.g., Diemer, Grant, Munn-Chernoff, Patterson, & Duncan, 2015; Smolek & Murnen, 2002).⁷ Important directions for future research include the examination of relations among NSSI, DE, and self-criticism in so far under-represented populations, including developing nations, minority groups, and men. Future research should also examine these characteristics as moderators of the self-criticism, NSSI, and DE relations.

⁶We also examined self-criticism measure as a potential moderator of the relation between self-criticism and NSSI and self-criticism and DE. Three self-criticism measures repeatedly emerged during the NSSI literature review: the Self-Rating Scale (Hooley et al., 2002), the Forms of Self-Criticism/Self-Reassurance Scale (FSCSR; Gilbert et al., 2004) and the Depressive Experiences Questionnaire-Self-Criticism subscale (Blatt et al.). As these measures were developed through slightly different methods and reflect slightly varied theoretical interpretations of self-criticism, we tested whether the choice of SC measure moderated the NSSI-SC relation. The point estimate for samples using the SRS was .41 (95% CI: .24 – .55), .54 (95% CI: .37 – .67) for samples using the FSCSR, and .38 (95% CI: .21 – .52) for samples using the DEQ-SC. Overlap across the confidence intervals argues against SC measure as a moderator, though the FSCSR trended toward higher estimates of the NSSI-SC relation.

We conducted similar analyses for measure as a moderator of the self-criticism-DE relation. Meta-analytic statistics suggest that self-criticism measure may moderate the relation of the construct to DE ($Q = 134.24$, $df = 9$, $p < .001$). We were unable to examine differences between specific measures due to the wide range of subsamples using each particular measure (e.g., 11 subsamples using the DEQ-SC versus one using the Self-Oriented Perfectionism scale). We also coded each study for using a perfectionism-related measure and tested this as a possible moderator of the SC-DE relation. The confidence interval around the correlation coefficient estimate for perfectionism-derived measures overlapped with non-perfectionism-derived measures (.30, 95% CI: .22 – .38 vs. .41, 95% CI: .34 – .47), suggesting no significant difference. Meta-analytic statistics regarding variance between the groups trended toward significance, however ($Q(1) = 3.82$, $p = .05$).

⁷Although not a main goal of this paper, we ran a meta-regression in which the proportion of female participants served as a continuous moderator of the self-criticism-NSSI relation. The result was not significant ($b = -0.0006$, $S.E. = 0.002$, $z = -0.44$, $p = .66$), although this may reflect limited representation of males in the included studies.

Despite these limitations, the present findings have implications in both clinical and research domains. Clinicians treating patients who engage in NSSI, DE, or both behaviors should evaluate and potentially target self-critical cognitions in treatment. Compassion-Focused Therapy for disordered eating represents one example of such an approach, although further research is necessary to evaluate its effectiveness (Goss & Allan, 2010, 2014). Among researchers, a growing community has called for the conceptualization of direct and indirect self-harm behaviors along a spectrum driven by common processes rather than as etiologically distinct behaviors (e.g., Nock, 2010; Sansone, Levitt, & Sansone, 2003; St. Germain & Hooley, 2012). The results of the current study highlight the importance of self-criticism in any transdiagnostic conceptualization of self-harm behavior.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

- American College Health Association. American College Health Association-National College Health Assessment II: Reference Group Executive Summary. Hanover, MD: American College Health Association; 2014.
- Baetens I, Claes L, Hasking P, Smits D, Grietens H, Onghena P, et al. 2015; The relationship between parental expressed emotions and non-suicidal self-injury: The mediating roles of self-criticism and depression. *Journal of Child and Family Studies*. 24:491–498. DOI: 10.1007/s10826-013-9861-8
- Beck, AT, Rush, AJ, Shaw, BF, Emery, G. *Cognitive Therapy of Depression*. New York: The Guilford Press; 1979.
- Benjamin LS. 1996; A clinician friendly version of the interpersonal circumplex: Structural analysis of social behavior (SASB). *Journal of Personality Assessment*. 66:248–266. DOI: 10.1207/s15327752jpa6602_5 [PubMed: 8869570]
- Berghold KM, Lock J. 2002; Assessing guilt in adolescents with anorexia nervosa. *American Journal of Psychotherapy*. 56:378–390. [PubMed: 12400204]
- Bers SA, Besser A, Harpaz-Rotem I, Blatt SJ. 2013; An empirical exploration of the dynamics of anorexia nervosa: Representations of self, mother, and father. *Psychoanalytic Psychology*. 30:188–209.
- Biostat. *Comprehensive Meta-Analysis (Version 3)* [Computer software]. Englewood, NJ: Author; 2015.
- Blatt SJ, D’Afflitti JP, Quinlan DM. 1976; Experiences of depression in normal young adults. *Journal of Abnormal Psychology*. 85(4):383–389. [PubMed: 956505]
- Boone L, Vansteenkiste M, Soenens B, Van der Kaap-Deeder J, Verstuyf J. 2014; Self-critical perfectionism and binge eating symptoms: a longitudinal test of the intervening role of psychological need frustration. *Journal of Counseling Psychology*. 61(3):363–373. DOI: 10.1037/a0036418 [PubMed: 25019540]
- Burke, TA; Stange, JP; Hamilton, JL; Cohen, JN; O’Garro-Moore, J; Daryanani, I; Abramson, L; Alloy, LB. *Cognitive and Emotion-Regulatory Mediators of the Relationship Between Behavioral Approach System Sensitivity and Nonsuicidal Self-Injury Frequency*. *Suicide & Life-Threatening Behavior*. 2014.

- Cawood CD, Huprich SK. 2011; Late adolescent nonsuicidal self-injury: the roles of coping style, self-esteem, and personality pathology. *Journal of Personality Disorders*. 25(6):765–781. DOI: 10.1521/pedi.2011.25.6.765 [PubMed: 22217223]
- Claes L, Houben A, Vandereycken W, Bijttebier P, Muehlenkamp J. 2010; Brief report: the association between non-suicidal self-injury, self-concept and acquaintance with self-injurious peers in a sample of adolescents. *Journal of Adolescence*. 33(5):775–778. DOI: 10.1016/j.adolescence.2009.10.012 [PubMed: 19910041]
- Claes, L, Muehlenkamp, JJ. Non-suicidal self-injury in eating disorders: Advancements in etiology and treatment. Heidelberg: Springer; 2014.
- Claes L, Vandereycken W. 2007; Is there a link between traumatic experiences and self-injurious behaviors in eating-disordered patients? *Eating Disorders*. 15:305–315. DOI: 10.1080/10640260701454329 [PubMed: 17710568]
- Cole DA, Maxwell SE. 2003; Testing mediational models with longitudinal data: Questions and tips in the use of structural equation modeling. *Journal of Abnormal Psychology*. 112:558–577. DOI: 10.1037/0021843X.112.4.558 [PubMed: 14674869]
- Costa J, Maroco J, Pinto-Gouveia J, Ferreira C, Castilho P. 2016; Validation of the psychometric properties of the self-compassion scale. Testing the factorial validity and factorial invariance of the measure among borderline personality disorder, anxiety disorder, eating disorder and general populations. *Clinical Psychology & Psychotherapy*. 23:460–468. DOI: 10.1002/cpp.1974 [PubMed: 26289027]
- Cucchi A, Ryan D, Konstantakopoulos G, Stroumpa S, Kaçar A, Renshaw S, Landau S, Kravariti E. 2016; Lifetime prevalence of non-suicidal self-injury in patients with eating disorders: a systematic review and meta-analysis. *Psychological Medicine*. 46(7):1345–1358. DOI: 10.1017/S0033291716000027 [PubMed: 26954514]
- Diemer EW, Grant JD, Munn-Chernoff MA, Patterson DA, Duncan AE. 2015; Gender Identity, Sexual Orientation, and Eating-Related Pathology in a National Sample of College Students. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*. 57(2):144–149. DOI: 10.1016/j.jadohealth.2015.03.003 [PubMed: 25937471]
- Duarte C, Pinto-Gouveia J, Ferreira C. 2014; Escaping from body image shame and harsh self-criticism: Exploration of underlying mechanisms of binge eating. *Eating Behaviors*. 15:638–643. DOI: 10.1016/j.eatbeh.2014.08.025 [PubMed: 25248129]
- Duarte C, Pinto-Gouveia J, Rodrigues T. 2015; Being bullied and feeling ashamed: Implications for eating psychopathology and depression in adolescent girls. *Journal of Adolescence*. 44:259–268. DOI: 10.1016/j.adolescence.2015.08.005 [PubMed: 26318063]
- Duval S, Tweedie R. 2000; Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*. 56(2):455–463. [PubMed: 10877304]
- Egger M, Smith GD, Schneider M, Minder C. 1997; Bias in meta-analysis detected by a simple, graphical test. *BMJ*. 315:629. [PubMed: 9310563]
- Fairburn CG, Cooper Z, Shafran R. 2003; Cognitive behaviour therapy for eating disorders: a “transdiagnostic” theory and treatment. *Behaviour Research and Therapy*. 41(5):509–528. [PubMed: 12711261]
- Fairburn CG, Welch SL, Doll HA, Davies BA, O'Connor ME. 1997; Risk factors for bulimia nervosa: A community-based case-control study. *Archives of General Psychiatry*. 54:509–517. DOI: 10.1001/archpsyc.1997.01830180015003 [PubMed: 9193191]
- Feinson MC, Meir A. 2014; Disordered eating and cultural distinctions: Exploring prevalence and predictors among women in Israel. *The Israel Journal of Psychiatry and Related Sciences*. 51:145–153. [PubMed: 25372565]
- Fennig S, Hadas A, Itzhaky L, Roe D, Apter A, Shahar G. 2008; Self-criticism is a key predictor of eating disorder dimensions among inpatient adolescent females. *International Journal of Eating Disorders*. 41:762–765. DOI: 10.1002/eat.20573 [PubMed: 18570191]
- Firestone RW, Seiden RH. 1990; Suicide and the continuum of self-destructive behavior. *Journal of American College Health*. 38(5):207–213. DOI: 10.1080/07448481.1990.9936189 [PubMed: 2312939]

- Flett GL, Goldstein AL, Hewitt PL, Wekerle C. 2012; Predictors of deliberate self-harm behavior among emerging adolescents: An initial test of a self-punitiveness model. *Current Psychology*. 31:49–64. DOI: 10.1007/s12144-012-9130-9
- Forsen Mantilla E, Bergsten K, Birgegard A. 2014; Self-image and eating disorder symptoms in normal and clinical adolescents. *Eating Behaviors*. 15:125–131. DOI: 10.1016/j.eatbeh.2013.11.008 [PubMed: 24411765]
- Foulon C, Guelfi JD, Kipman A, Adès J, Romo L, Houdeyer K, Marquez S, Mouren MC, Rouillon &, Gorwood P. 2007; Switching to the bingeing/purging subtype of anorexia nervosa is frequently associated with suicidal attempts. *European Psychiatry*. 22(8):513–519. DOI: 10.1016/j.eurpsy.2007.03.004 [PubMed: 17482799]
- Fox KR, Franklin JC, Ribeiro JD, Kleiman EM, Bentley KH, Nock MK. 2015; Meta-analysis of risk factors for nonsuicidal self-injury. *Clinical Psychology Review*. 42:156–167. DOI: 10.1016/j.cpr.2015.09.002 [PubMed: 26416295]
- Gilbert P. 2002; Evolutionary approaches to psychopathology and cognitive therapy. *Journal of Cognitive Psychotherapy*. 16(3):263–294.
- Gilbert P, Clarke M, Hempel S, Miles JNV, Irons C. 2004; Criticizing and reassuring oneself: An exploration of forms, styles and reasons in female students. *The British Journal of Clinical Psychology / the British Psychological Society*. 43(Pt 1):31–50. DOI: 10.1348/014466504772812959
- Gilbert P, McEwan K, Irons C, Bhundia R, Christie R, Broomhead C, Rockliff H. 2010; Self-harm in a mixed clinical population: The roles of self-criticism, shame, and social rank. *British Journal of Clinical Psychology*. 49(4):563–576. DOI: 10.1348/014466509X479771 [PubMed: 20109278]
- Glassman LH, Weierich MR, Hooley JM, Deliberto TL, Nock MK. 2007; Child maltreatment, non-suicidal self-injury, and the mediating role of self-criticism. *Behaviour Research and Therapy*. 45(10):2483–2490. DOI: 10.1016/j.brat.2007.04.002 [PubMed: 17531192]
- Glenn JJ, Michel BD, Franklin JC, Hooley JM, Nock MK. 2014; Pain analgesia among adolescent self-injurers. *Psychiatry Research*. 220(3):921–926. DOI: 10.1016/j.psychres.2014.08.016 [PubMed: 25172611]
- Gordon, KH, Kwan, MY, Minnich, AM, Carter, DL. Etiological models of nonsuicidal self-injury and eating disorders. In: Claes, L, Muehlenkamp, J, editors *Nonsuicidal self-injury in eating disorders*. New York: Springer; 2014.
- Goss K, Allan S. 2010; Compassion Focused Therapy for Eating Disorders. *International Journal of Cognitive Therapy*. 3(2):141–158. DOI: 10.1521/ijct.2010.3.2.141
- Goss K, Allan S. 2014; The development and application of compassion-focused therapy for eating disorders (CFT-E). *The British Journal of Clinical Psychology*. 53(1):62–77. DOI: 10.1111/bjc.12039 [PubMed: 24588762]
- Guerreiro DF, Figueira ML, Cruz D, Sampaio D. 2015; Coping strategies in adolescents who self-harm. *Crisis*. 36:31–37. DOI: 10.1027/0227-5910/a000289 [PubMed: 25467046]
- Harkness-Murphy E, MacDonald J, Ramsay J. 2013; Self-harm and psychosocial characteristics of looked after and looked after and accommodated young people. *Psychology, Health & Medicine*. 18:289–299. DOI: 10.1080/13548506.2012.712706
- Heatherton TF, Baumeister RF. 1991; Binge eating as escape from self-awareness. *Psychological Bulletin*. 110:86–108. [PubMed: 1891520]
- Higgins, JPT, Green, S, editors *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0* [updated March 2011]. The Cochrane Collaboration; 2011. Available from <http://handbook.cochrane.org>
- Hooley JM, Ho DT, Slater J, Lockshin A. 2010; Pain perception and nonsuicidal self-injury: A laboratory investigation. *Personality Disorders*. 1:170–179. DOI: 10.1037/a0020106 [PubMed: 22448633]
- Hooley JM, St Germain SA. 2014; Nonsuicidal self-injury, pain, and self-criticism: Does changing self-worth change pain endurance in people who engage in self-injury? *Clinical Psychological Science*. 2:297–305. DOI: 10.1177/2167702613509372
- Horney, K. *Neurosis and human growth: The struggle toward self-realization*. New York: Norton; 1950.

- Itzhaky L, Shahar G, Stein D, Fennig S. 2015; In Eating-Disordered Inpatient Adolescents, Self-Criticism Predicts Nonsuicidal Self-Injury. *Suicide and Life-Threatening Behavior*. 46(4):385–397. DOI: 10.1111/sltb.12223 [PubMed: 26475665]
- Lehman AK, Rodin J. 1989; Styles of self-nurturance and disordered eating. *Journal of Consulting and Clinical Psychology*. 57(1):117–122. [PubMed: 2925962]
- Lipsey, MW, Wilson, DB. *Practical meta-analysis*. Thousand Oaks, CA: Sage; 2001.
- Mantilla, EF; Birgegard, A. The enemy within: The association between self-image and eating disorder symptoms in healthy, non help-seeking and clinical young women; *Journal of Eating Disorders*. 2015. 3
- Maxwell SE, Cole DA. 2007; Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods*. 12:23–44. DOI: 10.1037/1082-989X.12.1.23 [PubMed: 17402810]
- Maxwell SE, Cole DA, Mitchell MA. 2011; Bias in cross-sectional analyses of longitudinal mediation: Partial and complete mediation under an autoregressive model. *Multivariate Behavioral Research*. 46:816–841. DOI: 10.1080/00273171.2011.606716 [PubMed: 26736047]
- Munro C, Randell L, Lawrie SM. 2017; An integrative bio-psycho-social theory of anorexia nervosa. *Clinical Psychology & Psychotherapy*. 24:1–21. DOI: 10.1002/cpp.2047 [PubMed: 27739190]
- Nock MK. 2009; Why do people hurt themselves? New insights into the nature and functions of self-injury. *Current Directions in Psychological Science*. 18(2):78–83. DOI: 10.1111/j.1467-8721.2009.01613.x [PubMed: 20161092]
- Nock MK. 2010; Self-Injury. *Annual Review of Clinical Psychology*. 6(1):339–363. DOI: 10.1146/annurev.clinpsy.121208.131258
- Nolen-Hoeksema S, Watkins ER. 2011; A Heuristic for Developing Transdiagnostic Models of Psychopathology Explaining Multifinality and Divergent Trajectories. *Perspectives on Psychological Science*. 6(6):589–609. DOI: 10.1177/1745691611419672 [PubMed: 26168379]
- Noordenbos G, Aliakbari N, Campbell R. 2014; The relationship among critical inner voices, low self-esteem, and self-criticism in eating disorders. *Eating Disorders*. 22:337–351. DOI: 10.1080/10640266.2014.898983 [PubMed: 24678635]
- Orwin R. 1983; A fail-safe N for effect size in meta-analysis. *Journal of Educational Statistics*. 8:157–159. DOI: 10.2307/1164923
- Sansone RA, Levitt JL, Sansone LA. 2003; Eating Disorders and Self-Harm: A Chaotic Intersection. *Eating Disorders Review for Professionals*. 14(3)
- Shanmugam V, Jowett S, Meyer C. 2012; Eating psychopathology amongst athletes: Links to current attachment styles. *Eating Behaviors*. 13:5–12. DOI: 10.1016/j.eatbeh.2011.09.004 [PubMed: 22177389]
- Skegg K. 2005; Self-harm. *Lancet (London, England)*. 366(9495):1471–1483. DOI: 10.1016/S0140-6736(05)67600-3
- Smolak L, Murnen SK. 2002; A meta-analytic examination of the relationship between child sexual abuse and eating disorders. *The International Journal of Eating Disorders*. 31(2):136–150. [PubMed: 11920975]
- St Germain SA, Hooley JM. 2012; Direct and indirect forms of non-suicidal self-injury: Evidence for a distinction. *Psychiatry Research*. 197(1–2):78–84. DOI: 10.1016/j.psychres.2011.12.050 [PubMed: 22406394]
- Svirko E, Hawton K. 2007; Self-injurious behavior and eating disorders: the extent and nature of the association. *Suicide & Life-Threatening Behavior*. 37(4):409–421. [PubMed: 17896881]
- Swannell SV, Martin GE, Page A, Hasking P, St John NJ. 2014; Prevalence of nonsuicidal self-injury in nonclinical samples: systematic review, meta-analysis and meta-regression. *Suicide & Life-Threatening Behavior*. 44(3):273–303. [PubMed: 24422986]
- Wedig MM, Nock MK. 2010; The functional assessment of maladaptive behaviors: A preliminary evaluation of binge eating and purging among women. *Psychiatry Research*. 178(3):518–524. DOI: 10.1016/j.psychres.2009.05.010 [PubMed: 20537726]
- White S, Reynolds-Malear JB, Cordero E. 2011; Disordered eating and the use of unhealthy weight control methods in college students: 1995, 2002, and 2008. *Eating Disorders*. 19:323–334. DOI: 10.1080/10640266.2011.584805 [PubMed: 22352972]

- Whitlock J, Eckenrode J, Silverman D. 2006; Self-injurious behaviors in a college population. *Pediatrics*. 117(6):1939–1948. [PubMed: 16740834]
- You J, Lin MP, Leung F. 2014; A longitudinal moderated mediation model of nonsuicidal self-injury among adolescents. *Journal of Abnormal Child Psychology*. 43(2):381–390. DOI: 10.1007/s10802-014-9901-x

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Figure 1.
Study Identification and Selection
PRISMA diagram showing the identification and selection of articles for the NSSI meta-analysis (Panel A) and DE meta-analysis (Panel B).

A.

B.

Figure 2.**Forest Plots of NSSI and DE Studies**

Forest plots depicting the point estimate for the relation of NSSI to SC (Panel A) and DE to SC (Panel B). Confidence intervals associated with each individual study are also shown, along with the overall effect size estimates (diamond).

Figure 3.

Funnel Plots of NSSI and DE Studies

The standard error of each study is plotted against its estimated effect size expressed as Fisher's Z . NSSI studies are shown in Panel A; DE studies in Panel B. Smaller studies (with larger standard errors) are plotted toward the bottom of the graph. Asymmetrical grouping of studies on either side of the overall effect size estimate (vertical line) may indicate publication bias.

Table 1

Search terms by construct, database

	PsychInfo	PubMed	EMBASE
Self-criticism	SU.EXACTEXPLODE("Self criticism") OR AB.TI("self-criticism") OR AB.TI("self-hatred") OR AB.TI("self-blame") OR AB.TI("self-hatred") OR AB.TI("self-crit*") OR AB.TI("self-crit*"))	("Self criticism"[tiab] OR "self-criticism"[tiab] OR "self-hatred"[tiab] OR "self-blame"[tiab] OR "self-crit*" [tiab] OR "self-crit*" [tiab])	("self-criticism" or "self criticism" or "self-hat" or "self hat\$").mp.
Non-suicidal self-injury	(SU.EXACTEXPLODE("Self Injurious Behavior") OR (SU.EXACTEXPLODE("Self Mutilation")) OR (SU.EXACTEXPLODE("Self Inflicted Wounds")) OR AB.TI("self-injury") OR AB.TI("self injury") OR AB.TI("non-suicidal self-injury") OR AB.TI("non-suicidal self injury") OR AB.TI("self-harm") OR AB.TI("self harm") OR AB.TI("cutting") OR AB.TI("NSSI"))	("self-injurious behavior"[MeSH Terms] OR "self-injurious behavior"[tiab] OR "self-injury"[tiab] OR "self injury"[tiab] OR "non-suicidal self-injury"[tiab] OR "non-suicidal self injury"[tiab] OR "self-harm" [tiab] OR "self harm"[tiab] OR "cutting"[tiab] OR "NSSI"[tiab])	(('self-injurious behavior' or 'self-injurious behaviour' or 'self injurious behavior' or 'self injurious behaviour' or 'self-injury' or 'self injury' or 'non-suicidal self-injury' or 'non-suicidal self injury' or 'self-harm\$' or 'self harm\$' or 'NSSI' or 'self-mutilat\$' or 'self mutilat\$').mp.
Disordered Eating	AB.TI(Purging) OR AB.TI(Eating Disorders) OR AB.TI("Eating Disorders") OR AB.TI("Binge Eating Disorder") OR AB.TI("anorexi*") OR AB.TI("bulimi*") OR AB.TI("disordered eating") OR AB.TI("binge*") OR AB.TI("restrict*") OR AB.TI("laxative")	((("Feeding and Eating Disorders"[Majr]) OR "Anorexia Nervosa"[Majr:NoExp]) OR "Binge-Eating Disorder"[Majr:NoExp]) OR "Bulimia Nervosa"[Majr:NoExp] OR "anorex*" OR "bulim*" OR "restrict*" OR "binge*" OR "purg*"))	*anorexia nervosa/ or binge eating disorder/ or *bulimia/ or "binge\$".mp. or "purg\$".mp. or "disordered eat* ".mp. or "eating disord* ".mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

Table 2

Comparison of effect size for relation of self-criticism (SC) to NSSI, DE

	Effect size	95% CI	k
SC-NSSI	.38	.29 – .46	15
SC-DE	.40	.34 – .45	24

Note. NSSI = nonsuicidal self-injury; DE