Relationships between dimensions of emotional experience, rumination, and nonsuicidal self-injury: An application of the Emotional Cascade Model

Katerina Hatzopoulos[1], Mark Boyes[1,2]*, & Penelope Hasking[1,2]

1: School of Population Health, Faculty of Health Sciences, Curtin University

2: Curtin enAble Institute, Faculty of Health Sciences, Curtin University

*Correspondence:

Curtin enAble Institute, Faculty of Health Sciences
Curtin University, GPO Box U1987
Perth, 6845

Abstract

Objectives: The Emotional Cascade Model posits that non-suicidal self-injury (NSSI) functions to distract from cascades of intense negative emotion and rumination. We investigated the moderating role of rumination in the relationships between reactivity, intensity, and perseveration of emotion and NSSI. **Method**: University students (N = 992) completed self-report measures of self-injury, emotional reactivity, intensity and perseveration, and rumination. **Results:** Together, the dimensions of negative emotion were associated with NSSI, but none contributed unique variance. For positive emotion, reactivity was negatively associated with history of self-injury and perseveration was negatively associated with frequency of the behaviour. Rumination was associated with NSSI, but did not moderate associations between the dimensions of negative emotion and self-injury. Rumination moderated the relationship between perseveration of positive emotion and history of NSSI, such that it was only significant at high levels of rumination. **Conclusion**: Findings highlight the importance of dimensions of positive emotion in understanding self-injury.

Keywords: Non-suicidal self-injury, NSSI, self-injury, Emotional Cascade Model, rumination.

Relationships between Dimensions of Emotional Experience, Rumination, and Non-Suicidal Self-Injury: An Application of the Emotional Cascade Model

Non-suicidal self-injury (NSSI) is the deliberate, self-inflicted damage to one's own body tissue without suicidal intent (International Society for the Study of Self-injury, 2018). NSSI does not include culturally and socially-sanctioned body modifications such as piercing and tattooing, but comprises several other behaviours like skin cutting, burning, scratching, and self-battery (Nock, 2009). University students are more likely to engage in NSSI than the general population, with 20% having self-injured at some point in their lives (Swannell et al., 2014). Corresponding estimated prevalence rates are 17.2%, 13.4%, and 5.5% for adolescents, young adults, and adults respectively (Swannell et al., 2014). Although NSSI engagement typically begins during adolescence, there is a second peak age of onset at 20-24 years (Gandhi et al., 2018), which coincides with university attendance for many young people. Additionally, Kiekens et al. (2019) found that incidence of first onset NSSI was 10.3% over the first year and 6.0% over the second year of university, further pointing to the university period as a time of elevated risk for NSSI engagement. Of concern is that NSSI among university students is not only associated with poor academic performance (Kiekens et al., 2016), but is linked to negative mental health outcomes, including emotional disorders (Kiekens et al., 2019) and future suicidal thoughts and behaviours (Kiekens et al., 2018). Enhancing knowledge about factors that contribute to the initiation and maintenance of NSSI is crucial in identifying at-risk individuals, developing prevention and intervention approaches, and consequently reducing adverse impacts. Though NSSI can serve a range of functions for individuals, emotion regulation has been recognised as the most common reason people self-injure (Taylor et al., 2018).

The Emotional Cascade Model is a prominent emotion regulation theory that was originally developed to illustrate the link between emotional dysregulation and the wide array of dysregulated behaviours engaged in by individuals with Borderline Personality Disorder, including substance abuse, binge-eating, problematic interpersonal behaviours, and NSSI (Selby & Joiner, 2009). Given that research has demonstrated a strong connection between NSSI and emotion regulation more broadly (Glenn & Klonsky, 2013), the Emotional Cascade Model may be applied beyond the context of Borderline Personality Disorder, to explain self-injury regardless of the presence of psychological disorder. According to the model, people who engage in behaviours like NSSI tend to repetitively focus (ruminate) on negative emotional stimuli or situations, which intensifies the experience of negative emotions (Selby & Joiner, 2009). This instigates a positive feedback loop whereby amplified emotional intensity draws more attention to the stimuli, prompting further escalation in rumination, and eventually resulting in cascades of increasingly intense emotion (Selby & Joiner, 2009). For some, this vicious cycle heightens the emotional

experience to such an aversive extent that typical distraction practices, for example watching television, become incapable of disrupting the cascade. Instead, more extreme forms of attention diversion, such as NSSI, are needed to shift attention away from intrusive ruminative thoughts and overwhelming emotions. Self-injury can reduce intense, unwanted emotions by redirecting attention to physical sensations created by the behaviour, for example the sight of blood or the sensation of pain (Selby et al., 2013). The immediate distraction provided is thought to cease the build-up of negative emotion by impeding the ruminative process and breaking the cascade. This produces short-term feelings of emotional relief, thus negatively reinforcing the behaviour (Selby & Joiner, 2009).

The Emotional Cascade Model is supported empirically by both self-report (Selby et al., 2013; Slabbert et al., 2018) and experimental studies (Arbuthnott et al., 2015), with rumination consistently differentiating between individuals who engage in self-injury and those who do not. Further, there is robust evidence indicating a relationship between elevated negative emotion and increased risk of self-injury (Bresin, 2014; Victor & Klonsky, 2014), with rumination also being shown to strengthen this association (Arbuthnott et al., 2015; Nicolai et al., 2016). Although the model emphasises intensity of emotion as being central to NSSI engagement, there is extensive research reporting stable individual differences in other dimensions of emotional experience that could likewise be influential. Along with intensity (the *strength* of emotional responses), salient characteristics of emotional responding that have received significant attention in the literature include reactivity (the *probability* of experiencing an emotional response) and perseveration (the *duration* of emotional responses once elicited). These dimensions of emotion have all displayed links to psychopathology. For example, greater negative emotional intensity has been associated with psychological distress (Bornovalova et al., 2011) and anxiety (Brumariu & Kerns, 2013), and anxiety reactivity and perseveration both account for unique variance in trait anxiety (Rudaizky & MacLeod, 2014; Rudaizky et al., 2012).

Attempts have been made to accurately assess the reactivity, intensity, and perseveration dimensions of emotion. For instance, the self-report Emotion Reactivity Scale (Nock et al., 2008) was designed to encompass these three dimensions and is the measure of dispositional emotional experience that has primarily been utilised in NSSI-related research. Studies using the Emotion Reactivity Scale have commonly found that individuals with a history of self-injury report higher levels of emotional reactivity, as measured by the total scale score, relative to those with no history (Claes et al., 2014; Dawkins et al., 2018; Glenn et al., 2011; Smith et al., 2017). However, although designed to assess emotional reactivity, intensity, and perseveration, the Emotion Reactivity Scale is structurally unidimensional (Nock et al., 2008) and conflates the frequency, strength, and duration of emotional response. Therefore, the extent to which individual

differences in emotional reactivity, intensity, and perseveration are associated with NSSI is uncertain.

More recently, the Emotional Reactivity Intensity and Perseveration Scale (ERIPS; Ripper et al., 2018) was developed to distinguish between, and independently assess, dimensions of emotional reactivity, intensity, and perseveration. Using the ERIPS, these dimensions have been shown to account for unique variance in trait negative and positive emotion, be differentially related to depression, anxiety, and stress (Boyes et al., 2017; Ripper et al., 2018), and be associated with variability in state emotionality (Boyes et al., 2020). Additionally, the ERIPS assesses these dimensions in the context of both negative and positive emotion. This is critical in the field of NSSI as emerging evidence indicates that, along with negative emotion, individual differences in the experience of positive emotion are also associated with self-injury. Generally, individuals who engage in NSSI, compared to those who do not, report experiencing decreased positive emotion (Arbuthnott et al., 2015; Boyes et al., 2019; Bresin, 2014; Santangelo et al., 2017; Victor & Klonsky, 2014). Some people who self-injure also report significant increases in low-arousal positive emotions (e.g. relieved, calm) following NSSI (Claes et al., 2010; Klonsky, 2009; Kranzler et al., 2018). In contrast, high-arousal positive emotions (e.g. happy, excited) show less change. In this case, NSSI may be used to efficiently and effectively generate certain positive emotional states. Moreover, research suggests that positive emotion could be protective against self-injury (Burke et al., 2018; Cohen et al., 2015), even when levels of negative emotion are high (Hasking et al., 2018). Conversely, Jenkins and Schmitz (2012) imply that individuals who engage in NSSI experience positive emotion at higher intensities than those who do not self-injure. Due to their associations with mania, intense positive emotional states might be unpleasant for some, signifying that NSSI may be employed to eliminate 'out of control' positively valenced emotions (Gruber, 2011). Further exploration of positive emotion is needed to enrich our understanding of the part it plays in NSSI.

The dimensions of negative and positive emotion captured by the ERIPS have only been investigated once in NSSI-related research. Boyes et al. (2019) found that individuals with a history of NSSI, compared to those with no history of self-injury, reported more trait negative emotional reactivity, intensity, and perseveration, though group differences were negated after adjusting for mental illness. Consistent with recent evidence showing that positive emotion is negatively associated with NSSI, those with a history of NSSI also reported less trait positive emotional reactivity, intensity, and perseveration. Although group differences were observed for each of the dimensions, due to high inter-correlations it is unclear whether each dimension contributed unique variance over and above the variance shared. In the same study, Boyes et al. (2019) also used movie clips to induce both negative and positive emotion. After inducing sadness

using a sad movie clip, relative to those with no history of self-injury, individuals with a history of NSSI demonstrated a slower return to a baseline emotional state, thus exemplifying the link between perseveration of negative emotion and NSSI. Further, in response to an amusing movie clip, individuals with a history of NSSI demonstrated less amusement across time, implying that a lack of positive emotion may be implicated in NSSI. Together, these findings provide preliminary support for the associations between negative and positive emotional reactivity, intensity, and perseveration and NSSI.

The Current Study

This study aimed to investigate the way trait negative and positive emotional reactivity, intensity, and perseveration interact with rumination to predict lifetime history of NSSI. Further, it explored whether the dimensions of trait negative and positive emotion and rumination interacted to predict frequency of NSSI among individuals who had a history of self-injury. It was hypothesised that negative emotional reactivity, intensity, and perseveration, and rumination would be positively associated with both history and frequency of NSSI. It was also predicted that rumination would moderate the relationships between the dimensions of negative emotion and NSSI, such that each relationship would be strengthened by high levels of rumination. Given previous mixed findings regarding positive emotion and NSSI, analyses involving the dimensions of positive emotion were exploratory in nature.

Method

Participants

Recruited as part of a larger study on emotion and NSSI, 1002 Australian university students (74.8% female, 24.3% male, 1.0% another gender) completed an online questionnaire. Data for 10 participants who identified as a gender other than female or male were omitted from further analyses as this group was insufficient in size to permit meaningful group comparisons. The final sample comprised 992 participants, between the ages of 17 and 64 (M = 21.71, SD = 5.25). The majority of participants were born in Australia (76.1%) and 10 (1.0%) identified as Aboriginal or Torres Strait Islander.

Measures

Non-Suicidal Self-Injury. Lifetime history of non-suicidal self-injury was assessed using the first section of the Inventory of Statements about Self-Injury (ISAS; Klonsky & Glenn, 2009). Participants were provided with a definition of NSSI and were then asked to indicate if they had engaged in self-injury at any point in their life. For those with a history of NSSI, further questions were asked about contextual and descriptive factors, including age of onset, main form of self-injury, frequency of NSSI behaviours over the past year (0 = *none* to 5 = *5 or more times*), and 13 functions of self-injury. Each function was assessed with three items rated on a 3-point Likert

scale (0 = *not relevant* to 2 = *very relevant*). Scores for each subscale range from 0 to 6, with higher scores representing higher endorsement of that function. In samples of university students, the ISAS has demonstrated high 1 to 4 week test-retest reliability (*r* = .85; Klonsky et al., 2008), and correlations with depression and suicide ideation indicate good construct validity (Klonsky & Glenn, 2009).

Emotional Reactivity, Intensity, and Perseveration. Emotional reactivity, intensity and perseveration were measured using the Emotional Reactivity Intensity and Perseveration Scale (ERIPS; Ripper et al., 2018). The ERIPS is a 60-item measure of independent dimensions of trait negative and positive emotion and is an adaptation of the Positive and Negative Affect Schedule (Watson et al., 1988), using the same 20 adjectives (10 positive, e.g. excited; 10 negative, e.g. upset) but with modified instructions and response options. To assess emotional reactivity, participants were asked, "When exposed to a situation that would make the 'average' person experience this feeling, how likely is it that you will experience this particular feeling?" (1 = *not at all likely* to 5 = *extremely likely*). To assess emotional intensity, participants were asked, "When you are experiencing a situation that does make you feel this way, how intense is the feeling compared to how other people feel?" (1 = *not at all intense* to 5 = *extremely intense*). To assess emotional perseveration, participants were asked, "When you are experiencing a situation that does make you feel this way, how long is this feeling likely to persist?" (1 = *not at all persistent* to 5 = *extremely persistent*). Relevant items were summated to produce separate indices of negative and positive emotional reactivity, intensity and perseveration. Scores for each subscale range from 10 to 50, with higher scores reflecting greater negative or positive emotional reactivity, intensity, and perseveration. In a sample of university students, the ERIPS has displayed excellent internal consistency (*a* = .89 - .92) and good construct validity, with the negative emotional dimensions being positively correlated with trait negative emotion, psychological distress, depression, anxiety, and stress, and the positive emotional dimensions being negatively correlated with these variables (Ripper et al., 2018). In the current sample, the ERIPS subscales demonstrated excellent internal consistency, with Cronbach's alphas ranging between *a* = .91 (positive emotional perseveration) and *a* = .93 (negative emotional reactivity).

Rumination. Rumination was measured using the Ruminative Thought Style Questionnaire (RTSQ; Brinker & Dozois, 2009). The RTSQ is a 20-item valence-neutral measure of global rumination. Participants responded to items on a 7-point Likert scale (1 = *not at all like me* to 7 = *completely like me*). Scores range from 20 to 140, with higher scores representing higher levels of rumination. In a sample of university students, the RTSQ has displayed excellent internal consistency (*a* = .92) and high 1 to 2 week test-retest reliability (*r* = .80; Brinker & Dozois, 2009). The RTSQ also has good convergent validity with the Global Rumination Scale (*r* = .64) and Penn

State Worry Questionnaire (r = .44), and discriminant validity with the Shipley Institute of Living Scale, a measure of verbal ability (r = -.08; Brinker & Dozois, 2009). Importantly, the RTSQ reliably assesses rumination among people with and without a history of NSSI (Tonta et al., 2020). In the current sample, the RTSQ demonstrated excellent internal consistency (a = .95).

Procedure

After gaining ethical approval from the University's Human Research Ethics Committee (RDHS-236-15), the study was advertised to the undergraduate participant pool for research credit, online platforms (e.g. Facebook), and at universities Australia-wide. Students recruited online or through other universities were entered into a draw to win an iPad or one of ten $25 vouchers. Participants were informed that they would be answering questions about NSSI and emotional experiences. Participants were given a link directing them to an online survey where they were informed about the aims and nature of the study, participation requirements, confidentiality, right to withdraw and voluntary participation, risks and benefits, and data storage method. Participants were required to provide consent, by checking a box, in order to proceed to the questionnaire. Completion of the questionnaire took approximately 45 to 60 minutes. At the commencement of the study and upon completion, all participants were provided with a list of resources, including counselling service contact details and online information about self-injury.

Data Analysis

Two hierarchical logistic regressions were conducted to assess whether negative and positive emotional reactivity, intensity, and perseveration, and rumination predicted odds of NSSI. The first included the dimensions of negative emotion and the second including the dimensions of positive emotion. Next, Poisson regressions were conducted to assess whether the same variables predicted frequency of NSSI among individuals with a history of self-injury. Given the high proportion of participants reporting not having self-injured within the last 12 months, Poisson regression analyses were used to account for a zero-inflation in the data (Lambert, 1992). Before all regression analyses were conducted, predictor variables were standardised to reduce multicollinearity (Aiken & West, 1991). To statistically control for age, gender, and history of mental illness, these variables were entered on block one of the regressions. The dimensions of emotion were entered on block two of the regressions for each valence. Rumination was entered on block three. Two-way interactions between emotional reactivity, intensity, and perseveration and rumination were entered on block four. Significant two-way interactions were probed using simple slopes tests and illustrated graphically at ± one standard deviation from the mean (Aiken & West, 1991).

<div align="center">Results</div>

Although Missing Values Analysis revealed that data were not missing completely at random, χ^2 (5093) = 5405.29, p = .001, the amount of missing data were minimal (<1%), therefore missing data were imputed using expectation maximisation (Tabachnick & Fidell, 2013). Using a cut-off of ± 3.29 standard deviations from the mean of the given distribution (Tabachnick & Fidell, 2013), three univariate outliers were identified for rumination. These outliers were truncated so that they were within the ± 3.29 standard deviation range (Allen et al., 2014). No influential multivariate outliers were identified.

Sample Characteristics

Participants were asked whether they had ever been diagnosed with a mental illness, of which 29.2% (n = 290) reported that they had. The majority reported either a diagnosis of depression, anxiety, or co-morbid depression and anxiety (n = 236, 81.4%), and only 6.6% (n = 19) reported a diagnosis of Borderline Personality Disorder. Of the total sample, 36.3% (n = 360) reported a history of NSSI. The most common form of NSSI was cutting (45.6%), followed by banging or hitting self (11.9%) and severe scratching (11.7%). The mean age of NSSI onset was 15.15 years (SD = 3.51). Emotion regulation was the most highly endorsed function of NSSI (M = 4.17, SD = 1.76), followed by self-punishment (M = 3.60, SD = 2.01). Peer bonding was the least endorsed reason for engaging in self-injury (M = 0.22, SD = 0.75). Of those who had a history of NSSI, 51.3% (n = 185) had self-injured within the last year and 19.4% (n = 70) had self-injured 5 or more times during that period. Women (39.9%) were significantly more likely than men (25.1%) to have a history of NSSI, χ^2 (1, N = 992) = 17.42, p < .001. Additionally, individuals with a history of NSSI were significantly more likely to have a history of mental illness (52.2%) than those without a history of NSSI (16.1%), χ^2 (1, N = 992) = 144.35, p < .001. Frequency of NSSI among those with a history of self-injury was related to history of mental illness, r_{pb} = .18, p < .001, but not gender, r_{pb} = .03, p = .55. Table 1 and Table 2 present the individual direct associations between each variable of interest and NSSI, and show that all variables were correlated in the expected direction.

Insert Table 1 and Table 2 here

Predicting Odds of NSSI

Dimensions of Negative Emotion

In the first step, age (OR = 0.83), gender (OR = 1.86), and history of mental illness (OR = 5.96) were entered as covariates and significantly differentiated between participants who had engaged in NSSI and those who had not, χ^2_{step} (3, 992) = 160.91, p < .001. The addition of negative

emotional reactivity, intensity, and perseveration on step two was significant, χ^2_{step} (3, 992) = 26.50, $p < .001$. However, the individual dimensions of negative emotion did not make unique contributions to the model. Step three containing rumination was significant, χ^2_{step} (1, 992) = 7.59, $p = .01$. Rumination was positively associated with the probability of NSSI ($OR = 1.28$). The two-way interactions were entered on step four and did not significantly predict odds of NSSI as a step, χ^2_{step} (3, 992) = 3.01, $p = .39$, and none of the individual interactions were significant. The final model (Table 3) was statistically significant, χ^2_{model} (10, 992) = 198.01, $p < .001$, accounting for between 18.1% (Cox & Snell R^2) and 24.8% (Nagelkerke R^2) of the variance in history of NSSI.

Dimensions of Positive Emotion

After controlling for age, gender, and history of mental illness, the addition of positive emotional reactivity, intensity, and perseveration on step two was significant, χ^2_{step} (3, 992) = 22.63, $p < .001$. Positive emotional reactivity was negatively associated with the probability of NSSI ($OR = 0.75$). Positive emotional intensity and perseveration were not significantly associated with the probability of NSSI. Step three containing rumination was significant, χ^2_{step} (1, 992) = 19.38, $p < .001$. Rumination was positively associated with the probability of NSSI ($OR = 1.42$). The two-way interactions were entered on step four and did not significantly predict odds of NSSI as a step, χ^2_{step} (3, 992) = 5.16, $p = .16$. However, the interaction between positive emotional perseveration and rumination was significant ($p = .04$), therefore it was interpreted for exploratory purposes. As depicted in Figure 1, there was a negative association between perseveration of positive emotion and NSSI at high levels of rumination ($b = -.33$, $z = -2.03$, $p = .04$, 95% CI [-0.64, -0.01]), but not at low levels of rumination ($b = .16$, $z = .91$, $p = .36$, 95% CI [-0.18, 0.49]). The final model (Table 3) was statistically significant, χ^2_{model} (10, 992) = 208.07, $p < .001$, accounting for between 18.9% (Cox & Snell R^2) and 25.9% (Nagelkerke R^2) of the variance in history of NSSI.

Insert Table 3 here

Insert Figure 1 here

Predicting Frequency of NSSI

Dimensions of Negative Emotion

In the first step, age, gender, and history of mental illness were entered as covariates and significantly predicted frequency of NSSI among participants who had a history of self-injury, χ^2 (3, 342) = 39.51, $p < .001$. The addition of negative emotional reactivity, intensity, and perseveration on step two was significant in predicting frequency of NSSI, χ^2 (6, 339) = 69.82, $p < .001$. However,

the individual dimensions of negative emotion did not make unique contributions to the model. Rumination in step 3 did not contribute unique variance to the model, $\chi^2 (1, 338) = .10$, $p = .76$. Although the final model (Table 4) was statistically significant, $\chi^2 (10, 335) = 74.23$, $p < .001$, the two-way interactions entered on step four did not contribute unique variance.

Dimensions of Positive Emotion

After controlling for age, gender, and history of mental illness, the addition of positive emotional reactivity, intensity, and perseveration on step two was significant in predicting frequency of NSSI, $\chi^2 (6, 339) = 75.78$, $p < .001$. Positive emotional perseveration was negatively associated with frequency of NSSI. Positive emotional reactivity and intensity were not significantly associated with frequency of NSSI. Rumination in step three did not contribute unique variance to the model, $\chi^2 (1, 338) = 2.75$, $p = .10$. Although the final model (Table 4) was statistically significant, $\chi^2 (10, 335) = 83.63$, $p < .001$, the two-way interactions entered on step four did not contribute unique variance.

Insert Table 4 here

Discussion

The negative associated outcomes of NSSI warrant further efforts to explain the mechanisms that underlie this complex behaviour. Adopting an emotional cascade framework, the aim of the current study was to investigate the roles of different dimensions of both negative and positive emotion, and their links with rumination, in NSSI. Overall, results partially support the hypotheses, with negative and positive emotional experience, as well as rumination, seeming to be important factors in understanding NSSI. Although not interacting with negative emotional reactivity, intensity, and perseveration, rumination interacted with positive emotional perseveration to predict odds of engaging in NSSI. Further, positive emotional perseveration was associated with reduced frequency of self-injury. These findings highlight the potential utility of considering positive emotion, and different dimensions of emotional experience in the Emotional Cascade Model, which may facilitate prevention and intervention efforts.

Consistent with previous research linking negative emotion to self-injury (Bresin, 2014; Victor & Klonsky, 2014), negative emotional reactivity, intensity, and perseveration were significantly correlated with NSSI in bivariate analyses. However, the dimensions of negative emotion were not uniquely associated with NSSI in multivariate analyses. Although unexpected, this finding is not without precedent, as the only previous study to examine these dimensions independently in an NSSI context found that differences between individuals with and without a history of NSSI, on each of the dimensions of negative emotion, were negated after adjusting for mental illness

diagnosis (Boyes et al., 2019). Nevertheless, as indicated by the combined contribution of the dimensions to the models, the role of negative emotion in the onset and maintenance of NSSI is clear (Selby & Joiner, 2009). As such, future research intending to disentangle the dimensions (as well as other conceptually related constructs, e.g. avoidance/intolerance of negative emotional states; Juarascio et al., 2020) and their associations with NSSI may prove valuable in advancing our understanding of self-injury. This might be achieved through the development of a more sensitive self-report measure that accurately tap into the dimensions of emotional reactivity, intensity, and perseveration. Alternatively, assessing responding to laboratory-based emotion-induction tasks that specifically target each dimension of emotion could be a worthy line of inquiry (Rudaizky & MacLeod, 2014).

Although rumination was not directly related to frequency of NSSI, it was associated with history of self-injury. Specifically, individuals with a greater tendency to ruminate were more likely to report a history of NSSI. Taken with existing literature linking rumination to self-injury (Arbuthnott et al., 2015; Selby et al., 2013; Slabbert et al., 2018), these results underscore the central influence that rumination may have on the onset of NSSI engagement. However, rumination did not interact with negative emotional reactivity, intensity, or perseveration to predict either odds or frequency of NSSI. This is particularly surprising given the well documented association between negative emotion and rumination (Nicolai et al., 2016; Nolen-Hoeksema, 1991; Selby & Joiner, 2009). Failure to observe such interactions may be attributed to the RTSQ, which does not distinguish between rumination on positive or negative stimuli, but rather is valence-neutral. It is possible that only ruminating on negative emotional experiences causes a cascade of negative emotion (Brinker & Dozois, 2009; Nolen-Hoeksema, 1991). Alternatively, an emotional cascade might be a more ongoing, dynamic process, whereby fluctuations in rumination prompt increases in negative emotion (Selby et al., 2013). As trait measures cannot capture such fluctuations, this may explain the absence of an interaction between rumination and the dimensions of negative emotion.

As expected, positive emotional reactivity, intensity, and perseveration were significantly correlated with NSSI in bivariate analyses. Additionally, multivariate analyses revealed that individuals who experienced higher levels of positive emotional reactivity were less likely to report a history of self-injury. Comparably, Boyes et al. (2019) found that people with a history of NSSI, relative to those with no history of self-injury, reported less positive emotional reactivity. Of note is that this NSSI-related difference remained significant after adjusting for history of mental illness (Boyes et al., 2019), as did the association between positive emotional reactivity and history of NSSI in the current study. That positive emotional reactivity was related to decreased odds of NSSI, but intensity did not differentiate between individuals with and without a history of

self-injury, suggests that experiencing positive emotional responses more often, as opposed to more strongly, may reduce the probability of NSSI. This finding is in accordance with prior research demonstrating that individuals who do not self-injure display heightened reactivity to positive stimuli, whereas people who engage in NSSI display dampened reactivity to such stimuli, especially under conditions of stress (Tatnell et al., 2018). It thus seems that one's ability to attend and respond to positive situations may be a key factor in the likelihood of whether they ever self-injure or not, however further work is needed to explore this possibility.

In relation to the involvement of the dimensions of positive emotion in emotional cascades, it appears that perseveration is of particular prominence, with rumination potentially moderating the relationship between positive emotional perseveration and history of self-injury. Although additional research is required to replicate this finding, positive emotional perseveration seems to be associated with reduced odds of NSSI among individuals with a greater tendency to ruminate. This may suggest that repetitively thinking about positive exchanges or events can extend the duration of positive emotional responses, and theoretically lead to a 'cascade' of persistent positive emotion. While cascades of intense positive emotion might be unpleasant for some (Gruber, 2011), results indicate that encountering positive emotional states continuously over time is linked to a decreased probability of NSSI. This conceivable explanation is consistent with past research that has found people with above average levels of positive rumination and positive emotion report less engagement in self-injury (Burke et al., 2018). These novel findings hence provides some empirical support for the possible role of positive emotional perseveration in the Emotional Cascade Model.

Similarly, positive emotional perseveration appears to be of importance when examining frequency of NSSI among individuals who have a history of self-injury. Within this group, perseveration was the only dimension of positive emotion that was associated with frequency of self-injury. These findings extend the burgeoning body of work demonstrating that the experience of positive emotion can be protective against NSSI (Boyes et al., 2019; Burke et al., 2018; Cohen et al., 2015; Hasking et al., 2018), by suggesting that positive emotional perseveration may play an especially significant role. While a lack of positive emotional reactivity could be a necessary antecedent to the decision to self-injure, an ongoing lack of positive emotion might be saliently involved in the maintenance of the behaviour. As such, there is a need for clinicians to focus on enhancing clients' recognition, acknowledgement, and savouring of positive situations and occurrences. Consequently, this could prolong the experience of positive emotion, which may both avert people from initiating NSSI and lessen how often others engage the behaviour.

Theoretical and Practical Implications

The results of this study are broadly in line with the Emotional Cascade Model, implying that certain aspects, namely negative emotion and rumination, could assist in explaining NSSI. However, the expected interactions between these variables were not observed, providing no evidence for emotional cascades of rumination and negative emotion occurring. Nonetheless, building on the existing model, the interaction between positive emotional perseveration and rumination may provide preliminary evidence for the occurrence of emotional cascades involving the duration of positive emotion, which may induce pleasant emotional states that subsequently reduce risk of NSSI onset. Since rates of Borderline Personality Disorder in the current sample were low and history of mental illness was controlled for in the analyses, this investigation extends the model outside the context of Borderline Personality Disorder. Should the relationships between the dimensions of positive emotion and NSSI be clarified, incorporating a dimensionalised view of positive emotional experience in the Emotional Cascade Model might be worthwhile to better predict and prevent self-injury.

Based on the current findings, prevention and intervention initiatives that focus on the acceptance of negative emotion may reduce the likelihood and frequency of NSSI engagement. Acceptance and Commitment Therapy (Hayes et al., 1999) could be particularly effective as it encourages people to embrace their uncomfortable thoughts and feelings, reducing the urge to eliminate them through behaviours such as NSSI. It also promotes the use of alternative strategies for emotion regulation that enable individuals to approach and tolerate negative emotions, instead of using self-injury to avoid or escape these experiences (Gratz, 2007). Additionally, therapeutic approaches aimed at decreasing rumination on negative experiences may be useful in preventing self-injury. One such approach is Rumination-Focused Cognitive Behavioural Therapy (Watkins et al., 2007), which is designed to target negative cyclical thought processes by helping people change habitual patterns of rumination. This may improve individuals' ability to control negative thoughts and shift attention away from feelings of distress (Watkins et al., 2011), hence minimising the need to reduce these feelings using self-injury.

The results of this study suggest that instead of merely attempting to lessen the effect of negative emotional experiences, it might be vital for programs to simultaneously foster the experience of positive emotion. Specifically, interventions that bolster positive emotional reactivity could be effective in reducing the likelihood of self-injury. For example, Mindfulness-Based Cognitive Therapy (Segal et al., 2002) aims to improve present-moment awareness, and may help people to notice and respond to positive events more frequently. This therapy has been found to boost positive emotion and decrease depression vulnerability (Keng et al., 2011), and could thus be applied in NSSI prevention or treatment settings to increase opportunity for

positive emotional experiences. Other interventions devised to promote 'savouring' (Bryant, 1989) may facilitate positive emotional perseveration, and might thereby prove fruitful in reducing risk of NSSI, as well as the severity of the behaviour among those who already self-injure. 'Savouring' involves strategies to enhance and sustain positive emotion, such as thinking back (i.e. ruminating) on positive experiences (Bryant & Veroff, 2007). Since such strategies have shown efficacy in alleviating symptoms of anxiety and depression (Quoidbach et al., 2010; Taylor et al., 2016), it may be beneficial to explore their utility in the context of NSSI. In addition, it would be necessary to evaluate the effectiveness of all proposed interventions, as to determine their ability to mitigate engagement in self-injury.

Limitations and Suggestions for Future Research

While the findings of the current study provide a greater understanding of how dimensions of negative and positive emotion, and rumination, are related to NSSI, some limitations should be noted. Firstly, the cross-sectional nature of the study precludes conclusions about temporal ordering being drawn (Rodriguez-Blanco et al., 2018). As the Emotional Cascade Model depicts how events unfold over time in the experience of an emotional cascade (Selby et al., 2013), future research could use Ecological Momentary Assessment methods to investigate the dynamic interplay between emotion and cognitions in real-time. Alternatively, experimental methods may better capture the nuanced relationships between the dimensions of emotion, rumination, and NSSI. The possibility of assessing reactivity, intensity, and perseveration of emotional states in laboratory settings has been demonstrated (Rudaizky & MacLeod, 2014), such as through the use of a film paradigm (Boyes et al., 2019). Future research could thus examine NSSI-related differences in responding across time, for example to emotion-induction tasks, using both self-report and psychophysiological measures that assess each dimension of emotion.

Lastly, the sample for this study comprised only university students, limiting the generalisability of findings. Although university students were purposely recruited for this study, due to the high prevalence and negative consequences of NSSI in this population, the relationships explored may manifest differently in clinical or treatment-seeking samples. It is possible that the levels of negative and positive emotion, as well as rumination, were not sufficiently high in the current sample to demonstrate the full range of relationships with NSSI. Moreover, of the individuals with a history of self-injury, many had self-injured few times or not at all over the last 12 months. This could have distorted the relationships observed and the significance of effects, potentially leading to inaccurate conclusions being drawn about frequency of NSSI. Clinical or treatment-seeking samples may experience more variability and engage in more frequent, recent self-injury. Therefore, further investigation into how the dimensions of emotion and rumination interact to predict NSSI within these populations is warranted.

Conclusion

In assessing dimensions of both negative and positive emotion, and the moderating role of rumination from an emotional cascade perspective, results indicate that although negative emotion is important, the experience of positive emotion may be salient in understanding NSSI. Notably, that rumination may interact with positive emotional perseveration to predict NSSI presents the possibility that repeated focus on positive situations might prolong the experience of positive emotion, and be protective against self-injury. Moving forward, researchers could consider the roles of different dimensions of positive emotion in conceptualisations of NSSI, and clinicians could target boosting positive emotion, perhaps through promoting savouring strategies, in order to reduce the likelihood and frequency of self-injury.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Sage.

Allen, P., Bennett, K., & Heritage, B. (2014). *SPSS statistics version 22: A practical guide* (3rd ed.). Cengage.

Arbuthnott, A. E., Lewis, S. P., & Bailey, H. N. (2015). Rumination and emotions in nonsuicidal self-injury and eating disorder behaviors: A preliminary test of the emotional cascade model. *Journal of Clinical Psychology*, *71*(1), 62-71. https://doi.org/10.1002/jclp.22115

Bornovalova, M., Matusiewicz, A., & Rojas, E. (2011). Distress tolerance moderates the relationship between negative affect intensity with borderline personality disorder levels. *Comprehensive Psychiatry*, *52*(6), 744-753. https://doi.org/10.1016/j.comppsych.2010.11.005

Boyes, M. E., Carmody, T. M., Clarke, P. J. F., & Hasking, P. A. (2017). Emotional reactivity and perseveration: Independent dimensions of trait positive and negative affectivity and differential associations with psychological distress. *Personality and Individual Differences*, *105*, 70-77. https://doi.org/10.1016/j.paid.2016.09.025

Boyes, M. E., Clarke, P. J. F., & Hasking, P. A. (2020). Relationships between dispositional and experimentally elicited emotional reactivity, intensity, and perseveration. *Personality and Individual Differences*, *152.* https://doi.org/10.1016/j.paid.2019.109573

Boyes, M. E., Wilmot, A., & Hasking, P. A. (2019). Nonsuicidal self-injury-related differences in the experience of negative and positive emotion. *Suicide and Life-Threatening Behaviour*, *50*(2), 437-448. https://doi.org/10.1111/sltb.12599

Bresin, K. (2014). Five indices of emotion regulation in participants with a history of nonsuicidal self-injury: A daily diary study. *Behavior Therapy*, *45*(1), 56-66. https://doi.org/10.1016/j.beth.2013.09.005

Brinker, J. K., & Dozois, D. J. A. (2009). Ruminative thought style and depressed mood. *Journal of Clinical Psychology*, *65*(1), 1-19. https://doi.org/10.1002/jclp.20542

Brumariu, L. E., & Kerns, K. A. (2013). Pathways to anxiety: Contributions of attachment history, temperament, peer competence, and ability to manage intense emotions. *Child Psychiatry and Human Development*, *44*(4), 504-515. https://doi.org/10.1007/s10578-012-0345-7

Bryant, F. B. (1989). A four-factor model of perceived control: Avoiding, coping, obtaining, and savoring. *Journal of Personality*, *57*(4), 773-797. https://doi.org/10.1111/j.1467-6494.1989.tb00494.x

Bryant, F. B., & Veroff, J. (2007). *Savoring: A new model of positive experience*. Lawrence Erlbaum.

Burke, T. A., McArthur, B., Daryanani, I., Abramson, L. Y., & Alloy, L. (2018). Latent classes of

trait affect and cognitive affective strategies are associated with depression, non-suicidal self-injury, and well-being. *Journal of Affective Disorders*, *225*, 180-187. https://doi.org/10.1016/j.jad.2017.08.015

Claes, L., Klonsky, E. D., Muehlenkamp, J., Kuppens, P., & Vandereycken, W. (2010). The affect-regulation function of nonsuicidal self-injury in eating-disordered patients: Which affect states are regulated? *Comprehensive Psychiatry, 51*(4), 386-392. https://doi.org/10.1016/j.comppsych.2009.09.001

Claes, L., Smits, D., & Bijttebier, P. (2014). The Dutch version of the emotion reactivity scale: Validation and relation with various behaviors in a sample of high school students. *European Journal of Psychological Assessment*, *30*(1), 73-79. https://doi.org/10.1027/1015-5759/a000171

Cohen, J. N., Stange, J. P., Hamilton, J. L., Burke, T. A., Jenkins, A., Ong, M., Heimberg, R. G., Abramson, L. Y., & Alloy, L. B. (2015). The interaction of affective states and cognitive vulnerabilities in the prediction of non-suicidal self-injury. *Cognition and Emotion*, *29*(3), 539-547. https://doi.org/10.1080/02699931.2014.918872

Dawkins, J. C., Hasking, P. A., Boyes, M. E., Greene, D., & Passchier, C. (2019). Applying a cognitive-emotional model to nonsuicidal self-injury. *Stress and Health*, *35*(1), 39-48. https://doi.org/10.1002/smi.2837

Gandhi, A., Luyckx, K., Baetens, I., Kiekens, G., Sleuwaegen, E., Berens, A., Maitra, S., & Claes, L. (2018). Age of onset of non-suicidal self-injury in Dutch-speaking adolescents and emerging adults: An event history analysis of pooled data. *Comprehensive Psychiatry*, *80*, 170-178. https://doi.org/10.1016/j.comppsych.2017.10.007

Glenn, C. R., Blumenthal, T. D., Klonsky, E. D., & Hajcak, G. (2011). Emotional reactivity in nonsuicidal self-injury: Divergence between self-report and startle measures. *International Journal of Psychophysiology*, *80*(2), 166-170. https://doi.org/10.1016/j.ijpsycho.2011.02.016

Glenn, C. R., & Klonsky, E. D. (2013). Nonsuicidal self-injury disorder: An empirical investigation in adolescent psychiatric patients. *Journal of Clinical Child and Adolescent Psychology, 42*(4), 496-507. https://doi.org/10.1080/15374416.2013.794699

Gratz, K. L. (2007). Targeting emotion dysregulation in the treatment of self-injury. *Journal of Clinical Psychology, 63*(11), 1091-1103. https://doi.org/10.1016/10.1002/jclp.20417

Gruber, J. (2011). Can feeling too good be bad? Positive emotion persistence (PEP) in bipolar disorder. *Current Directions in Psychological Science*, *20*(4), 217-221. https://doi.org/10.1177/0963721411414632

Hasking, P. A., Di Simplicio, M., McEvoy, P. M., & Rees, C. S. (2018). Emotional cascade theory

and non-suicidal self-injury: The importance of imagery and positive affect. *Cognition Emotion*, *32*(5), 941-952. https://doi.org/10.1080/02699931.2017.1368456

International Society for the Study of Self-injury. (2018). *What is self-injury?* https://itriples.org/about-self-injury/what-is-self-injury/

Jenkins, A. L., & Schmitz, M. F. (2012). The roles of affect dysregulation and positive affect in non-suicidal self-injury. *Archives of Suicide Research*, *16*(3), 212-225. https://doi.org/10.1080/13811118.2012.695270

Juarascio, A., Manasse, S., Clark, K. E., Schaumberg, K., Kerrigan, S., Goldstein, S. P., Evans, B. C., Wyckoff, E., Murray, H. B., Felonis, C. R., & Forman, E. (2020). Understanding the overlap and differences in terms describing patterns of maladaptive avoidance and intolerance of negative emotional states. *Personality and Individual Differences, 158*, 109859. https://doi.org/10.1016/j.paid.2020.109859

Keng, S., Smoski, M. J., & Robins, C. J. (2011). Effects of mindfulness on psychological health: A review of empirical studies. *Clinical Psychology Review*, *31*(6), 1041-1056. https://doi.org/10.1016/j.cpr.2011.04.006

Kiekens, G., Claes, L., Demyttenaere, K., Auerbach, R. P., Green, J. G., Kessler, R. C., Mortier, P., Nock, M. K., & Bruffaerts, R. (2016). Lifetime and 12-month nonsuicidal self-injury and academic performance in college freshmen. *Suicide and Life-Threatening Behavior*, *46*(5), 563-576. https://doi.org/10.1111/sltb.12237

Kiekens, G., Hasking, P. A., Boyes, M. E., Claes, L., Mortier, P., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Kessler, R. C., Myin-Germeys, I., Nock, M. K., & Bruffaerts, R. (2018). The associations between non-suicidal self-injury and first onset suicidal thoughts and behaviors. *Journal of Affective Disorders*, *239*, 171-179. https://doi.org/10.1016/j.jad.2018.06.033

Kiekens, G., Hasking, P. A., Claes, L., Boyes, M. E., Mortier, P., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Kessler, R. C., Myin-Germeys, I., Nock, M. K., & Bruffaerts, R. (2019). Predicting the incidence of non-suicidal self-injury in college students. *European Psychiatry*, *59*, 44-51. https://doi.org/10.1016/j.eurpsy.2019.04.002

Klonsky, E. D. (2009). The functions of self-injury in young adults who cut themselves: Clarifying the evidence for affect-regulation. *Psychiatry Research, 166*(2), 260-268. https://doi.org/10.1016/j.psychres.2008.02.008

Klonsky, E. D., & Glenn, C. R. (2009). Assessing the functions of non-suicidal self- injury: Psychometric properties of the inventory of statements about self-injury (ISAS). *Journal of Psychopathology and Behavioral Assessment*, *31*(3), 215-219. https://doi.org/10.1007/s10862-008-9107-z

Klonsky, E. D., Olino, T. M., La Greca, A. M., & Prinstein, M. J. (2008). Identifying clinically distinct

      subgroups of self-injurers among young adults: A latent class analysis. *Journal of*

      Consulting And Clinical Psychology, *76*(1), 22-27. https://doi.org/10.1037/0022-

      006X.76.1.22

Kranzler, A., Fehling, K. B., Lindqvist, J., Brillante, J., Yuan, F., Gao, X., Miller, A. L., & Selby, E. A.

      (2018). An ecological investigation of the emotional context surrounding nonsuicidal self-

      injurious thoughts and behaviors in adolescents and young adults. *Suicide and Life-*

      Threatening Behavior, 48(2), 149-159. https://doi.org/10.1111/sltb.12373

Lambert, D. (1992). Zero-Inflated Poisson regression, with an application to defects in

      manufacturing. *Technometrics*, *34*(1), 1-14.

      https://doi.org/10.1080/00401706.1992.10485228

Nicolai, K. A., Wielgus, M. D., & Mezulis, A. (2016). Identifying risk for self-harm: Rumination

      and negative affectivity in the prospective prediction of nonsuicidal self-injury. *Suicide*

      and Life-Threatening Behavior, *46*(2), 223-233. https://doi.org/10.1111/sltb.12186

Nock, M. K. (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.

      https://doi.org/10.1111/j.1467-8721.2009.01613.x

Nock, M. K., Wedig, M. M., Holmberg, E. B., & Hooley, J. M. (2008). The emotion reactivity

      scale: Development, evaluation, and relation to self-injurious thoughts and behaviors.

      Behavior Therapy, *39*(2), 107-116. https://doi.org/10.1016/j.beth.2007.05.005

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of

      depressive episodes. *Journal of Abnormal Psychology*, *100*(4), 569-582. https://doi.org/

      10.1037/0021-843X.100.4.569

Quoidbach, J., Berry, E., Hansenne, M., & Mikolajczak, M. (2010). Positive emotion

      regulation and well-being: Comparing the impact of eight savouring and dampening

      strategies. *Personality and Individual Differences*, *49*(5), 368-373.

      https://doi.org/10.1016/j.paid.2010.03.048

Ripper, C. A., Boyes, M. E., Clarke, P., & Hasking, P. A. (2018). Emotional reactivity, intensity,

      and perseveration: Independent dimensions of trait affect and associations with

      depression, anxiety, and stress symptoms. *Personality and Individual Differences*, *121*, 93-

      99. https://doi.org/10.1016/j.paid.2017.09.032

Rodriguez-Blanco, L., Carballo, J. J., & Baca-Garcia, E. (2018). Use of ecological momentary

      assessment (EMA) in non-suicidal self-injury (NSSI): A systematic review. *Psychiatry*

      Research, *263,* 212-219. https://doi.org/10.1016/j.psychres.2018.02.051

Rudaizky, D., & MacLeod, C. (2014). Anxiety reactivity and anxiety perseveration represent

independent dimensions of anxiety vulnerability: An in vivo study. *Anxiety, Stress, and Coping*, *27*(4), 361-375. https://doi.org/10.1080/10615806.2013.853047

Rudaizky, D., Page, A., MacLeod, C. (2012). Anxiety reactivity and anxiety perseveration represent dissociable dimensions of trait anxiety. *Emotion*, *12*(5), 903-907. https://doi.org/10.1037/a0025612

Santangelo, P., Koenig, J., Funke, V., Parzer, P., Resch, F., Ebner-Priemer, U., & Kaess, M. (2017). Ecological momentary assessment of affective and interpersonal instability in adolescent non-suicidal self-injury. *Journal of Abnormal Child Psychology*, *45*(7), 1429-1438. https://doi.org/10.1007/s10802-016-0249-2

Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse*. Guildford Press.

Selby, E. A., Franklin, J., Carson-Wong, A., & Rizvi, S. L. (2013). Emotional cascades and self-injury: Investigating instability of rumination and negative emotion. *Journal of Clinical Psychology*, *69*(12), 1213-1227. https://doi.org/10.1002/jclp.21966

Selby, E. A., & Joiner, T. E. (2009). Cascades of emotion: The emergence of borderline personality disorder from emotional and behavioral dysregulation. *Review of General Psychology*, *13*(3), 219-229. https://doi.org/10.1037/a0015687

Slabbert, A., Hasking, P. A., & Boyes, M. E. (2018). Riding the emotional roller coaster: The role of distress tolerance in non-suicidal self-injury. *Psychiatry Research*, *269*, 309-315. https://doi.org/10.1016/j.psychres.2018.08.061

Smith, K. E., Hayes, N., Styer, D., & Washburn, J. J. (2017). Emotional reactivity in a clinical sample of patients with eating disorders and nonsuicidal self-injury. *Psychiatry Research*, *257*, 519-525. https://doi.org/10.1016/j.psychres.2017.08.014

Swannell, S. V., Martin, G., Page, A., Hasking, P. A., & St John, N. J. (2014). Prevalence of nonsuicidal self-injury in nonclinical samples: Systematic review, meta-analysis and meta-regression. *Suicide and Life-Threatening Behavior*, *44*(3), 273-303. https://doi.org/10.1111/sltb.12070

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Pearson.

Tatnell, R., Hasking, P. A., Lipp, O. V., Boyes, M. E., & Dawkins, J. (2018). Emotional responding in NSSI: Examinations of appraisals of positive and negative emotional stimuli, with and without acute stress. *Cognition and Emotion*, *32*(6), 1304-1316. https://doi.org/10.1080/02699931.2017.1411785

Taylor, P. J., Jomar, K., Dhingra, K., Forrester, R., Shahmalak, U., & Dickson, J. M. (2018). A meta-analysis of the prevalence of different functions of non-suicidal self-injury. *Journal of Affective Disorders*, *227*, 759-769. https://doi.org/10.1016/j.jad.2017.11.073

Taylor, C., Lyubomirsky, S., & Stein, M. (2016). Upregulating the positive affect system in anxiety and depression: Outcomes of a positive activity intervention. *Depression and Anxiety*, *34*(3), 267-280. https://doi.org/10.1002/da.22593

Tonta, K. E., Hasking, P. A., Boyes, M. E., Howell, J., McEvoy, P., & Kiekens, G. (2020). Measurement invariance of three brief measures of rumination in young adults with and without a history of self-injury. *European Journal of Psychological Assessment*, 1-8. https://doi.org/10.1027/1015-5759/a000605

Victor S. E., & Klonsky E. D. (2014). Daily emotion in non-suicidal self-injury. *Journal of Clinical Psychology*, *70*(4), 364-375. https://doi.org/10.1002/jclp.22037

Watkins, E. R., Mullan, E., Wingrove, J., Rimes, K., Steiner, H., Bathurst, N., Eastman, R., & Scott, J. (2011). Rumination-focused cognitive–behavioural therapy for residual depression: Phase II randomised controlled trial. *British Journal of Psychiatry*, *199*(4), 317-322. https://doi.org/10.1192/bjp.bp.110.090282

Watkins, E. R., Scott, J., Wingrove, J., Rimes, K., Bathurst, N., Steiner, H., Kennell–Webb, S., Moulds, M., & Malliaris, Y. (2007). Rumination-focused cognitive behaviour therapy for residual depression: A case series. *Behaviour Research and Therapy*, *45*(9), 2144-2154. https://doi.org/10.1016/j.brat.2006.09.018

Watson, D., Clark, L., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063-1070. https://doi.org/10.1037/0022-3514.54.6.1063

Table 1

Descriptive Statistics and Correlations between Variables in the Regression Models that include Dimensions of Negative Emotion

Variable	History of NSSI		No History of NSSI									
	M (SD)	Range	M (SD)	Range	Cohen's d	2	3	4	5	6	7	8	9
1. Age	21.55 (4.12)	31	21.81 (5.80)	47	—	.00	.13***	-.02	-.09	-.14***	-.15***	-.14***	-.16***
2. Gender[a]	—	—	—	—	—	—	—	—	.03	.22***	.14***	.20***	.13***
3. History of mental illness[b]	—	—	—	—	—		—	—	.18***	.27***	.28***	.31***	.21***
4. History of NSSI[c]	—	—	—	—	—			—	—	.23***	.26***	.28***	.24***
5. Frequency of NSSI[d]	1.72 (2.00)	5	—	—	—				—	.21***	.23***	.23***	.14
6. Negative emotional reactivity	33.43 (9.20)	40	28.96 (8.96)***	40	-0.49					—	.70***	.68***	.43***
7. Negative emotional intensity	32.32 (9.03)	40	27.49 (8.14)***	40	-0.57						—	.75***	.45***
8. Negative emotional perseveration	32.18 (8.30)	40	27.30 (8.06)***	40	-0.60							—	.54***
9. Rumination	103.26 (21.23)	120	92.00 (22.69)***	120	-0.51								—

Note. Associations between dichotomous and continuous variables are point bi-serial correlations. Group differences were tested using Independent Samples *t* Tests.

[a] Male = 1, Female = 2. [b] No history of mental illness = 0, History of mental illness = 1. [c] No history of NSSI = 0, History of NSSI = 1. [d] Frequency of NSSI in the last year, among subsample with a history of self-injury.

**p < .01. ***p < .001.

Table 2

Descriptive Statistics and Correlations between Variables in the Regression Models that include Dimensions of Positive Emotion

Variable	History of NSSI		No History of NSSI		Cohen's d	2	3	4	5	6	7	8	9
	M (SD)	Range	M (SD)	Range									
1. Age	21.55 (4.12)	31	21.81 (5.80)	47	—	.00	.13***	-.02	-.09	.00	-.02	.03	-.16***
2. Gender[a]	—	—	—	—	—	—	—	—	.03	.04	-.06	-.03	.13***
3. History of mental illness[b]	—	—	—	—	—		—	—	.18***	-.18***	-.13***	-.22***	.21***
4. History of NSSI[c]	—	—	—	—	—			—	—	-.20***	-.13***	-.19***	.24***
5. Frequency of NSSI[d]	1.72 (2.00)	5	—	—	—				—	-.21***	-.16**	-.24***	.14
6. Positive emotional reactivity	31.09 (8.01)	40	34.23 (7.33)***	40	0.41					—	.60***	.65***	-.13***
7. Positive emotional intensity	28.69 (8.01)	40	30.77 (7.46)***	40	0.27						—	.70***	-.03
8. Positive emotional perseveration	27.20 (7.49)	38	30.15 (6.99)***	40	0.41							—	-.13***
9. Rumination	103.26 (21.23)	120	92.00 (22.69)***	120	-0.51								—

Note. Associations between dichotomous and continuous variables are point bi-serial correlations. Group differences were tested using Independent Samples *t* Tests.

[a] Male = 1, Female = 2. [b] No history of mental illness = 0, History of mental illness = 1. [c] No history of NSSI = 0, History of NSSI = 1. [d] Frequency of NSSI in the last year, among subsample with a history of self-injury.

**p < .01. ***p < .001.

Table 3

Logistic Regression Analyses Predicting Odds of NSSI

	Dimensions of Negative Emotion				Dimensions of Positive Emotion		
Variable	B (S.E.)	Odds Ratio [95% CI]	Wald	Variable	B (S.E.)	Odds Ratio [95% CI]	Wald
Constant	-1.43 (.18)***	.24	66.09	Constant	-1.56 (.17)***	.21	80.75
Age	-0.08 (.08)	0.92 [0.79, 1.08]	0.95	Age	-0.13 (.08)	0.88 [0.75, 1.04]	2.39
Gender	0.46 (.19)*	1.58 [1.10, 2.28]	6.14	Gender	0.56 (.19)**	1.75 [1.22, 2.52]	9.16
History of mental illness	1.51 (.17)***	4.53 [3.28, 6.26]	83.45	History of mental illness	1.54 (.16)***	4.66 [3.38, 6.42]	88.45
Negative emotional reactivity	-0.04 (.11)	0.96 [0.77, 1.20]	0.14	Positive emotional reactivity	-0.26 (.10)*	0.77 [0.63, 0.94]	6.46
Negative emotional intensity	0.21 (.12)	1.23 [0.97, 1.57]	2.80	Positive emotional intensity	0.00 (.11)	1.00 [0.81, 1.24]	0.00
Negative emotional perseveration	0.14 (.13)	1.15 [0.90, 1.47]	1.28	Positive emotional perseveration	-0.09 (.12)	0.92 [0.73, 1.15]	0.53
Rumination	0.27 (.09)**	1.30 [1.09, 1.56]	8.35	Rumination	0.36 (.08)***	1.43 [1.22, 1.68]	19.14
Negative emotional reactivity X rumination	0.11 (.12)	1.12 [0.89, 1.41]	0.93	Positive emotional reactivity X rumination	0.04 (.09)	1.04 [0.86, 1.25]	0.17
Negative emotional intensity X rumination	0.08 (.13)	1.09 [0.85, 1.39]	0.45	Positive emotional intensity X rumination	0.09 (.10)	1.10 [0.90, 1.35]	0.83
Negative emotional perseveration X rumination	-0.21 (.12)	0.82 [0.64, 1.03]	2.84	Positive emotional perseveration X rumination	-0.24 (.12)*	0.79 [0.62, 0.99]	4.12

Note. CI = confidence interval.
*p < .05. **p < .01. ***p < .001.

Table 4

Poisson Regression Analyses Predicting Frequency of NSSI in the Last Year

Dimensions of Negative Emotion				Dimensions of Positive Emotion			
Variable	B (S.E)	IRR [95% CI]	Wald χ^2	Variable	B (S.E)	IRR [95% CI]	Wald χ^2
Intercept	0.54 (.11)***	1.71 [1.39, 2.11]	24.85	Intercept	0.53 (.10)***	1.70 [1.40, 2.07]	26.74
Age	-0.18 (.13)	0.83 [0.64, 1.08]	1.94	Age	-0.20 (.12)	0.82 [0.64, 1.05]	2.51
Gender	0.06 (.19)	1.06 [0.73, 1.55]	0.10	Gender	-0.01 (.20)	0.99 [0.68, 1.43]	0.01
History of mental illness	-0.37 (.13)**	0.69 [0.53, 0.90]	7.76	History of mental illness	-0.34 (.13)**	0.71 [0.55, 0.92]	7.03
Negative emotional reactivity	0.01 (.11)	1.01 [0.81, 1.27]	0.01	Positive emotional reactivity	-0.12 (.10)	0.90 [0.74, 1.09]	1.22
Negative emotional intensity	0.18 (.10)	1.19 [0.98, 1.46]	2.92	Positive emotional intensity	0.08 (.12)	1.09 [0.86, 1.37]	0.47
Negative emotional perseveration	0.06 (.11)	1.06 [0.85, 1.33]	0.26	Positive emotional perseveration	-0.23 (11)*	0.79 [0.64, 0.99]	4.40
Rumination	0.04 (.09)	1.05 [0.88, 1.25]	0.25	Rumination	0.15 (.10)	1.16 [0.97, 1.38]	2.64
Negative emotional reactivity X rumination	0.09 (.09)	1.09 [0.92, 1.30]	1.00	Positive emotional reactivity X rumination	0.05 (.08)	1.05 [0.89, 1.24]	0.36
Negative emotional intensity X rumination	-0.15 (.09)	0.86 [0.72, 1.04]	2.48	Positive emotional intensity X rumination	-0.08 (.11)	0.92 [0.75, 1.14]	0.55
Negative emotional perseveration X rumination	0.07 (.10)	1.07 [0.88, 1.29]	0.46	Positive emotional perseveration X rumination	0.07 (.09)	1.07 [0.90, 1.28]	0.58

Note. IIR = incidence rate ratio. CI = confidence interval.

*p < .05. **p < .01. ***p < .001.

Figure 1.

The relationship between perseveration of positive emotion and odds of NSSI is moderated by rumination. High and low values are defined as one standard deviation above and below the mean.