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Emotion-related impulsivity and rumination: Unique and conjoint effects on suicidal ideation, suicide attempts, and nonsuicidal self-injury across two samples

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Abstract

Introduction: Rumination and emotion-related impulsivity predict suicidal ideation, suicide attempts, and nonsuicidal self-injury (NSSI). Because rumination and emotion-related impulsivity, though, are highly correlated, we consider their unique vs. conjoint influence on suicidal ideation and self-harm.

Method: Across two samples of adults (N 's = 171 and 191), we examined how rumination and emotion-related impulsivity relate to suicidal ideation, suicide attempts, and NSSI. We assess the more general process of repetitive negative thinking and the more specific process of suicide-related rumination. Participants completed the Three-Factor Impulsivity Index and the self-report Columbia-Suicide Severity Rating Scale. Those in sample 1 completed the Perseverative Thinking Questionnaire and the Deliberate Self-Harm Inventory, and those in Sample 2 completed the Suicide Rumination Scale.

Results: Emotion-related impulsivity and both forms of rumination showed robust bivariate correlations with suicidal ideation, suicide attempts, and NSSI. Neither rumination or impulsivity related to suicide attempts controlling for ideation or to NSSI. In multivariable analyses, emotion-related impulsivity but not general rumination was tied to suicidal ideation. In contrast, suicide-related rumination was more directly tied to suicidal ideation than was impulsivity.

Conclusions: Findings provide support for a more nuanced approach to the forms of impulsivity and rumination related to suicidal ideation.

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AUTHOR CONTRIBUTIONS

Sheri L Johnson: Conceptualization (equal); Formal analysis (equal); Funding acquisition (equal); Investigation (equal); Methodology (equal); Supervision (equal); Validation (equal); Writing – original draft (equal). **Morgan Robison:** Conceptualization (supporting); Data curation (supporting); Writing – review & editing (supporting). **Sarah Anvar:** Conceptualization (supporting); Data curation (supporting); Investigation (supporting); Methodology (supporting); Writing – review & editing (supporting).

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

Keywords

emotion-related impulsivity; nonsuicidal self-injury; rumination; suicidal ideation; suicide attempt

INTRODUCTION

For decades, impulsivity has been conceptualized as one trigger of suicidality and nonsuicidal self-injury (Nock, 2010; Orden et al., 2010). Findings from empirical studies, however, have been decidedly mixed (McHugh et al., 2019). Impulsivity, though, may be an overly broad concept in that various dimensions of impulsivity are only modestly correlated and show differential links with outcomes (Cyders & Smith, 2008; Whiteside & Lynam, 2001).

Suicidality and self-harm indices are particularly relevant to a specific form of impulsivity: emotion-related impulsivity, defined as the tendency toward rash and regrettable thought, behavior, and speech during states of high emotion. In one meta-analysis, emotion-related impulsivity was significantly related to a composite of suicidality and NSSI, $r = 0.25$, and the effect size for emotion-related impulsivity was larger than those for other forms of impulsivity, such as sensation seeking, lack of perseverance, and lack of premeditation (Berg et al., 2015). In a second meta-analysis, emotion-related impulsivity correlated strongly with the presence of nonsuicidal self-injury (NSSI), $d = 0.59$ (Hamza et al., 2015). Emotion-related impulsivity has also been linked to specific facets of suicidality, including suicidal ideation, to endorsing greater likelihood of dying in a future suicide attempt (Miller et al., 2003), and to suicide attempts (Anestis et al., 2012; Anestis & Joiner, 2011; Johnson et al., 2017; Klonsky & May, 2010). Some work links emotion-related impulsivity to increased risk of suicide attempts when controlling for suicidal ideation (Auerbach et al., 2017), but other work has not confirmed this pattern (Klonsky & May, 2010). In longitudinal work, emotion-related impulsivity has predicted risk of suicide attempts, faster time to suicide attempts among those at risk, and the onset of NSSI (Kasen et al., 2011; Riley et al., 2015; Yen et al., 2009). In short, multiple studies indicate that emotion-related impulsivity is related to NSSI, suicidal ideation, and suicide attempts.

One question though is whether these effects of emotion-related impulsivity are direct or better explained by a third variable. Specifically, emotion-related impulsivity is closely tied to emotion regulation difficulties (Juarascio et al., 2020), and those, in turn, have also been tied to suicidal ideation and NSSI (Hatkevich et al., 2019; McKenzie & Gross, 2014). Here, we focus on understanding the conjoint and unique contributions of emotion-related impulsivity and ruminative thought tendencies. Critically, we consider both the specific tendency to ruminate about suicidal ideation, along with the more general tendency to engage in repetitive negative thinking (RNT). In contrast to suicide-related rumination, RNT reflects a process of cyclical engagement with negative thoughts, regardless of content.

Repetitive negative thinking, particularly general rumination, has been found to be correlated with suicidal ideation (Morrison & O'Connor, 2008). In addition to ideation, rumination has been found to be related to higher rates of suicide attempts among persons who experience suicidal ideation (Dhingra et al., 2015; Yaseen et al., 2012), although others have found

that persons with a history of suicide attempts did not differ from those with ideation alone in their brooding levels (Crane et al., 2007). Beyond the cross-sectional findings, in prospective research, rumination has predicted suicidal ideation and behavior (Kalebi et al., 2001; Miranda & Nolen-Hoeksema, 2007; O'Connor & Noyce, 2008). Across 13 studies, researchers found that rumination correlated robustly with suicidal ideation, Hedge's $g = 0.74$, and modestly with suicide attempts, Hedge's $g = 0.26$ (Rogers & Joiner, 2017). The effects for general rumination were numerically larger (although not significantly so) than the effects of the more specific brooding form of rumination (Rogers & Joiner, 2017), suggesting that the perseverative quality of the thought might matter more than specific sub-processes or specific content (Ehring & Watkins, 2009). Accordingly, we focus on general RNT here.

Repetitive negative thinking is also conceptually and empirically related to NSSI. For example, according to the emotional cascade model of repetitive self-harm (Selby et al., 2008), when individuals vulnerable to self-harm experience an emotion-eliciting event, they are likely to ruminate, which intensifies negative emotions. In turn, these negative emotions foster more rumination, iteratively contributing to an escalation of distress. To escape from intolerable pain, individuals may choose destructive behaviors, including NSSI, as one way to break the cycle of maladaptive attention to distress. Consistent with theory, researchers have found that RNT is elevated among persons who engage in NSSI (Hoff & Muehlenkamp, 2009; although see Selby et al., 2009), and longitudinally predicts greater likelihood, frequency, and medical severity of NSSI (Nicolai et al., 2016; Selby et al., 2010; Voon et al., 2014). In sum, like emotion-related impulsivity, RNT has been tied to suicidal ideation, attempts, and NSSI, and to the transition from ideation to attempts.

Emotion-related impulsivity is conceptually and empirically related to rumination. Both involve failures of top-down control over responses to emotion (Carver & Johnson, 2018). Moreover, within the emotional cascade model, rumination is expected to lead to many of the same maladaptive behaviors—such as disordered eating, substance abuse, or NSSI, that have been tied to emotion-related impulsivity (Berg et al., 2015; Selby et al., 2008). Empirically, multiple researchers have shown that rumination is related to emotion-related impulsivity, both cross-sectionally, with r 's = 0.25–0.52 (Bravo et al., 2019; Hasegawa et al., 2018; Jungmann et al., 2016; Rebetz et al., 2018; Valderrama & Miranda, 2017; Wang & Borders, 2018), and prospectively (Selby et al., 2008). Conceptually, then, it is important to consider the conjoint and separable effects of emotion-related impulsivity and rumination on suicidal ideation and attempts, and on NSSI.

Several articles have shown that emotion-related impulsivity can exert separate, unique influences on psychopathology when controlling for rumination, including on gambling, depression, procrastination, and eating disorder pathology (Hasegawa et al., 2018; Rebetz et al., 2018; Ruiz de Lara et al., 2019; Wang & Borders, 2018). Findings have varied in whether rumination is significantly correlated to these outcomes when controlling for emotion-related impulsivity, with some positive findings (Hasegawa et al., 2018; Ruiz de Lara et al., 2019), and some negative findings (Rebetz et al., 2018; Wang & Borders, 2018). We are aware of only one study, though, that has considered the separable and overlapping influences of emotion-related impulsivity and rumination on suicidality. In one conjoint

analysis, Negative Urgency, but not the brooding facet of rumination, was related to suicidal ideation both cross-sectionally and prospectively (Valderrama & Miranda, 2017).

Here, we extend previous work in three ways. First, we consider suicide attempts and NSSI in addition to suicidal ideation. Second, we consider two distinct forms of emotion-related impulsivity. Most of the work on emotion-related impulsivity has focused on impulsive speech and action in response to emotion states, which we capture using the Feelings Trigger Action scale. A second form of emotion-related impulsivity, labeled as Pervasive Influence of Feelings, refers to unconstrained thought and motivational responses to mostly negative emotion states (Carver et al., 2011). This inability to constrain cognitive responses to negative emotion would seem particularly likely to be tied to rumination, as both capture problems with control over thoughts.

Third, in addition to considering RNT, we consider tendencies to ruminate specifically about suicidal ideation. Beyond general tendencies toward perseverative thinking, suicidal ideation is tied to an attentional bias and cognitive fixation on suicide-related stimuli (Rogers et al., 2021). Accordingly, it has been argued that the combined effect of perseverative thinking coupled with a focus on suicidal ideation might be particularly pernicious. The Suicide Rumination Scale was developed to capture this combination (Rogers, Gorday, et al., 2021), and it has been shown to be statistically separable from general rumination, $r = 0.39$ (Rogers & Joiner, 2018a). Of more import, suicide-related rumination has been shown to correlate with number of lifetime suicide attempts more closely than did a measure of general rumination, and to differentiate those with and without suicide attempts even when controlling for general rumination (Rogers & Joiner, 2018a). Given that suicide-related rumination involves a failure of control over thoughts in reference to the distressing content area of suicide, one would expect a particularly strong correlation of Pervasive Influence of Feelings with this form of rumination. Taken together, our aim was to extend knowledge regarding the breadth of self-harm outcomes, and to provide more nuanced information about the most important aspects of emotion-related impulsivity and rumination.

In two independent samples, we examine the unique and conjoint links of emotion-related impulsivity and rumination in relation to suicidal ideation, suicide attempts, and NSSI. In the first sample, we assessed RNT as measured with the Perseverative Thought Questionnaire (PTQ), and assessed suicidal ideation, suicide attempts, and NSSI. In the second, we focused on suicide-related rumination in a sample of persons who reported suicidal ideation. In the second sample, we did not examine NSSI given that the content of the Suicide Rumination scale focuses only on suicidal ideation.

We hypothesized that Pervasive Influence of Feelings, and to a smaller extent, Feelings Trigger action would be correlated with higher RNT and higher suicide-related rumination. We hypothesized that controlling for rumination, Pervasive Influence of Feelings would be related to higher severity of suicidal ideation, greater likelihood of lifetime suicide attempts, and greater likelihood of lifetime NSSI. Hypotheses, anticipated sample size, and data analysis were pre-registered on OSF (Sample 1: <https://osf.io/4yjhb>, Sample 2: https://osf.io/ntqzy/?view_only=0da328e991de44e382dd23925a8f384c).

METHOD

Ethics

All study procedures were approved by the institutional review boards before data collection began (Sample 1 University of Miami IRB number 20130686; Sample 2 University of California Berkeley CPHS 2021–08-14566). APA ethical principles were followed in the conduct of the research. All potential participants completed informed consent procedures online before completing study measures.

Participants and procedures

An advertisement for the survey was posted to Amazon Mechanical Turk (MTurk) users in the United States who speak English and were adults ages 18 and older. For both samples, informed consent and data collection occurred online via Qualtrics (Qualtrics, Provo, Utah). Participants were paid for completion of surveys commensurate with general MTurk procedures. Both samples completed some measures not used in the current report (see pre-registration for details). Examination of MTurk IDs indicated that samples were entirely non-overlapping.

Sample 1—Sample 1 was gathered between May 12, 2020, and July 7, 2020. To avoid potential exhaustion, participants in sample 1 completed measures in two sessions, which were completed within a week of each other (mean = 5.6 days); all measures for this paper were given in the first session, except the PTQ, which was administered in session 2. Some participants were recruited to complete survey 1 without regard to self-harm. Others were invited based on endorsement of self-harm behavior, including nonsuicidal self-injury ($n = 113$) or a history of suicide attempt ($n = 53$). Of the initial survey takers ($N = 518$), participants were removed from the data set for data quality concerns, using recommended procedures (Meade & Craig, 2012). Fifteen were excluded for duplicate Mturk IDs, 74 for careless responding (e.g., inconsistency in pre-screen and session 1 responses concerning suicidality, failing attention items), and 8 were excluded for completing the survey in <10 min. Of the 421 with valid data, only 267 accepted the invitation to S2. Of those, 13 were excluded for duplicate Mturk ids, 26 for careless responding and 12 who did not complete the PTQ. This resulted in a sample size of $N = 171$ for analyses.

Sample 2—Sample 2 was gathered between November 30 and December 15, 2020. Participants completed a prescreening survey to assess inclusion criteria of suicidal ideation during their lifetime, and exclusion criteria of self-reported history of psychosis, dementia, or neurological disorder. One attention check (“dog is to cat as puppy is to:”) was included in the prescreening survey. Those who passed criteria and the attention check item were invited to take part in the main study, which consisted of a single session.

Of the 293 who passed the screening survey and so were invited to continue to the main study, 276 (94%) chose to do so. Of those, 53 were excluded from analyses for incompleteness or careless responding (e.g., failing to correctly respond to attention checks or providing inconsistent responses regarding ideation from pre-screen to main survey, or endorsing ASAD but then reporting that their ideation or intent had diminished rather than

intensified; Meade & Craig, 2012). Of the 223 remaining, those who did not endorse active suicidal ideation were excluded from completion of the suicide-rumination scale, such that the final sample for analysis was 191.

Measures

Both samples completed the Three-factor Impulsivity Index (TFII) and the Self-rated Columbia-Suicide Severity Rating Scale. To assess rumination, participants in sample 1 completed the Perseverative Thinking Questionnaire (PTQ); participants in study 2 completed the Suicide Rumination Scale. Only participants in sample 1 completed the Deliberate Self-Harm Inventory (DSHI).

Three-Factor Impulsivity Index—The TFII was developed to capture trait-like tendencies toward emotion-related and non-emotion-related impulsivity (Carver et al., 2011). Scale items were drawn from previously validated impulsivity scales and novel content. Factor analyses supported three subscales. *Pervasive Influence of Feelings* (PIF) covers tendencies toward poor constraint over motivation and cognition in the face of mostly negative emotions, including amotivation and extreme negative thoughts about the self and the future. *Feelings Trigger Actions* (FTA) captures tendencies to engage in regrettable speech and behavior in response to positive and negative emotions and includes items from the Positive Urgency and Negative Urgency subscales (Whiteside & Lynam, 2001). *Lack of Follow-Through* (LFT) includes items with no reference to emotion, including items from the Lack of Perseverance (Whiteside & Lynam, 2001), the Brief Self-Control Scale (scored in reverse, Tangney et al., 2004), the Laziness subscale (Jackson et al., 2010), and novel distractibility items. Scores reflect averages of the parcels within each subscale, with a possible range from 1 to 5. Previous research has shown that both forms of emotion-related impulsivity are more robustly related to suicidality and NSSI indices than are non-emotion-related impulsivity; Pervasive Influence of Feelings is particularly correlated with suicidal ideation, and Feelings Trigger Action is particularly correlated with suicide attempts and NSSI (Auerbach et al., 2017).

Columbia-Suicide Severity Rating Scale—Participants completed the 15-item self-rated Columbia-Suicide Severity Rating Scale (CSSR), a commonly used and well-validated survey of suicidal ideation and behavior (Posner et al., 2011). Past year ideation intensity was coded based on the most severe ideation endorsed, ranging from none (0), to passive death wish (1), to active suicidal ideation (2), to intention (3), and to plans (4). Participants also were asked the CSSR item concerning whether they had made any lifetime suicide attempt, “Have you made a suicide attempt or done anything to harm yourself because you wanted to die (even if you were not totally sure you wanted to die or just wanted to die a little bit)?” For those who endorsed an attempt, number of lifetime attempts was queried.

Deliberate Self-Harm Inventory—Participants in sample 1 completed the DSHI, which covers 17 common forms of NSSI (e.g., cutting, burning) and has been shown to have adequate construct, convergent and discriminant validity, and test–retest reliability (DSHI; Gratz, 2001). Participants were asked to describe only self-harm behavior that was intentional, not accidental, and not intended to kill themselves. To assess recurrence,

participants were asked to identify how many days they engaged in NSSI in the past year and in their lifetime.

Perseverative Thinking Questionnaire—Participants in sample 1 completed the PTQ, a 15-item self-report measure designed to assess trait-like tendencies toward repetitive negative thinking (Ehring et al., 2011). Participants were asked questions such as “My thoughts prevent me from focusing on other things” with answers ranging from never (0) to almost always (4). Although items cover repetition of thoughts, intrusiveness of the repetitive thoughts, and interference from those thoughts, most of the variance in PTQ scores is explained by a general factor, and so we relied on the total score here (McEvoy et al., 2018). The total score (possible range 0–60) has shown good internal consistency ($\alpha = 0.94$ – 0.95) and adequate 4-week test–retest reliability ($r = 0.69$) (McEvoy et al., 2018). Although the Ruminative Responses scale has been more commonly used to assess rumination, it has been criticized for including items that could reflect depressive symptoms (e.g., “Think about your feelings of fatigue and achiness”). The PTQ has the advantage that items are focused on perseverative thinking as a process without reference to any specific symptom content, including depression.

Suicide Rumination Scale—Participants in sample 2 completed the SRS, an 8-item self-report measure assessing the trait-like tendency to ruminate on thoughts, intentions, and plans related to suicide. The first item on the SRS screens for whether a person has experienced active ideation beyond passive death wish (for example, “ever had thoughts of suicide or pictured yourself dying by suicide?”); 32 persons who denied active ideation were not asked to complete the SRS. Those who endorsed active ideation were asked to rate a series of rumination-related items regarding times when they had felt suicidal (e.g., “cannot turn off these thoughts”) on a scale ranging from 1 (Almost never) to 5 (Almost always). Scores are summed with higher total scores reflecting more severity (possible range 8–40). The SRS has demonstrated strong psychometric properties across several samples (Rogers et al., 2021; Rogers, Gorday, et al., 2021; Rogers & Joiner, 2018b), and internal consistency in the present study was high ($\omega = 0.93$). The first four items on the SRS cover repetitive thoughts about the suicidal ideation (e.g., “cannot ‘turn off’ these thoughts,” “cannot escape these thoughts,” “am unable to stop thinking about suicide”). The last four items cover features of the ideation (“think about how I want to kill myself,” “imagine what killing myself with different methods would be like,” “imagine the process of how I want to kill myself,” and “wonder what the fastest and easiest way to die”). To ensure that findings were not confounded by the severity of ideation, we used the 8-item score in core analyses but conducted supplemental analyses excluding the last 4 items.

Data analysis

As preliminary analyses, we examined whether distributions of key variables approximated normalcy, and we examined bivariate correlations among key variables in both samples. We examined whether participants who completed the second session in sample 1 differed from those who attrited. We also assessed whether the two samples were comparable in age and gender. We present correlations of key variables with demographic variables.

To test hypotheses, we constructed parallel hierarchical linear regression models, each with gender and age controlled in block 1, the rumination scale in block 2, and emotion-related impulsivity (Pervasive Influence of Feelings, Feelings Trigger Action) and non-emotion-related impulsivity (Lack of Follow Through) in block 3. Given the relatively low rates of behavior in the past year, we focus on lifetime (presence or absence) of suicide attempts and NSSI. In both samples, we constructed parallel regression models to examine the outcome variable of past year severity of suicidal ideation. In both samples, we also constructed binomial regression models to examine the outcome variable of lifetime presence or absence of a suicide attempt, controlling for suicidal ideation. In sample 1 only, we examined the outcome variable of presence or absence of NSSI using a binomial regression model. Confidence intervals and p values were bootstrapped using SPSS procedures, with case resampling with replacement from the original data and 1000 bootstrap samples, to increase robustness against violations of multivariate distributional assumptions in the context of small samples.

Analyses were conducted using IBM SPSS Statistics for Windows, version 27 (IBM Corp.). Alpha was set to 0.05, and two-tailed tests were used.

RESULTS

Descriptive statistics for both samples are shown in Table 1. The two samples did not differ significantly in mean age, $t(392) = 1.637$, $p = 0.10$, or gender, chi-square (2) = 4.842, $p = 0.09$. As expected, the frequency of NSSI or suicide attempts were highly skewed and leptokurtic but all variables that were the focus of analyses approximated normalcy.

Within sample 1, those who did ($n = 161$) and did not ($n = 242$) complete session 2 did not differ significantly on age, $t(402) = -1.231$, $p = 0.21$, Feelings Trigger Action, $t(366.88) = -0.57$, $p = 0.57$, Lack of Follow-Through, $t(402) = 0.100$, $p = 0.91$, intensity of past year suicidal ideation, $t(309.84) = -1.56$, $p = 0.13$, or likelihood of engagement in lifetime NSSI, $t(328.95) = -1.29$, $p = 0.20$. Compared to those who only completed session 1, those who also completed session 2 endorsed higher Pervasive Influence of Feelings, $M_s = 2.86$ vs. 2.62, $t(402) = -2.405$, $p = 0.04$, and greater likelihood of endorsing a lifetime suicide attempt, 0.29 vs. 0.16, $t(293.85) = -3.14$, $p = 0.004$, and were more likely to be female (51.5% vs. 39.2%), chi-square (2) = 6.196, $p = 0.045$.

Table 2 shows bivariate correlations among demographic and key study variables for both samples. As shown, suicidal ideation, attempts, and NSSI showed moderate correlations, r^2 s > 0.36 in Sample 1 (in which attempts and NSSI were oversampled), and more modest in Sample 2, r^2 s < 0.36 . Impulsivity scores were moderately correlated with each other, r^2 s = 0.30–0.58. As expected, RNT (PTQ assessed only in sample 1) and Suicide Rumination scores (SRS assessed only in sample 2) were both robustly related to emotion-related impulsivity, r^2 s = 0.39–0.72, and more modestly to non-emotion-related impulsivity scores, r^2 s = 0.52 and 0.23. Both forms of emotion-related impulsivity and both forms of rumination were significantly correlated with suicidal ideation, presence or absence of suicide attempts, frequency of suicide attempts, and presence or absence of NSSI in both samples, most r^2 s > 0.20 . Lack of Follow Through was significantly correlated with suicidal ideation, presence

or absence of suicide attempts, suicide attempt frequency, and NSSI presence in sample 1, r 's > 0.30 , but not significantly related to these variables in sample 2, r 's < 0.21 .

Considering potential demographic confounds, education was unrelated to key variables in sample 1, but in sample 2, more highly educated individuals were older, less likely to report a suicide attempt, and endorsed higher levels of Feelings Trigger Action. Because impulsivity has been shown to interfere with educational attainment (Merrell et al., 2017), we followed recommendations for avoiding overcontrol in analyses, and did not control education in analyses of hypotheses (Streiner, 2016). Gender was generally not tied to key variables with the exception that women obtained significantly higher Pervasive Influence of Feelings scores than did men in both samples, and in sample 2, they were less likely to report a suicide attempt. Older individuals in both samples reported less impulsivity and rumination, and less suicidality and in sample 1, less self-harm.

Suicidal ideation

Hierarchical linear regression parameters for the effects of rumination and the three forms of impulsivity regressed on suicidal ideation are shown in Table 3. Tolerance estimates were acceptable. Only Pervasive Influence of Feelings was uniquely correlated with suicidal ideation severity in the past year in Sample 1, $p < 0.002$. No significant effects were observed for RNT, Feelings Trigger Action, or Lack of Follow Through, all p 's > 0.42 .

In sample 2, suicide-related rumination (SRS) significantly and robustly predicted severity of suicidal ideation, $p < 0.001$ (see Table 3). After accounting for suicide-related rumination, none of the impulsivity variables were significant, all p 's > 0.38 . Given overlap of the SRS items with ideation severity, we conducted post hoc parallel analyses with a short SRS score consisting only of the sum of the first 4 items (e.g., excluding the items that overlapped with ideation severity) in sample 2. Findings of the short SRS with suicidal ideation and suicidal attempts were substantively the same as those with the full SRS.

Suicide attempts

Findings of the binomial logistic regression models of the effects of rumination and impulsivity on the presence or absence of suicide attempt history are shown in Table 4. Suicidal ideation severity was controlled to consider the transition from ideation to action. As expected, suicidal ideation severity was significantly correlated with the presence of a suicide attempt in both samples. After accounting for gender, age, and suicidal ideation, none of the rumination or impulsivity variables predicted suicide attempt status in either sample, all p 's > 0.27 .

NSSI

In sample 1, we constructed a binomial logistic regression model to examine the conjoint and unique effects of RNT (PTQ) and the three forms of impulsivity on lifetime engagement in NSSI (DSHI). As shown in Table 5, controlling for age and gender, neither rumination or the impulsivity dimensions were significantly related to NSSI, p 's > 0.28 .

DISCUSSION

The goal of the current study was to observe the conjoint and unique effects of rumination and emotion-related impulsivity on suicidality and NSSI outcomes. We considered two different forms of emotion-related impulsivity, and we examined RNT in sample 1 and suicide-related rumination in study 2. As expected, general RNT and specific suicide-related rumination both were highly correlated with both forms of emotion-related impulsivity. In bivariate analyses, both forms of rumination and both forms of emotion-related impulsivity were significantly correlated with suicidal ideation severity, engagement in NSSI, suicide attempts controlling for suicidal ideation, and number of suicide attempts. In multivariable analyses, though, the relative contributions of rumination and impulsivity, though, differed depending on which form of rumination was being examined. That is, emotion-related impulsivity uniquely related to suicidal ideation severity, and RNT did not account for additional variance. In contrast, suicide-related rumination uniquely related to suicidal ideation severity, and effects of impulsivity did not account for significant variance after controlling for this specific form of rumination.

Despite significant bivariate links of impulsivity and rumination with suicide attempts, in the multivariable models, impulsivity and rumination did not account for additional variance in lifetime history of suicide attempt controlling for ideation, nor to NSSI. Because relatively few participants in either sample endorsed engagement in suicide attempts or NSSI in the past year, we focused on lifetime history in these analyses. The broader time window likely increased error variance, particularly given that impulsivity changes across the life course. Consistent with this idea, findings of a recent meta-analysis suggest that impulsivity is correlated to suicidal behavior in the past month, but not to such behavior across the life course (Liu et al., 2017). In one study, emotion-related impulsivity was related to past month suicide attempts, controlling for ideation (Auerbach et al., 2017). Other studies, though, frequently show little distinction between ideators and attemptors on many psychological variables (Klonsky et al., 2016), including rumination (Crane et al., 2007). Beyond more focus on past year suicide attempts, we recommend that future work consider how the effects of impulsivity and rumination on behavior may be amplified by a broader set of risk factors. For example, other work has shown that rumination may be more robustly related to NSSI among those with high negative affectivity (Nicolai et al., 2016).

Beyond the low base rates of recent self-harm behavior, some limitations are important to consider across outcomes. Perhaps of most import, the current study was limited by the cross-sectional design and the reliance on self-report measures. Future work would do well to consider whether rumination and impulsivity can prospectively predict suicidal ideation, and whether interviewer-or parent-based measures of impulsivity show similar effects. Sensitivity analyses indicate that with power = 0.80 and $\alpha = 0.05$, our sample size only was sufficient to detect effect sizes for unique variance explained within our multivariable models that exceeded f^2 values of 0.04 or 0.05 (for samples 2 and 1, respectively). That is, we were underpowered to detect small effect sizes in our multivariable models. We also failed to consider potential mediating mechanisms. Some have argued that the effects of impulsivity on suicidality may reflect greater exposure to bodily harm consequent to the impulsivity, and resultant increases in the acquired capacity for self-harm (Anestis et al.,

2011). As the significant effects in this study were for ideation, not attempts, this does not appear to be the pathway involved here. On the contrary, rumination, impulsivity, and suicidal ideation each have been related to deficits in cognitive control and to stress (cf. Carver & Johnson, 2018; Liu & Kleiman, 2012), and we were not able to measure those variables in the current study.

Some have criticized the reliability or validity of data gathered using MTurk. Regarding this concern, though, we would note that analyses included only those who endorsed the same profile of suicidal ideation at screening and the main survey; we excluded those who failed the catch trials dispersed throughout the measures to control for inattention, as well as data from participants who signaled careless responding (Meade & Craig, 2012). Previous work has shown that MTurk samples are not more biased or un-trusting than are other samples (Thomas & Clifford, 2017), and have high rates of mental health problems (Arditte et al., 2016), consistent with our ability to recruit two samples characterized by significant levels of suicidality. Indeed, there was some indication in sample 1 that those who endorsed higher emotion-related impulsivity and/or reported a previous suicide attempt were more likely to complete the full battery.

Despite the limitations, the current study has multiple strengths. To begin, the current study provides a novel examination of the highly related constructs of emotion-related impulsivity and rumination. The study was strengthened by examination of two conceptually distinct forms of emotion-related impulsivity, as well as two forms of rumination. Finally, we conducted analyses across two samples.

CONCLUSION

The current study yielded two novel findings. First, emotion-related impulsivity, and particularly Pervasive Influence of Feelings, is a construct with direct import for understanding suicidal ideation, even when considering a closely related form of emotion dysregulation. This finding adds to those from one previous study, suggesting that Pervasive Influence of Feelings is a particularly key form of impulsivity for understanding suicidal ideation. Second, suicide-related rumination related to suicidal ideation severity, even when controlling for emotion-related impulsivity. Taken together, these findings provide information about potential risk factors to target in addressing suicidal ideation. Given that ideation is such a painful and common experience, the ability to develop models of who may be most likely to experience these thoughts is a critically important goal for science and treatment development.

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DATA AVAILABILITY STATEMENT

De-identified data are available at Open Science Foundation. Sample 1: https://osf.io/dga4p/?view_only=df37657fd4694a4fa90d272c14908227. Sample 2: https://osf.io/ntqzy/?view_only=0da328e991de44e382dd23925a8f384c.

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TABLE 1

Descriptive statistics

	Sample 1 (N = 171)					Sample 2 (N = 191)				
	n (%)	Range	Mean (SD)	Skew (SE = 0.186)	Kurtosis (SE = 0.369)	n (%)	Range	Mean (SD)	Skew (SE = 0.176)	Kurtosis (SE = 0.350)
Dichotomous variables										
Gender (female)	88 (51.5)	n/a	0.48 (0.50)	0.071	-2.019	121 (63.4)	n/a	0.37 (0.48)	0.554	1.307
Race (Caucasian)	134 (78.5)	n/a				149 (78)	n/a			
Ethnicity (Hispanic)	10 (5.8)	n/a				12 (6.3)	n/a			
NSSI—Past year (Yes)	30 (17.5)	n/a				—	—			
NSSI—Lifetime (Yes)	58 (33.9)	n/a	0.34 (.48)	0.685	-1.548	112 (58.6)	n/a	0.59 (0.49)	-0.351	1.123
Suicidal ideation—Past year (Yes)	43 (25.1)	n/a				105 (55)	n/a			
Suicide attempt—Past year (Yes)	37 (21.6)	n/a				5 (2.6)	n/a			
Suicide attempt—Lifetime (Yes)	55 (32.2)	n/a	0.32 (0.47)	0.77	-1.423	84 (44)	n/a	0.44 (0.50)	0.243	1.059
Continuous or ordinal variables										
Age	n/a	19–71	37.36 (11.77)	0.715	-0.243	n/a	18–73	35.44 (11.36)	0.647	2.859
Lifetime total suicide attempts	n/a	0–15	1.18 (2.55)	3.212	11.857	n/a	0–16	1.44 (2.70)	3.311	16.053
Past year suicidal ideation score	n/a	0–5	0.85 (1.64)	1.678	1.212	n/a	0–5	1.47 (1.69)	0.734	2.069
Rumination	n/a	0–60	23.34 (15.33)	0.247	-0.884	n/a	8–40	18.96 (7.84)	0.577	2.896
Feelings Trigger Action	n/a	1–4.44	2.33 (0.90)	0.383	-0.873	n/a	1.2–4.9	2.93 (0.84)	0.204	2.351
Pervasive Influence of Feelings	n/a	1–5	2.88 (1.13)	0.055	-1.02	n/a	1–5	3.67 (0.91)	-0.634	2.819
Lack of Follow Through	n/a	1–4.34	2.34 (0.85)	0.117	-1.012	n/a	1–4.8	2.93 (0.84)	-0.183	2.488

Notes: Gender is coded as 0 = female, 1 = male; one nonbinary person was excluded from analyses in study 1. Rumination = perseverative thinking (PTQ) in sample 1, Suicide Rumination Scale in sample 2. Suicidal ideation and attempts were assessed using the Columbia-Suicide Severity Rating Scale. NSSI was assessed with the Deliberate Self-Harm inventory in sample 1, and the Columbia-Suicide Severity Rating Scale in sample 2.

TABLE 2

Bivariate correlations of demographic and key study variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Education		0.306 ***	0.056	-0.073	-0.205 **	-0.208 *	-0.101	-0.03	0.202 **	-0.0490.	-0.034
2. Age	-0.040		0.002	-0.114	-0.065	-0.039	0.310 ***	-0.136	-0.227 **	-0.255 ***	-0.217 **
3. Gender	0.032	0.052		0.015	-0.214 **	-0.058	-0.001	-0.003	-0.118	-0.162*	-0.001
4. Past year SI severity	0.039	-0.345 **	-0.072		0.087	0.150 *	0.094	0.504 ***	0.240 ***	0.202 ***	0.208 **
5. Lifetime suicide attempt (Y/N)	-0.008	-0.257 **	-0.089	0.486 **		0.477 ***	0.359 ***	0.244 ***	0.165 *	0.150 *	0.031
6. Lifetime attempts (total)	0.007	-0.311 **	-0.09	0.525 **	0.976 **		0.250 ***	0.232 **	0.208 **	0.160 *	0.067
7. Lifetime NSSI (Y/N)	0.101	-0.257 **	-0.137	0.377 **	0.493 **	0.364 **		0.161 *	0.212 **	0.111	0.107
8. Rumination	-0.015	-0.256 **	-0.106	0.388 **	0.454 **	0.289 **	0.460 **		0.389 ***	0.413 ***	0.227 **
9. FTA	0.004	-0.224 **	0.009	0.284 **	0.334 **	0.247 **	0.307 **	0.566 **		0.482 ***	0.301 ***
10. PIF	0.050	-0.297 **	-0.202 **	0.474 **	0.438 **	0.340 **	0.472 **	0.729 **	0.577 **		0.468 ***
11. LFT	-0.021	-0.262 **	-0.027	0.294 **	0.264 **	0.227 **	0.390 **	0.519 **	0.486 **	0.583 **	

Notes: Correlations are Pearson product moment correlations except Spearman correlations for analyses of Education in sample 2. Rumination was assessed with the Perseverative Thinking Questionnaire (PTQ) in sample 1 and the Suicide Rumination Scale in sample 2. NSSI was assessed using the Deliberate Self-Harm Inventory in sample 1, and the Columbia-Suicide Severity Rating Scale in sample 2. Suicidal ideation and attempts were assessed using the Columbia-Suicide Severity Rating Scale. Education was assessed as number of years in Sample 1, and using an ordinal scale in which 1 = less than high school, 2 = high school graduate, 3 = some college, 4 = 2-year degree, 5 = 4-year degree, 6 = professional degree, and 7 = doctorate in sample 2. Sample 1 (N= 171) correlations shown below the diagonal and sample 2 (N= 191) correlations shown above the diagonal.

Abbreviations: FTA, Feeling Triggering Action; LFT, Lack of Follow Through; PIF, Pervasive Influence of Feelings.

* $p < 0.05$

** $p < 0.01$.

Significant correlations are shown in bold font.

Impulsivity and rumination regressed on past year suicidal ideation severity (CSSR): Hierarchical linear multiple regression model parameters in sample 1 and sample 2

TABLE 3

	Sample 1 (N = 170)			Sample 2 (N = 191)		
	Standardized β	Tolerance	Bootstrapped <i>p</i>	Standardized β	Tolerance	Bootstrapped <i>p</i>
Rumination	0.096	0.429	0.423	0.455	0.777	< 0.001
Feelings Trigger Action	-0.014	0.588	0.877	0.009	0.698	0.885
Pervasive Influence of Feelings	0.363	0.365	0.002	0.069	0.583	0.376
Lack of Follow Through	-0.010	0.608	0.901	0.066	0.758	0.366
Gender	0.023	0.932	0.742	0.029	0.955	0.636
Age	-0.224	0.897	0.001	-0.018	0.913	0.793

Note: Sample 1 $R^2 = 0.282$, $p < 0.001$, adjusted $R^2 = 0.256$; Sample 2 $R^2 = 0.268$, $p < 0.001$, adjusted $R^2 = 0.244$. Rumination was assessed with the Perseverative Thinking Questionnaire (PTQ) in sample 1 and the Suicide Rumination Scale in sample 2.

Abbreviation: CSSR, Columbia-Suicide Severity Rating scale. Significant correlations are shown in bold font.

Impulsivity and rumination regressed on presence vs. absence of lifetime suicide attempt: Binary logistic regression models

TABLE 4

	Sample 1 (N = 170)				Sample 2 (N = 191)			
	Odds ratio	b	95% CI	p	Odds ratio	b	95% CI	p
Suicidal ideation	9.336	2.234	1.340, 3.959	0.001	3.507	1.255	0.849, 2.124	0.001
Rumination	1.035	0.034	-0.003, 0.090	0.110	1.005	0.005	-0.048, 0.025	0.586
Feelings Trigger Action	1.391	0.330	-0.244, 1.032	0.265	0.914	-0.089	-0.770, 0.469	0.768
Pervasive Influence of Feelings	1.138	0.129	-0.730, 0.834	0.735	1.127	0.119	-0.457, 0.772	0.668
Lack of Follow Through	0.831	-0.185	-0.846, 0.420	0.502	0.929	-0.073	-0.615, 0.411	0.769
Gender	0.840	-0.175	-1.161, 0.763	0.702	0.337	-1.087	-2.075, -0.306	0.005
Age	0.975	-0.026	-0.081, 0.009	0.192	0.990	-0.010	-0.048, 0.025	0.586

Notes: Nagelkerke $R^2 = 0.473$, $p < 0.001$ in sample 1, and 0.439, $p < 0.001$ in sample 2. Rumination was assessed with the Perseverative Thinking Questionnaire (PTQ) in sample 1 and the Suicide Rumination Scale in study 2; Suicidal ideation = Lifetime endorsement of passive or active ideation on the Columbia-Suicide Severity Rating Scale.

Abbreviation: CI, confidence interval. Significant correlations are shown in bold font.

Impulsivity and rumination regressed on lifetime presence or absence of NSSI (DSHI) in sample 1 ($N = 170$): Binary logistic multiple regression model

TABLE 5

	Odds ratio	b	95% confidence interval	p
Rumination (PTQ)	1.030	0.029	-0.002, 0.071	0.118
Feelings Trigger Action	1.388	0.328	-0.151, 0.918	0.279
Pervasive Influence of Feelings	1.519	0.418	-0.102, 1.023	0.289
Lack of Follow Through	1.393	0.332	-0.275, 1.013	0.323
Gender	0.671	-0.399	-1.232, 0.410	0.424
Age	0.976	-0.024	-0.065, 0.006	0.018

Note: Estimated Nagelkerke $R^2 = 0.357$.

Abbreviations: DSHI, Deliberate Self-Harm Inventory; PTQ, Perseverative Thinking Questionnaire.

Significant correlations are shown in bold font.