Published in final edited form as:
Suicide Life Threat Behav. 2022 April ; 52(2): 256–267. doi:10.1111/sltb.12818.

Affective states and nonsuicidal self-injury (NSSI): Results from an ecological momentary assessment study of veterans with NSSI disorder

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Abstract

Background: The affective states most strongly associated with nonsuicidal self-injury (NSSI) remain poorly understood, particularly among veterans. The present study used ecological momentary assessment (EMA) to examine relationships between affect ratings and NSSI urges and behaviors among veterans with NSSI Disorder.

Methods: Participants ($N = 40$) completed EMA entries via mobile phone for 28 days (3,722 total entries). Entries included intensity ratings for 5 basic affective states, as well as NSSI urges and behaviors, during the past 4 hours.

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N.A.K. developed the study concept. All authors contributed to the study design. Testing and data collection were performed by N.A.K., A.J.M., and N.A. P.A.D. performed the data analysis and interpretation in consultation with K.H.D., J.J.G., and N.A.K. K.H.D., J.J.G., P.A.D., and A.J.M. drafted the paper. N.A.K., C.A.D., B.B.D., E.C.M., S.B.M., K.L.G., P.J.S., P.S.C., J.S.H., and J.C.B. provided critical revisions. All authors approved the final version of the paper for submission.

Results: Bivariate analyses indicated that each affect variable was significantly associated with both NSSI urges and behaviors. *Angry/hostile* and *sad* were most strongly associated with both NSSI urges and behaviors. A multivariate regression revealed that whereas all 5 basic affective states were contemporaneously (within the same period) associated with NSSI urges, *angry/hostile*, *disgusted with self*, and *happy* (inversely related) were contemporaneously associated with NSSI behaviors. In a lagged model, *angry/hostile* and *sad* were associated with subsequent NSSI urges, but not behaviors.

Conclusions: Findings highlight the relevance of particular affective states to NSSI, and the potential utility of targeting anger in treatments for NSSI among veterans. There is a need for future EMA research to further investigate temporal relationships between these variables.

Keywords

nonsuicidal self-injury; mood; emotion; ecological momentary assessment; veterans

Introduction

Nonsuicidal self-injury (NSSI) refers to the direct and deliberate destruction of body tissue without conscious intent to die (Nock, 2010). Despite the serious nature of NSSI behaviors, they are surprisingly prevalent among general adult (4-6%) and psychiatric (21%) populations (Briere & Gil, 1998; Swannell et al., 2014). Among veterans seeking treatment for posttraumatic stress disorder (PTSD), rates are even higher. For example, Kimbrel and colleagues (2018) recently found that 82% of veterans seeking treatment for PTSD reported a lifetime history of NSSI, and 64% reported engaging in NSSI during the past two weeks. Beyond the physical damage associated with NSSI, this behavior is associated with a host of other serious negative health outcomes (e.g., Briere & Gil, 1998; Zetterqvist, Lundh, Dahlström, & Svedin, 2013), including heightened risk for future suicide attempts (Franklin et al., 2017; Klonsky, May, & Glenn, 2013; Ribeiro et al., 2016).

Despite the seriousness of NSSI, interventions aimed at preventing and treating NSSI among veterans are lacking, in part because the proximal correlates of NSSI within this population are still not well understood. An important first step in understanding the factors that may increase risk for NSSI among veterans is to identify the affective states that accompany NSSI urges and behaviors in daily life. To this end, ecological momentary assessment (EMA), which utilizes mobile technology to dynamically assess cognitions, emotions, and behaviors as they occur in the natural environment, provides a unique opportunity to examine whether specific affective states are associated with engagement in NSSI thoughts and behaviors (Bolger, Davis, & Rafaeli, 2003).

Prior research suggests that positive and negative affect play a prominent role in NSSI. Cross-sectional studies have found that NSSI is associated with mood and anxiety symptoms (e.g., Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005), as well as higher negative affect and lower positive affect in daily life (e.g., Bresin, 2014; Victor & Klonsky, 2014). Further, research suggests that NSSI primarily serves to regulate emotional (intrapersonal) and social (interpersonal) states and environments (Hepp et al., 2020; Nock, 2010). Consistent with this affect-regulation function of NSSI, EMA studies among adolescents and young adults

have shown that NSSI is typically preceded by an increase in negative affect (Andrewes et al., 2017; Armey et al., 2011; Kranzler et al., 2018) and decrease in positive affect (Andrewes et al., 2017; Kranzler et al., 2018) and followed by a decrease in negative affect (Andrewes et al., 2017; Armey et al., 2011; Kranzler et al., 2018) and increase in positive affect (Andrewes et al., 2017; Kranzler et al., 2018), although some studies have produced discrepant findings. For example, Snir and colleagues (2015) failed to replicate the pattern of increased negative affect prior to and decreased negative affect following NSSI, and other researchers have found increased negative affect after NSSI (Houben et al., 2017; Koenig et al., 2020).

Notably, less research has examined the specific affective states (e.g., anger, anxiety, disgust) most strongly associated with NSSI urges and behaviors in the moment. Among the studies that have focused on specific affective states, there have been mixed findings. Bresin and colleagues (2013) conducted a daily diary study of young adults who self-injure and found that daily ratings of sadness, but not guilt, were related to NSSI urges, among those who were high in negative urgency; however, they did not examine the role of externalizing emotions (i.e., anger). Nock, Prinstein, and Sterba (2009) found that increases in angry and hostile forms of emotion were associated with and predictive of NSSI behavior, whereas sadness, scared, or anxious emotions were not. Victor and colleagues (2019) conducted an EMA study comparing the roles of internalizing (e.g., shame, anxiety, sadness) and externalizing (e.g., hostile, angry) negative affect on NSSI urges among young women who had reported NSSI or suicidal urges within the past year. They found that changes in internalizing negative affect, but not externalizing negative affect, were associated with subsequent NSSI urges. Further, increased perceived rejection was associated with higher odds of NSSI urges. Similarly, another daily diary study of young adults who self-injure found that NSSI behavior was most often reported in the context of feeling rejected/hurt (Turner et al., 2016). A recent study of veterans with NSSI disorder found that anger/hostility preceded and predicted subsequent NSSI urges and behaviors, but not vice versa (Dillon et al., 2021).

The majority of the aforementioned EMA studies were conducted with young adult or adolescent, predominantly female, samples. Furthermore, many of them consisted of a single daily diary entry relying on retrospective recall of the day. Many of these studies have either examined general negative affect or select affective states (e.g., sadness, guilt) rather than focusing on basic emotional states. In his seminal model of emotions, Ekman (1992) identified six basic emotions that are neurobiologically based and universal across cultures: happiness, surprise, fear, sadness, anger, and disgust. Other models of emotion have also proposed similar basic emotions (see Tracy & Randles, 2011 for a review). To our knowledge, there have been no EMA studies examining the basic affective states of self-injuring veterans. Given the elevated rate of PTSD among veterans, relative to the general population (Fulton et al., 2015; Kimbrel, DeBeer, Meyer, Gulliver, & Morissette, 2016), the particular affective states associated with NSSI within this population may differ. In particular, given the centrality of anger, shame, and anxiety to PTSD (American Psychiatric Association, 2013), there may be an especially strong relationship between these specific affective states and NSSI among veterans.

Given the absence of prior work examining the specific, basic affective states most strongly associated with NSSI among self-injuring veterans, the present study sought to extend extant research on the affective correlates of NSSI by identifying the specific affective states most strongly associated with NSSI urges and behaviors in a sample of veterans with NSSI disorder. NSSI disorder was included in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a "disorder for future study" (American Psychiatric Association, 2013). Diagnostic criteria include: 1) engagement in NSSI on five or more days in the past year with an expectation that it will relieve negative thoughts/feelings, resolve an interpersonal difficulty, and/or create a positive feeling; 2) the NSSI must be preceded by negative thoughts/feelings or interpersonal problems, a preoccupation with the behavior that is difficult to resist, and/or frequent urges to engage in NSSI; and 3) the behavior cannot be socially sanctioned and must cause significant distress or impairment. Initial evidence has supported the validity of NSSI disorder as an independent and distinct disorder that is distinguishable from other disorders and associated with significant distress and impairment (Zetterqvist, 2015); however, much remains unknown about this diagnosis and those who meet criteria for this disorder. In particular, very few studies have used EMA methods to study NSSI in a sample comprised exclusively of indivduals with NSSI disorder. Using multilevel bivariate and multivariate regression models, we first examined which basic affective states were independently associated with NSSI urges and behaviors. We then identified the basic affective states most strongly associated with NSSI urges and behaviors. We examined both contemporaneous (within the same 4 hour period) and lagged (within the 6 hours prior) effects of basic affective states on NSSI urges and behavior.

Materials and Methods

Participants

This study was approved by the Durham VA IRB and Research and Development Committee. Participant demographic and clinical characteristics are presented in Table 1. EMA study proceduers have been described elsewhere (see Dillon et al., 2021). Participants included 40 veterans enrolled in a sub-study of a larger project focused on studying the impact of NSSI on veterans' functional outcomes. Potential participants were contacted via mailings targeting veterans who had sought care in dedicated VA clinics for PTSD and through letters and calls to veterans who had agreed to have their names listed in research recruitment databases. Several participants were also referred to the study by their clinicians.

Potential participants were screened by phone to ensure that they met basic eligibility criteria. Final eligibility was determined at the time of the baseline assessment. Inclusion criteria for the present analyses were: veteran status, being at least 18 years of age, having a current diagnosis of NSSI disorder, and being willing to complete the EMA sub-study procedures. Participants were excluded if they had imminent risk for suicide or homicide warranting immediate intervention or met criteria for a lifetime diagnosis of bipolar disorder or psychotic spectrum disorder. With regard to the latter, because the goal of the parent grant was to examine the association between NSSI and functioning, individuals with bipolor or psychotic spectrum disorders were excluded due to concerns of a confounding influence of these diagnoses on functioning. Participants had a mean age of 46.67 (SD = 12.76; range

23-77) and were predominantly male (72.5%). With respect to racial background, 55% were African American and 45% were White. Participants had a mean of 14.03 years of education (*SD* = 3.07). Notably, in addition to having a diagnosis of NSSI disorder, the majority of participants had additional psychiatric disorders at the time of the study, the most common of which were PTSD (90%) and major depressive disorder (MDD; 82.5%).

Measures and Procedure

Diagnostic measures.—At the baseline appointment of the larger study, the majority of psychiatric disorders were assessed via the Structured Clinical Interview for DSM-5 (SCID-5; First, Williams, Karg, & Spitzer, 2016). The Clinician Administered Nonsuicidal Self-injury Disorder Index (CANDI; Gratz et al., 2015) was used to assess NSSI Disorder. The CANDI exhibits good interrater reliability (κ = .83) and adequate internal consistency (α = .71; Gratz et al., 2015). In addition, given that NSSI disorder is a newly proposed disorder (American Psychiatric Association, 2013), weekly diagnostic review group meetings were convened to discuss and determine final consensus for NSSI disorder in order to ensure diagnostic accuracy across raters.

Ecological momentary assessments.—Participants carried an Android smartphone provided to them by the study team for EMA data collection for 28 days (3722 total entries across participants). At an initial training session, the participant and study team member set a 14-hour wake period and a 10-hour sleep period during which the alarmed prompts would be active and inactive, respectively. Investigator-initiated alarms were designed to go off approximately every four hours (between 3.5 and 4.5 hours apart) during the 14-hour waking period. There was also a nightly alarm that was scheduled to go off 15 minutes before the end of the waking period. Participants had a two-minute window to respond to an alarm. If an alarm was missed, it was repeated five minutes later. If that alarm was missed, then a final alarm sounded 30-40 minutes later. Participants could also delay an initial alarm by snoozing it for five minutes or 30-40 minutes. Alarms could be “put to sleep” for 1, 2, 3, or 4 hours if participants were in a situation where it might be dangerous or problematic to respond (e.g., while driving, while in a meeting). Each initiation of a diary entry was time-stamped, ensuring that self-initiated entries were not clumped together and allowing for assessment of protocol adherence. Prior to the 28-day data collection period, all participants were trained in the use of the electronic diary following established procedures, including engaging in one-on-one training sessions with the study team (Beckham et al., 2013). Participants then practiced the electronic diary at home for 24 hours (Mitchell et al., 2014). Following this practice period, participants had a phone call with the study team to address any problems. Once the training period was completed and participants fully understood the electronic diary procedures, they began the 28-day sampling period.

Blocked random alarms (randomly sounding between 3.5 and 4.5 hours after the previous one) and event-based (when having an urge to engage in NSSI or engaging in NSSI) sampling were used. EMA data consisted of responses to the three investigator-initiated prompts per day, from which participants received one full diary (up to 48 question prompts) and two abbreviated diaries (up to 31 question prompts). Additionally, participants completed self-initiated diaries if they had an urge to engage in or actually did engage

in NSSI behavior (full diary). On average, diaries took 2.11 minutes to complete. Entries that exceeded 10 minutes in length were deleted to ensure that data consistently reflected a snapshot of participants' affective states during the four hours preceding the start of the EMA entry.

Participants were compensated according to their level of compliance with the EMA procedures: They were paid $250 for completion of 75-100% of the prompted diaries, $170 for 50-74%, $100 for 25-49%, and $50 for 0-25%. As a result, there were high rates of compliance (81.6%) and a mean of 68.57 (*SD* = 16.54) prompted diary entries over the study. When including self-initiated entries as well, participants completed a mean of 86.35 (*SD* = 15.90) entries.

NSSI urges and behaviors.—At each diary entry, participants were asked to respond to questions inquiring about the presence of NSSI urges (i.e., *In the past 4 hours, have you had an urge to self-injure?)* and behaviors (i.e., *Have you engaged in self-injurious behavior in the past 4 hours?).* Additionally, each evening, prior to suspending the app for the night, a nightly diary asked participants whether any NSSI urges or behaviors occurred over the day that were not already reported within the three random diary entries. If answered affirmatively, participants were prompted to identify the time the urge and/or behavior took place. For our analyses, these instances were added to the existing daytime diaries if they fell within a 4-hour window of a daytime entry and thus could be paired with corresponding affect data.

Affective states.—At each diary entry, affective states were assessed. To reduce participant burden, some affective states were combined into one question (e.g., happy *or* joyful). These items were drawn from the 60-item Postitive and Negative Affect Schedule-Expanded Form (PANAS-X; Watson & Clark, 1999), including items from the general dimension scale (i.e., *afraid; nervous; hostile*), the basic negative emotion scale (i.e., *angry; disgusted with self; sad*), and the basic positive emotion scale (i.e., *happy or joyful*). The basic emotion of "surprise" was not assessed, so we were only able to examine associations of fear, sadness, anger, disgust, and happiness with NSSI urges and behaviors. Participants rated the extent to which they felt each affective state "during the past 4 hours" via a Likert-type scale using the following anchors: 0=*Not at all*; 1=*A little bit*; 2=*Moderately*; 3=*Quite a bit*; 4=*Extremely*. The scale was modified from the original PANAS-X to include a "Not at all" answer choice (as opposed to "Very slightly or not at all"). Because the goal was to examine the associations between the basic affective states (e.g., fear, sadness, anger, disgust, happiness) and NSSI, a composite "anger" score was created by averaging the *angry* and *hostile* items and a composite "fear" score was created by averaging the *afraid* and *nervous* items.

Data Analysis Plan

Multilevel modeling (MLM; Snijders & Bosker, 1999) was used to analyze the data, which entailed multiple EMA readings nested within individual participants. Because effects are estimated at the lowest level of the analysis (i.e., diary entry) while accounting for clustering at higher levels (i.e., individual participant), MLM is uniquely suited for unbalanced

data (i.e., data missing at random and with differing numbers of cases per individual). To disentangle the within-person association of momentary affective states with NSSI urges and behaviors from the between-person association, grand-mean standardized (GMS) affect scores were generated by calculating each individual's mean affect levels across the observation period and *z*-scoring these in relation to those of the other participants in the sample. Individual-mean standardized (IMS) scores were then calculated by using each individual's mean affect levels and corresponding SDs to *z*-score the affect levels recorded at each reading. The resulting GMS and IMS scores were completely orthogonal to one another.

To examine potential lagged effects of basic affective states on NSSI urges and behavior, thereby bolstering the hypothesis that affect is the driver in changes in NSSI, in addition to using contemporaneous (within the same 4 hour period) affect variables to predict NSSI urges and behaviors, we examined models in which lagged affect variables were used as predictors. Specifically, we used lagged IMS affect scores that preceded NSSI urge and behavior records by up to 6 hours. As such, for each set of analyses that we conducted, one set was run using contemporaneous affect scores as predictors, and another was run using lagged affect scores as predictors. two sets of primary analyses were conducted. First, bivariate analyses were conducted to examine the independent associations of each of the five basic affective state variables with urges to engage in NSSI and engagement in NSSI behaviors. In each of these models, both the GMS and IMS affective state scores were entered as predictors, with the former representing person-level effects and the latter representing context-specific (i.e., affect-related) effects. The second set of analyses examined adjusted models of NSSI urges and behaviors with these affective state variables. In addition to the IMS and GMS affective scores, the adjusted models additionally covaried for gender, race, current MDD status, and current PTSD status. Pseudo-R^2 values for each of the adjusted models were derived using Snijders and Bosker's (2012) method.

Given planned missingness of affective state data, multiple imputation was used to impute 50 imputation datasets via the Markov chain Monte Carlo method. Imputation model variables included all of the IMS momentary affective state variables collected in the diary (upset, afraid, angry, ashamed, calm, confused, disgusted with self, excited, guilty, happy or joyful, hopeful, hostile, hurt, lonely, nervous, out of touch, proud, relaxed, sad, worthless, interpersonal stress, social support, and stress), the three IMS PTSD symptom cluster items, and the two aforementioned composite affective state items (anger and fear). Multiple imputation was performed prior to deriving lagged affect scores.

Logistic MLM was conducted using PROC GLIMMIX, available *via* SAS 9.4. To minimize familywise Type I errors, the false-discovery rate method proposed by Benjamini and Hochberg (1995) was applied to the bivariate analyses, specifically the IMS affective state estimates. This methodology differentiates random findings from hypothesis-driven outcomes and is more powerful than Bonferroni-type adjustments that control the false-positive rate. It entails ranking the *p*-values for a given set of estimates from smallest to largest and then comparing these to the *p*-value achieved by multiplying alpha by the rank order, divided by the number of tests. As such, only the largest *p*-value from a given test is

compared to the original alpha value. In the present study, an alpha of .05 was used, and all tests were two-sided.

Results

Electronic Diary Entries

Over the 28-day period, participants completed a total of 886 nighttime diaries (M = 22.15 per participant, SD = 7.23) and 2,658 random-alarm entries (M = 2.38 per participant per day, SD = 0.63). Thirty-six participants (90.0%) made at least one self-initiated entry for a total of 600 self-initiated entries (M = 0.60 per participant per day, SD = 0.42). Nighttime diaries took participants a mean of 0.95 minutes (SD = 0.91) to complete; random-alarm entries took a mean of 2.27 minutes (SD = 1.58); and self-initiated entries took a mean of 3.04 minutes (SD = 1.64) to complete. Participants reported experiencing an urge to engage in NSSI 627 times (615 reported via daytime entries and 12 reported during nighttime entries) and engaging in NSSI behavior 288 times (286 reported via daytime entries and 2 reported during nighttime entries) during the study period. Descriptives for each of the affective state variables are reported in Table 2.

Bivariate Associations of Affective States with NSSI Urges and Behaviors

The results of the bivariate analyses examining associations of each of the IMS and GMS affective state variables with NSSI urges are reported in Table 3. The results of the corresponding analyses demonstrating the relations between affective states and NSSI behaviors are reported in Table 4. In both sets of models, each of the contemporaneous IMS affective state variables was a significant predictor, even after controlling for the false-discovery rate. These reflect the momentary association of basic affective states with NSSI urges and behaviors. Each of the lagged affective state predictors of NSSI urge were also significant after controlling for the false-discovery, although their effects were slightly weaker than the corresponding contemporaneous scores. All lagged variables except for *disgusted with self* were significantly predictive of NSSI behaviors after controlling for the false-discovery rate. Again, the lagged effects were slightly weaker than contemporaneous effects. The affective state variables were ranked according to the strength of their association with NSSI urges or behaviors (by F-values). *Angry/hostile* and *sad* had the strongest IMS associations in both sets of models, whereas *happy* had the weakest IMS associations in three out of four models.

Adjusted Regressions Examining Associations of Affective States to NSSI Urges and Behaviors

The results of the adjusted multilevel models examining the associations of affective states with NSSI urges and behaviors are reported in Tables 5 and 6, respectively. In both the NSSI urge and behavior models, contemporaneous *angry/hostile*, *disgusted with self*, and *happy* (inversely related) were significant. In the NSSI urges model, contemporaneous *afraid/nervous* and *sad* were also significant. Only between-person differences in *angry/hostile* affective states were associated with NSSI urges. None of the between-person differences in basic affective states were associated with NSSI behaviors, and none of the demographic or clinical variables were associated with either NSSI urges or behaviors.

In the models with lagged affective state predictors, only *angry/hostile* and *sad* were predictive of NSSI urges, and none of the affective state variables were predictive of NSSI behaviors. According to Snijders and Bosker's (2012) pseudo-R2 calculation, the adjusted models of NSSI urged explained 46.4% of the variance via contemporaneous affect and 40.0% of the variance via lagged affect scores. The adjusted models of NSSI behavior explained 40.2% of the variance via contemporaneous affect and 34.6% of the variance via lagged affect scores.

Discussion

The present study sought to identify the basic affective states most relevant to NSSI urges and behaviors among veterans with NSSI disorder using a rich set of EMA data. Findings of a series of bivariate analyses revealed significant within-person associations between each of the contemporaneous affective states examined in this study and both NSSI urges and behaviors. When examining lagged associations between basic affective states and NSSI urges and behaviors, the effects were similar though slightly weaker than those of the corresponding contemporaneous affective state. All of the lagged variables were associated with NSSI urges and all but *disgusted with self* were significantly associated with NSSI urges. Moreover, across all bivariate analyses, *angry/hostile* and *sad* emerged as most strongly associated with both NSSI urges and behaviors within this sample. Results of a second set of analyses examining the relative unique contemporaneous associations of the affective states revealed that within-person changes in *angry/hostile, afraid/nervous, sad, disgusted with self,* and *happy* (inversely related) were uniquely associated with NSSI urges. Furthermore, within-person changes in *angry/hostile, disgusted with self,* and *happy* (inversely related) were uniquely associated with NSSI behaviors. In the models with lagged affective state predictors, only *angry/hostile* and *sad* were predictive of NSSI urges, and none of the affective state variables were predictive of NSSI behaviors

All of the between-person bivariate associations between the basic contemporaneous affective states and NSSI urges and behaviors were significant. In the adjusted multilevel models, *angry/hostile* was the only contemporaneous affective state at the between-person level that was uniquely related to NSSI urges. None of the contemporaneous affective states were uniquely related to NSSI behaviors at the between-person level. It is possible that the lack of additional between-persons effects was due to lack of power to detect significant unique contributions. Nonetheless, this pattern of findings suggests that both urges to engage in NSSI and NSSI behaviors are more closely related to contextual factors than nomothetic ones, particularly given the relatively homogeneous sample.

Findings of significant bivariate associations between all basic affective states and NSSI urges and behaviors are consistent with both theory and research emphasizing the relevance of positive and negative affect to NSSI (see Schatten, Allen, & Armey, 2019). Results of this study extend extant theory and research in this area to an understudied veteran population, emphasizing the relevance of momentary affective states to NSSI urges and behaviors in daily life. In particular, although findings suggest that negative and positive affect in general may be relevant to NSSI among veterans, results highlight the centrality of three particular affective states to NSSI within this population.

First, findings highlight the particular relevance of anger-spectrum emotions to NSSI among veterans with NSSI disorder. Specifically, findings that *angry/hostile* was the affective state most strongly associated with both NSSI urges and behaviors in the bivariate analyses and uniquely associated with NSSI urges and behaviors in the contemporaneous multivariate models and the lagged model for NSSI urges highlight the relevance of anger to NSSI among veterans. Notably, nearly 90% and 95% of participants in the current sample met criteria for current and lifetime PTSD diagnoses, respectively. Persistent negative affect (anger, fear, horror, guilt, shame) and irritable/aggressive behavior are diagnostic symptoms of PTSD, which may confer inherent risk within the diagnosis. Prior meta-analyses have found that anger difficulties are consistently strongly associated with PTSD (Olatunji et al., 2010; Orth & Wieland, 2006). Additionally, our findings are consistent with Carver and Harmon-Jones's (2009) conceptualization of anger as an approach-oriented negative emotion. We found that within-person anger was contemporaneously associated with increased NSSI urges and behaviors, whereas within-person sadness and fear were associated with urges, but not behaviors. This suggests that although all of these negative emotions may increase urges for NSSI, only anger elicits the approach response (i.e., NSSI behavior). Conversely, sadness and fear are avoidance-oriented emotions that may elicit different kind of behaviors (e.g., flight, isolation). Together, these findings suggest that anger-related emotions may be especially promising treatment targets among veterans with NSSI disorder and PTSD.

Second, within-person *self-disgust* was also uniquely associated with both NSSI urges and behaviors in the contemporaneous models. These findings underscore the potential relevance of shame-related emotions to NSSI within this population as well, and are consistent with past research highlighting the relevance of anger and shame in particular to NSSI within other populations (e.g., Armey et al., 2011; Nock et al., 2009). For example, in an EMA study of adolescents and young adults with NSSI thoughts and urges, anger- and shame-related emotions (e.g., self-hatred, anger towards others), in contrast to other negative emotions, predicted the transition from NSSI thoughts to behaviors (Nock et al., 2009). Likewise, another EMA study with a college sample found that both anger and shame increased prior to and decreased following an NSSI episode (Armey et al., 2011). However, notably *self-disgust* was the only lagged affective state that was not significantly related to NSSI behaviors in the bivariate models, indicating that self-disgust accompanied NSSI behaviors rather than preceding them. In other words, individuals who engaged in NSSI may have experienced parallel or subsequent increases in self-disgust, rather than self-disgust precipitating NSSI behavior. Further research is necessary to examine this relationship further.

Finally, findings that within-person changes in the affective state of *happy* were uniquely inversely related to both NSSI urges and behaviors suggest the relevance of decreases in this particular positive affective state to NSSI behaviors as well. Specifically, these findings highlight the potential importance of decreases in feelings of happiness in addition to increases in feelings of anger- and shame-related emotions to within-person risk for NSSI behaviors.

Study Limitations

The present study has several limitations that should be noted. First, although the focus on veterans meeting diagnostic criteria for NSSI disorder may be considered a strength of this study (as this is both a relevant and understudied population), the results may not generalize to other samples. In particular, given that the sample consisted primarily of men and those with co-occurring PTSD, results may not generalize to women veterans, veterans without PTSD, or other relevant non-veteran samples. Future studies using a similar framework in civilian populations are needed to clarify the affective states most relevant to NSSI across a range of individuals. Additionally, the use of select PANAS-X items to assess relevant affective states relies on participants' awareness and understanding of their discrete emotional experiences – something that may be more challenging for individuals with PTSD and other emotional difficulties. Likewise, the use of single items to assess many of the affective states of interest further increases the extent to which individual differences in how participants understand or interpret these items may influence responses. Future research incorporating multiple indices of relevant emotions, is needed to further clarify the relations of specific affective states to NSSI among veterans. Additionally, by asking participants to rate their experience "in the past 4 hours," it is possible that responses were affected by recall bias and fluctuations over time. The contemporaneous analyses do not allow us to determine the extent to which changes in affective states preceded, accompanied, or followed NSSI urges and behaviors. Future research should assess these experiences in the present moment. Furthermore, it is unclear whether the within-person emotions that were identified as being associated with NSSI behaviors are predictive of NSSI behaviors above and beyond their prediction of NSSI urges. When investigating temporal models of NSSI, future research may benefit from examining the specific affective states that contribute to the progression from NSSI urges to behaviors.

Conclusion

The current EMA study is the first of its kind to examine the specific affective states associated with NSSI urges and behaviors in daily life among veterans diagnosed with NSSI disorder. Results highlight the relevance of anger and hostility to NSSI urges and behaviors within this population.Further, self-disgust and happiness (inverse relationship) were associated with NSSI behavior. Given that anger and shame figure prominently into mental health conditions common among veterans (e.g., PTSD), these affective states may be particularly useful transdiagnostic factors to target in treatments for veterans with NSSI, as well as future research on this important topic.

Acknowledgements

This work was supported by Merit Award #I01CX001486 to Dr. Kimbrel from the Clinical Sciences Research and Development Service (CSR&D) of VA Office of Research and Development (VA ORD). Manuscript preparation was partially supported by the VA Office of Academic Affiliations Advanced Fellowship Program in Mental Illness Research and Treatment (Dr. Glenn). Dr. Dillon was supported by a Career Development Award (IK2RX002965) from the Rehabilitation Research and Development Service of VA ORD. Dr. Beckham was supported by a Senior Research Career Scientist award (1K6BX003777) from the CSR&D of VA ORD. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the VA or the United States government or any of the institutions with which the authors are affiliated.

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Table 1

Participant Characteristics

	Mean (SD)	Freq. (%)
Age (years)	46.65 (12.76)	
Gender		
Male		29 (72.5%)
Female		11 (27.5%)
Race		
White		18 (45%)
Black		22 (55%)
Ethnicity		
Non-Hispanic		38 (95%)
Hispanic		2 (5%)
Diagnostic History		
Lifetime Posttraumatic Stress Disorder		38 (95%)
Current Posttraumatic Stress Disorder		36 (90%)
Lifetime Major Depressive Disorder		38 (95%)
Current Major Depressive Disorder		33 (82.5%)
Lifetime Obsessive Compulsive Disorder		19 (47.5%)
Current Obsessive Compulsive Disorder		18 (45%)
Lifetime Panic Disorder		11 (27.5%)
Current Panic Disorder		10 (25%)
Lifetime Social Anxiety Disorder		8 (20%)
Current Social Anxiety Disorder		8 (20%)
Lifetime Specific Phobia		1 (2.5%)
Current Specific Phobia		1 (2.5%)
Lifetime Generalized Anxiety Disorder		11 (27.5%)
Current Generalized Anxiety Disorder		11 (27.5%)
Lifetime Eating Disorder		7 (17.5%)
Current Eating Disorder		7 (17.5%)
Lifetime Excoriation Disorder		6 (15%)
Current Excoriation Disorder		5 (12.5%)
Lifetime Trichotillomania		4 (10%)
Current Trichotillomania		3 (7.5%)
Lifetime Alcohol Use Disorder		28 (70%)
Current Alcohol Use Disorder		9 (22.5%)
Lifetime Substance Use Disorder		11 (27.5%)
Current Substance Use Disorder		6 (15%)

Table 2

Electronic Diary Variable Descriptives

Variables	*n*	*Mean (SD)*
Afraid	2423	0.87 (1.08)
Nervous	2462	1.08 (1.08)
Angry	2430	1.24 (1.21)
Hostile	2452	0.81 (0.99)
Disgusted with self	2417	1.03 (1.22)
Happy or joyful	2471	0.72 (0.90)
Sad	2438	1.28 (1.23)

Note. Response scales for all variables ranged from 0 to 4.

Table 3

Bivariate Logistic Multilevel Models of Urges to Engage in NSSI

		Individual Mean Standardized Score		Grand Mean Standardized Score	
Rank	**Predictor**	***OR (95% CI)***	***p*-value**	***OR (95% CI)***	***p*-value**
	Contemporaneous Affect Ratings				
1	Angry/Hostile	2.19 (1.96 - 2.46)	< .001	3.48 (2.03 - 5.98)	< .001
2	Sad	1.88 (1.67 - 2.11)	< .001	2.00 (1.09 - 3.66)	.024
3	Afraid/Nervous	1.84 (1.64 - 2.06)	< .001	2.16 (1.20 - 3.90)	.010
4	Disgusted with Self	1.68 (1.51 - 1.86)	< .001	1.96 (1.08 - 3.55)	.026
5	Happy or Joyful	0.56 (0.49 - 0.65)	< .001	0.34 (0.18 - 0.66)	.001
	Lagged Affect Ratings				
1	Sad	1.51 (1.31 - 1.74)	< .001	3.14 (1.83 - 5.37)	< .001
2	Angry/Hostile	1.44 (1.25 - 1.66)	< .001	2.03 (1.12 - 3.69)	.019
3	Afraid/Nervous	1.27 (1.10 - 1.46)	< .001	2.04 (1.14 - 3.67)	.017
4	Happy or Joyful	1.27 (1.10 - 1.46)	.001	2.25 (1.27 - 3.98)	.005
5	Disgusted with Self	0.80 (0.69 - 0.93)	.005	0.37 (0.19 - 0.73)	.004

Note. All individual-mean standardized scores were significant, even after controlling for the false-discovery rate.

Table 4

Bivariate Logistic Multilevel Models of NSSI Behaviors

		Individual Mean Standardized Score		Grand Mean Standardized Score	
Rank	**Predictor**	***OR (95% CI)***	***p*-value**	***OR (95% CI)***	***p*-value**
	Contemporaneous Affect Ratings				
1	Angry/Hostile	1.85 (1.62 - 2.11)	< .001	2.61 (1.71 - 3.97)	< .001
2	Sad	1.64 (1.42 - 1.89)	< .001	2.44 (1.61 - 3.70)	< .001
3	Afraid/Nervous	1.52 (1.34 - 1.73)	< .001	2.34 (1.57 - 3.50)	< .001
4	Disgusted with Self	1.53 (1.33 - 1.75)	< .001	2.17 (1.40 - 3.37)	< .001
5	Happy or Joyful	0.57 (0.46 - 0.69)	< .001	0.48 (0.28 - 0.83)	.009
	Lagged Affect Ratings				
1	Sad	1.34 (1.13 - 1.57)	< .001	2.48 (1.63 - 3.77)	< .001
2	Angry/Hostile	1.32 (1.11 - 1.56)	.001	2.29 (1.45 - 3.61)	< .001
3	Afraid/Nervous	1.31 (1.11 - 1.54)	.001	2.34 (1.55 - 3.54)	< .001
4	Happy or Joyful	0.79 (0.65 - 0.97)	.023	0.48 (0.27 - 0.84)	.011
5	Disgusted with Self	1.18 (0.99 - 1.41)	.059	2.24 (1.43 - 3.51)	< .001

Note. All individual-mean standardized scores were significant, even after controlling for the false-discovery rate.

Table 5

Adjusted Multilevel Models of Urges to Engage in NSSI

	Contemporaneous Affect Model			Lagged Affect Model		
Predictors	**Est. (SE)**	***OR (95% CI)***	***p*-value**	**Est. (SE)**	***OR (95% CI)***	***p*-value**
Within-Person						
Intercept	−2.00 (1.16)	-	.087	−1.90 (1.12)	-	.090
Afraid/Nervous IMS	0.17 (0.07)	1.18 (1.04 - 1.35)	.013	0.02 (0.09)	1.02 (0.86 - 1.20)	.83
Angry/Hostile IMS	0.49 (0.07)	1.63 (1.42 - 1.87)	< .001	0.28 (0.09)	1.33 (1.11 - 1.58)	.002
Sad IMS	0.17 (0.08)	1.19 (1.02 - 1.38)	.025	0.21 (0.09)	1.23 (1.02 - 1.48)	.028
Disgusted with Self IMS	0.28 (0.07)	1.32 (1.15 - 1.51)	< .001	0.03 (0.09)	1.03 (0.87 - 1.23)	.73
Happy or Joyful IMS	−0.28 (0.08)	0.75 (0.64 - 0.88)	< .001	−0.05 (0.09)	0.95 (0.80 - 1.13)	.57
Between-Person						
Afraid/Nervous GMS	−0.20 (0.75)	0.82 (0.19 - 3.59)	.79	−0.09 (0.73)	0.91 (0.22 - 3.80)	.90
Angry/Hostile GMS	1.23 (0.60)	3.40 (1.04 - 11.06)	.042	1.11 (0.58)	3.03 (0.96 - 9.52)	.058
Sad GMS	−0.34 (0.77)	0.71 (0.16 - 3.23)	.66	−0.52 (0.74)	0.60 (0.14 - 2.57)	.49
Disgusted with self GMS	0.55 (0.56)	1.74 (0.58 - 5.17)	.32	0.75 (0.54)	2.12 (0.73 - 6.10)	.16
Happy or Joyful GMS	−0.62 (0.45)	0.54 (0.22 - 1.30)	.17	−0.40 (0.45)	0.67 (0.28 - 1.60)	.37
Gender (Female)	0.76 (0.73)	2.13 (0.52 - 8.83)	.30	0.92 (0.71)	2.50 (0.63 - 9.98)	.19
Race * (Black)	−0.05 (0.64)	0.95 (0.27 - 3.29)	.94	−0.17 (0.62)	0.85 (0.25 - 2.85)	.79
Current MDD	−0.51 (1.01)	0.60 (0.08 - 4.38)	.62	−0.28 (0.98)	0.75 (0.11 - 5.11)	.77
Current PTSD	−0.32 (1.26)	0.73 (0.06 - 8.60)	.80	−0.31 (1.21)	0.73 (0.07 - 7.89)	.80

* White used as reference category

Table 6

Adjusted Multilevel Models of NSSI Behavior

	Contemporaneous Affect Model			Lagged Affect Model		
Predictors	**Est. (SE)**	***OR (95% CI)***	***p*-value**	**Est. (SE)**	***OR (95% CI)***	***p*-value**
Within-Person						
Intercept	−3.75 (0.92)	-	< .001	−3.19 (0.93)	-	< .001
Afraid/Nervous IMS	0.14 (0.08)	1.14 (0.98 - 1.34)	.088	0.14 (0.10)	1.15 (0.95 - 1.40)	.16
Angry/Hostile IMS	0.37 (0.09)	1.45 (1.22 - 1.71)	< .001	0.11 (0.11)	1.12 (0.90 - 1.38)	.32
Sad IMS	0.14 (0.09)	1.15 (0.95 - 1.38)	.15	0.15 (0.11)	1.16 (0.94 - 1.44)	.18
Disgusted with Self IMS	0.17 (0.08)	1.19 (1.01 - 1.39)	.033	0.01 (0.10)	1.01 (0.83 - 1.24)	.89
Happy or Joyful IMS	−0.33 (0.11)	0.72 (0.58 - 0.90)	.004	−0.11 (0.11)	0.89 (0.71 - 1.12)	.32
Between-Person						
Afraid/Nervous GMS	0.25 (0.54)	1.28 (0.44 - 3.72)	.65	0.37 (0.55)	1.45 (0.49 - 4.28)	.50
Angry/Hostile GMS	0.59 (0.43)	1.80 (0.77 - 4.21)	.18	0.33 (0.44)	1.39 (0.58 - 3.31)	.46
Sad GMS	0.29 (0.56)	1.34 (0.44 - 4.05)	.60	0.24 (0.58)	1.28 (0.41 - 3.98)	.67
Disgusted with self GMS	−0.10 (0.41)	0.91 (0.41 - 2.02)	.81	−0.00 (0.42)	1.00 (0.44 - 2.29)	> .99
Happy or Joyful GMS	−0.44 (0.34)	0.65 (0.33 - 1.25)	.19	−0.49 (0.35)	0.61 (0.31 - 1.21)	.16
Gender (Female)	−0.21 (0.54)	0.81 (0.28 - 2.34)	.69	−0.29 (0.57)	0.75 (0.25 - 2.30)	.62
Race * (Black)	−0.30 (0.48)	0.74 (0.29 - 1.88)	.52	−0.28 (0.49)	0.76 (0.29 - 1.98)	.57
Current MDD	1.01 (0.78)	2.75 (0.60 - 12.71)	.19	0.97 (0.80)	2.64 (0.55 - 12.69)	.23
Current PTSD	−0.30 (0.94)	0.74 (0.12 - 4.64)	.75	−0.51 (0.95)	0.60 (0.09 - 3.92)	.60

* White used as reference category