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## **Social Stressors, Emotional Responses, and NSSI Urges and Behaviors in Daily Life**

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Social Stressors, Emotional Responses, and NSSI Urges and Behaviors in Daily Life

A Dissertation Presented

by

LAUREN A. HALICZER

Submitted to the Graduate School of the  
University of Massachusetts Amherst in partial fulfillment  
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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Psychological and Brain Sciences

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## ABSTRACT

### SOCIAL STRESSORS, EMOTIONAL RESPONSES, AND NSSI URGES AND BEHAVIORS IN DAILY LIFE

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Nonsuicidal self-injury (NSSI) is prevalent among young adults, and is associated with myriad negative outcomes, including heightened suicide risk. The defective self model of NSSI theorizes that individuals who are highly self-critical and who feel they are deserving of punishment are more likely to choose NSSI over other emotion regulation strategies. This empirically-supported model has a number of under-examined implications. Specifically, individuals who engage in NSSI may be more prone to experiencing self-conscious emotions in response to negative social feedback, and this may place individuals at heightened imminent risk for NSSI in everyday life. Few studies have examined self-conscious emotional reactivity to daily social stressors among those who engage in NSSI, and more work is needed to identify person-specific contexts that indicate elevated risk for NSSI. Therefore, the present study first examined whether individuals with a history of NSSI (vs. without) display greater self-conscious and negative emotional reactions to daily social stressors, as well as more dysfunctional features of these daily social stressors. Second, we examined whether within-person increases in these emotional reactions and social stressor features predict increased risk

for NSSI urges and behaviors in daily life. Participants were 134 young adult women who reported recent, recurrent NSSI ( $n = 77$ ) or no NSSI history ( $n = 57$ ) recruited from a large university and its surrounding community. Participants completed baseline measures of socioemotional functioning and engaged in a two-week daily diary protocol during which they reported on daily social stressors and NSSI urges and behaviors. The NSSI (vs. no NSSI) group reported significantly greater self-conscious and negative emotional reactions to daily social stressors, and social stressors characterized by greater distress, conflict, and confusion. In the NSSI group, experiencing social stressors characterized by greater-than-usual distress was associated with same-day NSSI urges and behavior. Experiencing social stressors characterized by greater-than-usual confusion predicted same-day NSSI urges, whereas greater-than-usual conflict predicted same-day NSSI behavior. Experiencing greater-than-usual self-conscious and negative emotional reactions to these stressors predicted same-day NSSI urges and behavior. Findings from this study have important clinical implications for the prevention and treatment of NSSI.

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# CHAPTER 1

## INTRODUCTION

Nonsuicidal self-injury (NSSI) is the deliberate destruction of one's own body tissue without the conscious intent to die (Favazza, 1998). NSSI behaviors reported most frequently include cutting, burning, severely scratching, and banging oneself (Whitlock et al., 2011). Lifetime prevalence rates of NSSI are alarmingly high among college-aged samples, especially female college students (Whitlock et al., 2011), with rates in student samples typically falling in the 15%-19% range (Glenn & Klonsky, 2011; Whitlock et al., 2011; Whitlock, Eckenrode, & Silverman, 2006), and even higher rates reported in clinical samples (Glenn et al., 2017). These rates surpass typical benchmarks for rates of NSSI in the general population (e.g., 17.2% of adolescents [10-17 years old], 13.4% of young adults [18-24 years old], and 5.5% of adults [ $\geq$  25 years old]; Swannell, Martin, Page, Hasking, & St John, 2014). Furthermore, the college age range (e.g., 20-24 years old) is one of the two periods of typical onset of NSSI (with the other being approximately 14-15 years old; Gandhi et al., 2018). Importantly, NSSI incurs substantial societal costs including functional impairment (Selby, Bender, Gordon, Nock, & Joiner, 2012), heightened risk for suicide (Klonsky, May, & Glenn, 2013; Wilkinson, Kelvin, Roberts, Dubicka, & Goodyer, 2011), and economic tolls, in part via emergency department visits each year (Centers for Disease Control and Prevention, 2016). Even the more common experience of thinking about or having urges for NSSI (Turner, Baglole, Chapman, & Gratz, 2019) puts one at increased risk for future NSSI behaviors (Nock et al., 2010; Washburn, Juzwin, Styer, & Aldridge, 2010). As such, further understanding of both NSSI urges and behaviors has great public health importance.

Increased attention on NSSI in recent literature has strengthened our understanding of why this concerning and often misunderstood behavior occurs. For instance, empirical evidence suggests that increased negative emotions tend to precipitate NSSI (e.g., Chapman & Dixon-Gordon, 2007), and escape or relief from negative emotions is one mechanism that perpetuates NSSI over time (e.g., Chapman, Gratz, & Brown, 2006). Indeed, accumulating research suggests that mood problems and difficulties regulating emotions are among the key risk factors for NSSI (Fox et al., 2015). Furthermore, individuals who engage in NSSI tend to display not only emotional dysfunction, such as high negative emotionality (Bresin, 2014), but also impairment in social functioning (Turner, Wakefield, Gratz, & Chapman, 2017). Thus, individuals who engage in NSSI may do so primarily to regulate unwanted emotions, which they may experience more intensely than those who do not engage in NSSI, or in response to stressful interpersonal interactions.

Despite our growing understanding of who is at risk for NSSI and why this behavior may occur, researchers are still grappling with the important question of when and in what contexts people turn to NSSI. Thus, a critical next step to develop just-in-time interventions for NSSI is to identify the specific contexts in people's everyday lives that confer increased risk for NSSI. Given that people who engage in NSSI (compared to those who do not) tend to experience greater negative emotions and social dysfunction, it is possible that NSSI is more likely to occur when these at-risk individuals experience acute social stressors and heightened negative emotional reactions to these stressors, although further investigation is needed. Answers to these questions may foster improved

understanding of how NSSI operates in daily life, and consequently, how best to both prevent and treat this potentially dangerous behavior.

### **1.1 Why Individuals Engage in NSSI**

One of the major hurdles to understanding and treating NSSI is pinpointing why individuals might engage in such a self-destructive behavior. A number of theories help explain why individuals turn to NSSI as a means of coping. Converging lines of research suggest that those who engage in NSSI do so because this behavior serves important functions (Nock & Prinstein, 2004). One way of inferring functions of NSSI is to ask individuals to report their motives for engaging in this behavior. Myriad motives have been reported across studies, including to self-punish, induce positive emotions, communicate distress to others, and influence one's external environment (Klonsky, 2011; Taylor et al., 2018). Importantly, both theory and empirical work suggest that the most common reason people engage in NSSI is to avoid or escape negative emotions (Klonsky & Glenn, 2009; Nock & Prinstein, 2004; Taylor et al., 2018). For instance, the experiential avoidance model of NSSI suggests that NSSI serves to relieve or permit escape from aversive and unwanted emotional states, which negatively reinforces the NSSI behavior and increases the likelihood of future NSSI (Chapman et al., 2006). Indeed, evidence suggests that negative emotional states tend to precede episodes of NSSI (Koenig et al., 2020), and both increases in positive affect (Muehlenkamp et al., 2009) and decreases in negative affect are often reported immediately following NSSI (Kranzler et al., 2018). However, this model does not explain why individuals with emotion regulation difficulties would engage in NSSI versus other, perhaps less painful strategies (e.g., disordered eating behaviors, substance use, risky sexual behaviors) for

avoiding or escaping negative emotion. Moreover, there is evidence that suggests that such self-inflicted pain may lead to subsequent offset of pain, or relief, across both physiological and emotional pain for everyone (Franklin et al., 2013), yet not everyone turns to NSSI.

The defective self model of NSSI offers an explanation for why some individuals may turn to NSSI to regulate intense emotions over other methods (Hooley, Ho, Slater, & Lockshin, 2010). This model proposes that individuals who are highly self-critical and who believe they deserve to be punished, compared to those who do not, may be more likely to choose NSSI as an emotion regulation strategy. For these individuals, who may experience self-hatred and high levels of negative emotions towards the self (e.g., shame, guilt), the experience of pain may be consistent with these negative self-views, and therefore self-affirming (Hooley et al., 2010). In fact, self-criticism has been found to explain the relationship between NSSI and willingness to endure physical pain (Glenn, Michel, Franklin, Hooley, & Nock, 2014). Thus, individuals who are highly self-critical and have negative views of themselves may be more inclined to want to punish themselves, and may have fewer barriers to self-directed injury (Hooley & Franklin, 2018). Over time, NSSI may come to serve other functions as well, and people may discover that NSSI also alleviates emotional pain (Muehlenkamp, Brausch, Quigley, & Whitlock, 2012).

The defective self model is intuitively appealing in that it brings together several domains of work. First, whereas we know that individuals with NSSI report sweeping emotion regulation difficulties (Andover & Morris, 2014), this model helps us to understand why such individuals turn to NSSI rather than other ways of avoiding or

escaping their unwanted emotions. Indeed, this model suggests that some individuals are highly self-critical and feel intense shame and disappointment in who they are. As such, engaging in a behavior that reinforces these negative beliefs and functions to self-punish may be especially attractive.

This model also indirectly suggests that individuals who engage in NSSI, who are especially prone to internally-directed negative emotions like shame, may demonstrate greater reactivity to negative interpersonal feedback (e.g., criticism, rejection) than those without such negative self-views. Indeed, this tendency fits with the broad interpersonal difficulties reported by individuals who engage in NSSI. In particular, these individuals report a high degree of interpersonal (Kim et al., 2015) and rejection (Brown et al., 2017; Jiang, Ren, Liu, & You, 2020; Perini et al., 2019) sensitivity, and consistent links are found between perceived rejection experiences and NSSI (Cawley, Pontin, Touhey, Sheehy, & James, 2019). It therefore follows that individuals who are highly shame-prone would be especially sensitive to criticism and negative feedback by others. Indeed, interpersonal conflict in daily life tends to precede increased NSSI urges and behaviors (Turner, Cobb, Gratz, & Chapman, 2016), and increases in feelings of rejection and criticism are often reported prior to NSSI urges and behaviors (Nock, Prinstein, & Sterba, 2009; Snir, Rafaeli, Gadassi, Berenson, & Downey, 2015; Victor et al., 2019). Furthermore, the link between recalled parental criticism and adolescent NSSI tends to be stronger among those with a self-critical cognitive style (Wedig & Nock, 2007). Similarly, the link between perceived parental invalidation in childhood and NSSI has been explained by high levels of shame (Mahtani, Hasking, & Melvin, 2019). The unique type of interpersonal distress experienced by these individuals may be characterized by

self-conscious emotions, such as shame, guilt, and embarrassment. Thus, self-directed harm (i.e., NSSI) may be an especially ego-syntonic way to respond to this type of shame-inducing social distress.

## **1.2 Support for the Defective Self Model**

The defective self model has been well-supported in the literature. For instance, this model is supported by consistent correlations between both propensities for negative attitudes towards the self, especially self-criticism, and self-conscious negative emotions that are linked to self-criticism, such as shame and guilt (Castilho, Pinto-Gouveia, & Duarte, 2017; Gilbert et al., 2010; Gilbert & Miles, 2000), and NSSI. Indeed, numerous studies have found a positive link between self-criticism (Fox, Toole, Franklin, & Hooley, 2017; Gilbert et al., 2010; Xavier, Pinto Gouveia, & Cunha, 2016) and NSSI. Similarly, feelings of shame and guilt are also positively associated with NSSI (e.g., Brown, Linehan, Comtois, Murray, & Chapman, 2009; Gilbert et al., 2010; Hack & Martin, 2018; Sheehy et al., 2019; Taylor, McDonald, Smith, Nicholson, & Forrester, 2019; Xavier, Pinto-Gouveia, et al., 2016). Furthermore, daily thoughts about self-punishment is one mechanism that has been found to link self-criticism and NSSI urge intensity (Lear, Wilkowski, & Pepper, 2019). This suggests that self-criticism may prime thoughts about oneself deserving punishment, leading to desires to self-punish in order to remedy these thoughts in a self-affirming manner. Indeed, self-criticism was found to distinguish between individuals who engage in NSSI versus other indirect forms of self-injury (e.g., substance abuse, disordered eating behavior; St. Germain & Hooley, 2012). Also consistent with the defective self model, individuals with NSSI histories and those with a propensity for self-criticism demonstrate a unique emotional response to pain.



Specifically, individuals high on self-criticism actually report an increase in positive mood and a decrease in negative mood while experiencing pain, whereas the opposite pattern was found for those low on self-criticism (Fox et al., 2017). As might therefore be expected, a brief intervention aimed at increasing self-worth and decreasing self-criticism was associated with decreased willingness to endure physical pain among those with a history of NSSI (Hooley & St. Germain, 2014).

Although it is clear that negative, self-conscious emotions are tied to NSSI, and that NSSI may serve to reduce distress in a self-affirming manner, minimal research has explored whether social stress in particular is one context that primes these self-conscious emotional reactions. If, in fact, individuals who engage in NSSI demonstrate heightened self-conscious emotions in response to daily social stressors, it is also unknown whether experiencing greater-than-usual self-conscious emotional reactions to social stress might place these individuals at increased imminent risk for NSSI in daily life.

### **1.3 Under-examined Implications of the Defective Self Model**

Although the defective self model of NSSI has garnered support from an array of studies, several important extensions of this model have gone relatively under-examined. First, this model indirectly suggests that individuals who are highly shame-prone and who turn to NSSI to reduce distress in a self-affirming manner may experience heightened negative self-focused emotions (such as shame and guilt) in response to stressful social interactions. However, little work has been done to substantiate this, especially focusing in on self-conscious emotions rather than negative affect broadly, as well as on everyday social stressors outside of the laboratory.

Second, extant literature indicates that both the experience of social stress (Nock et al., 2009; Snir et al., 2015; Turner et al., 2016; Victor et al., 2019), and increases in self-conscious emotions (Arney, Crowther, & Miller, 2011; Lear et al., 2019; Snir et al., 2015) tend to prompt NSSI urges and behaviors in daily life. Of importance, the defective self model helps pinpoint *who* is at high risk of choosing to engage in NSSI over other emotion regulation strategies, namely, those who are highly self-critical and believe they deserve to be punished. However, this model and its supporting literature base does not necessarily indicate *when* these high-risk individuals are more likely to turn to NSSI as a means of coping. Few studies have focused on the nuanced, within-person shifts in these self-conscious emotions and social stressor features to help us understand what makes NSSI more likely on certain days compared to others. Such investigation has the potential to illuminate specific contexts in everyday life in which prevention and intervention is vital.

If the defective self model is further validated and elaborated upon, it has important treatment implications. Current evidence-based treatments for NSSI typically focus on ameliorating emotion regulation deficits generally (e.g., Gratz & Gunderson, 2006; Linehan, 1993). However, if this model holds for most individuals with recurrent NSSI, it would suggest that tailoring these skills specifically to managing self-conscious emotions, particularly in response to social stressors, may be most impactful. Some preliminary findings indirectly support this notion. For instance, two online interventions have been developed recently that target self-criticism (Hooley, Fox, Wang, & Kwashie, 2018) and self-aversion (Franklin et al., 2016) among NSSI samples. Initial randomized controlled trials demonstrate improvements in self-criticism and NSSI outcomes,

although treatment effects tend to dissipate over time (Franklin et al., 2016; Hooley et al., 2018). These findings suggest that self-criticism and negative self-directed emotions are important intervention targets among those who engage in NSSI, although further refinement of such interventions is needed.

### **1.3.1 Self-conscious emotional reactivity to social stressors among those who engage in NSSI**

Building on the aforementioned under-examined implications of the defective self model, individuals who engage in NSSI should be especially prone to experiencing negative self-directed emotions in response to stressful social contexts, such as engagement in conflict or receipt of criticism or rejection by others. In particular, given that individuals with NSSI have prominent interpersonal impairments (e.g., Muehlenkamp, Brausch, Quigley, & Whitlock, 2012; Turner, Wakefield, Gratz, & Chapman, 2017), especially high sensitivity to rejection (Brown et al., 2017; Jiang et al., 2020; Perini et al., 2019), we expect that social stressors would elicit self-conscious emotions more strongly among this population than among individuals without NSSI histories. Some evidence does support this contextual reactivity among those who engage in NSSI. For example, feelings of self-hatred were found to mediate the link between peer victimization and NSSI (Xavier, Pinto-Gouveia, et al., 2016). This suggests that stressful social interactions, such as victimization by peers, may elicit heightened self-conscious feelings among this population.

Studies that utilize laboratory-based stressors to explore emotional reactivity to social stressors among NSSI samples also generally support this pattern of findings. In response to simulated online social interactions in which participants received positive

and negative personal feedback, patients who engage in NSSI reported feeling rejected more often and experienced greater sensitivity to rejection than controls (Perini et al., 2019). Interestingly, frequency of cutting and recency of the latest NSSI episode were positively correlated with perceived rejection, suggesting this interpersonal sensitivity may be more pronounced among those with more severe NSSI histories. The NSSI (vs. control) group also demonstrated differential brain activation in regions related to mood control. Compared to those with either a history of suicide attempts or no history of suicide attempts or NSSI, those with recent NSSI reported more stress and rated themselves as more interpersonally sensitive during a task of interpersonal conflict (i.e., Prisoner's Dilemma task; Kim et al., 2015). Specifically, this task required that participants either cooperate with or defect from an "opponent" who was programmed to defect after multiple consecutive trials of cooperation to simulate betrayal. Taken together, individuals who engage in NSSI tend to display heightened sensitivity to social rejection and report greater self-conscious distress in response to social stressors in the laboratory.

Other laboratory research on general emotional reactivity to social stressors in NSSI samples is more mixed. For example, in response to a task in which participants had to complete a mock job interview and mental arithmetic exercise in front of an audience (i.e., Trier Social Stress Test), no differences were found between NSSI and control groups in emotional responses or in heart rate variability, an index of emotion regulation (Kaess et al., 2012). However, the NSSI group demonstrated attenuated cortisol responses (a biomarker of stress reactivity), highlighting a discrepancy between self-report and some physiological measures of emotional reactivity in this population.

Furthermore, in response to a virtual ball-tossing task in which participants were either tossed (included) or not tossed (excluded) the ball by “other participants” (i.e., Cyberball task), the NSSI group (compared to both borderline personality disorder [BPD] + NSSI and healthy control groups) demonstrated enhanced brain activation during social exclusion compared to inclusion (Brown et al., 2017), suggesting possible context-specific reactivity. These studies, however, did not parse apart self-conscious from general negative emotional reactions to stressors. Given the established links between NSSI and self-conscious emotions and self-criticism, this is an important area for future research.

Few studies have examined emotional reactivity, specifically with regards to self-conscious emotions, to social stressors outside of the laboratory and in daily life among those who engage in NSSI. While it is important to explore NSSI within controlled lab settings, it is also important to understand how these individuals function in everyday life, especially when confronted with real-world stressors. Those studies that have examined such reactivity in daily life reveal similarly conflicting findings. When prompted to rate momentary affective states and feelings of attachment towards their mothers and best friends on an hourly basis, individuals with NSSI (vs. controls) displayed both greater affective and interpersonal instability (Santangelo et al., 2017). Somewhat in contrast, in response to negative interpersonal interactions in daily life, those with recent, recurrent NSSI did *not* report more intense negative affect than those without NSSI (Turner et al., 2017). Over a three-week period using ecological momentary assessment (EMA), internalizing negative affect mediated the relationship between rejection/criticism in daily life and NSSI (Victor et al., 2019). Regardless of

context, those with a history of NSSI tend to report higher levels of negative emotions and greater within-person variation in negative emotions in daily life (Bresin, 2014; Victor & Klonsky, 2014), and this heightened negative emotion in daily life predicts subsequent NSSI urges (Victor et al., 2019), thoughts (Kiekens et al., 2020) and behaviors (Armeij et al., 2011; Houben et al., 2017; Kranzler, Fehling, Anestis, & Selby, 2016). Thus, individuals with NSSI histories seem to have greater, more variable, and/or more prolonged negative emotions, at least in some instances. In sum, some evidence points to a link between social stressors and negative emotional reactivity in daily life among those who engage in NSSI compared to those who do not. However, more work is needed to clarify inconsistencies in these findings across studies, and to explore self-conscious emotional responses in particular.

### **1.3.2 Within-person shifts in social stress and self-conscious emotions as predictors of NSSI in daily life**

While the defective self model helps us understand who is at risk of choosing NSSI – those who hold highly negative self-views and who find the experience of pain to be ego-syntonic – the model must be extended to allow us to pinpoint *when* these individuals are at imminent risk of engaging in NSSI in daily life. The existing literature on near-term predictors of NSSI, particularly with regards to social and emotional factors, aims to uncover the answer to this question. For instance, across numerous samples of adolescents and/or young adults with histories of NSSI, higher-than-usual stress levels (Miller et al., 2019) and negative affect (Kiekens et al., 2020; Kranzler et al., 2018; Victor et al., 2019) have been found to predict engagement in NSSI thoughts/urges and/or behaviors. Importantly, this was not always the case when examining average between-

person stress levels, underscoring the importance of exploring within-person processes in the prediction of imminent NSSI. In a similar vein, high within-person levels of negative emotion predicted a higher probability of engaging in NSSI in the next time interval in an experience sampling study of inpatients with BPD features (Houben et al., 2017). As such, the evidence consistently points to increases in state negative affect from an individual's typical level as prompting NSSI in daily life. However, in line with the defective self model, we might expect that in addition to negative emotion broadly, increases in more negative self-focused emotions, such as shame and guilt, may be particularly likely to elicit NSSI urges and behaviors on a daily basis.

Indeed, studies have just recently begun to examine the effects of within-person fluctuations in self-conscious emotions and related constructs on NSSI in daily life. For instance, in one study that aimed to further explore the defective self model of NSSI using a more ecologically valid approach, within-person state levels of both self-critical and self-punishment cognitions were positively associated with momentary NSSI urge intensity (Burke et al., 2021). Of note, consistent with other studies that parse apart between vs. within-subjects effects, self-criticism at the between-subjects level did not significantly predict NSSI urges. Expanding from the momentary to the daily level, daily guilt was found to predict both NSSI urge intensity (above and beyond daily sadness, hostility, and fear) and NSSI behavior, while daily self-punishment cognitions predicted NSSI urge intensity and behavior (Lear et al., 2019). Furthermore, self-criticism indirectly predicted NSSI urge intensity through increased daily thoughts about punishment. Taken together, there is preliminary evidence pointing to increases in self-

conscious emotions and thoughts at the individual-level as predicting NSSI in daily life, although further investigation is needed.

In addition to emotional predictors of NSSI in daily life, some researchers have begun similarly exploring the types of social events and processes that lead to increased imminent risk for NSSI – again, underscoring not just *who* is at risk for NSSI, but identifying specific social contexts in which risk is acutely elevated. Evidence consistently pinpoints increases in perceptions or experiences of social stress, including rejection, criticism (Victor et al., 2019), isolation (Snir et al., 2015), arguments/conflicts, and feeling hurt (Turner, Yiu, Claes, Muehlenkamp, & Chapman, 2016) as preceding NSSI urges and/or behaviors in daily life across samples. Similarly, daily conflict was associated with stronger same-day NSSI urges and increased likelihood of NSSI acts among those with chronic NSSI (Turner, Cobb, et al., 2016). In some cases, these findings were not replicated at the between-subjects level (Victor et al., 2019). In others, inpatients who engage in NSSI reported increases in average feelings of low belongingness and burdening others prior to an NSSI act, although these findings disappeared when controlling for suicidal ideation (Kyron, Hooke, & Page, 2018). Similarly, at the sample-mean level, young adults who engage (vs. not) in NSSI reported less perceived support during and following interactions with peers in daily life, although findings were no longer significant when controlling for baseline levels of social anxiety, excessive reassurance-seeking, and reduced use of support seeking to cope (with the NSSI group reporting greater levels of all variables; Turner et al., 2017). Therefore, some evidence points to the experience of increased social stress prior to NSSI in daily life, as



well as dysfunctional daily social interactions within this population in general, yet more work is needed in this area.

#### **1.4 Limitations of the Literature**

Although the defective self model of NSSI has garnered support in the literature, several implications of this model have not been examined sufficiently. One important implication is that social stressors are likely to be especially provocative of negative emotions, particularly self-conscious emotions, for individuals with NSSI histories compared to those without. Studies with NSSI populations in daily life tend to focus either on emotional processes (e.g., Bresin, 2014; Bresin, Carter, & Gordon, 2013; Victor & Klonsky, 2014) *or* social contexts (e.g., Miller et al., 2018; Turner, Cobb, Gratz, & Chapman, 2016), with few studies examining emotional reactivity to social stress in particular. In addition, many studies utilize social stressors that have been contrived in the laboratory (e.g., Kaess et al., 2012; Kim et al., 2015; Perini et al., 2019; Schatten et al., 2015; Tatnell et al., 2018), which lack ecological validity, thereby limiting our understanding of both what real-world social stressors look like for those who engage in NSSI, as well as how these individuals respond to such stressors in their everyday lives, perhaps promoting increased risk for imminent NSSI. Furthermore, studies that examine emotional responses in NSSI populations often utilize measures of valence or arousal more broadly, collapsing across negative emotions in general (e.g., Kaess et al., 2012; Santangelo et al., 2017; Tatnell et al., 2018), with minimal research examining specific types of emotional reactions, such as self-conscious emotions, among this group compared to controls (Boyes, Wilmot, & Hasking, 2019). The literature that does exist on emotional reactivity to daily social stressors in NSSI is mixed, and therefore further work

in this area is needed to understand the discrepancies across studies. Research in this area is especially critical because it has the potential to identify proximal cues that would indicate risk for imminent NSSI, and to offer a means of pinpointing especially high-risk moments at which intervention is necessary. Moreover, clearer understanding of the dysfunctional characteristics that define the daily social interactions experienced by those who engage in NSSI may aid clinicians in identifying targeted interpersonal skills.

Another under-examined implication of the defective self model is that risk for NSSI may be particularly elevated when individuals experience self-conscious emotions and social stress above and beyond their typical levels. Indeed, numerous systematic reviews of the extant literature on ecological approaches to studying NSSI found that increased negative affect tends to precede daily NSSI urges and behaviors across samples (Hepp et al., 2020; Rodríguez-Blanco, Carballo, & Baca-García, 2018). However, relatively few studies (Burke et al., 2021; Lear et al., 2019) have narrowed in on particular types of negative emotions, specifically, self-conscious emotions like shame and guilt, that stem from theoretical models of NSSI (Hooley et al., 2010) and are likely to be acutely tied to risk for NSSI. Furthermore, many studies examine links between social stress, self-conscious emotions, and NSSI on a between-person basis, which limits our understanding of what makes a unique individual more susceptible to NSSI on certain days versus others, which has important implications for intervention. Additionally, studies that link social stressors with NSSI are often cross-sectional in nature (e.g., Ammerman & Brown, 2018; Baetens et al., 2015), and therefore more work is needed to better understand the more imminent effects of social stressors and their features on NSSI urges and behaviors in daily life. In fact, a recent review identified the urgent need for

more detailed assessment of interpersonal events that precede NSSI in daily life (Hepp et al., 2020).

## **1.5 Present Study Aims and Hypotheses**

The overarching goal of the current study was to elaborate upon the defective self model of NSSI. In particular, we aimed to examine whether individuals with recent, recurrent NSSI differ from individuals with no NSSI history in terms of self-conscious emotional reactions to stressful social interactions in daily life, as well as dysfunctional features of these interactions. Furthermore, we aimed to better understand within-person social and emotional characteristics that make NSSI urges and behaviors more likely on certain days than others. The sample for the current study was made up of young (i.e., 18-35 years) females who recently took a college course, which constitutes a particularly high-risk group for NSSI engagement (Hamza et al., 2013; Whitlock et al., 2011).

### **1.5.1 Aim 1: Examine group differences in dysfunctional social stressor features and self-conscious emotional reactions to daily social stressors**

Aim 1 of this study was to explore group differences (those with a history of NSSI vs. without) in dysfunctional social stressor features and self-conscious emotional reactions to social stressors in daily life. Based on data linking NSSI with daily conflict (Turner, Cobb, et al., 2016) and interpersonal difficulties more broadly (Turner et al., 2017), we hypothesized that (1a) the NSSI (vs. no NSSI) group would report that their stressful social interactions were characterized by greater distress, disagreement/conflict/tension, and confusion/mixed feelings. Furthermore, based on literature indicating heightened interpersonal and rejection sensitivity (Brown et al., 2017; Cawley, Pontin, Touhey, Sheehy, & James, 2019; Jiang et al., 2020; Perini et al.,

2019) among those who engage in NSSI, as well as more negative emotionality (Bresin, 2014) including feelings of shame and guilt, we hypothesized that (1b) the NSSI (vs. no NSSI) group would demonstrate greater self-conscious emotional reactions to these daily social stressors. We similarly explored whether such stressors were associated with greater negative emotional reactions more generally (of both high and low arousal) among the NSSI (vs. no NSSI) group.

### **1.5.2 Aim 2: Examine the link between within-person shifts in daily social stressor features and self-conscious emotional reactions and NSSI**

Aim 2 of this study was to examine whether within just the NSSI group, within-person increases in dysfunctional social stressor features and self-conscious emotional reactions to daily social stressors would predict the occurrence of an NSSI urge or behavior that day. We hypothesized that (2a) the likelihood of reporting (vs. not reporting) an NSSI urge would be higher on days characterized by 1) social stressors experienced as more distressing, 2) stressors characterized by more disagreement/conflict/tension, and 3) more confusion/mixed feelings than usual. Furthermore, we hypothesized that the likelihood of reporting (vs. not reporting) an NSSI urge would be higher on days characterized by 4) greater self-conscious emotional reactions to daily social stressors, and 5) greater negative (both high and low arousal) emotional reactions than usual.

In a similar vein, we hypothesized that (2b) the likelihood of reporting (vs. not reporting) an NSSI behavior would be higher on days characterized by 1) social stressors experienced as more distressing, 2) stressors characterized by more disagreement/conflict/tension, and 3) more confusion/mixed feelings than usual.

Furthermore, we hypothesized that the likelihood of reporting (vs. not reporting) an NSSI behavior would be higher on days characterized by 4) greater self-conscious emotional reactions to daily social stressors, and 5) greater negative (both high and low arousal) emotional reactions than usual.

### **1.5.3 Aim 3: Examine whether trait self-criticism accounts for the link between NSSI history and within-person emotional reactions to daily social stressors**

Given that individuals who engage in NSSI are highly self-critical in general (Hooley et al., 2010), an additional aim (Aim 3) of this study was to examine whether the link between NSSI history (present vs. absent) and greater emotional reactions to daily social stressors (Aim 1b) would be explained by elevated trait self-criticism. We hypothesized that (3) when controlling for NSSI history, there would be a positive link between average levels of trait self-criticism and elevated self-conscious and negative (high and low arousal) emotional reactions to daily social stressors.

## CHAPTER 2

### METHOD

#### 2.1 Participants

In total, 158 participants enrolled in this study, which was part of a larger project examining relations among pain endurance, emotions, and NSSI in the laboratory and over time. Participants were college-aged women recruited from the University of Massachusetts and the surrounding community. Participants were eligible for the study if they spoke fluent English, were able to read and complete online questionnaires, were between 18 and 35 years of age, and had been enrolled in a college class in the past year. Given that one of the laboratory sessions involved completing a behavioral task measuring pain endurance, exclusion criteria included pain or sensory disorders or medical diseases likely to affect the task (e.g., Raynaud's disease, heart problems, physical problems with participants' dominant hands, McCoy, Fremouw, & McNeil, 2010; peripheral vascular disease, Bohus et al., 2000), and male sex, given sex differences in pain perception (Gratz et al., 2011; Klatzkin, Mechlin, & Girdler, 2010; Riley III, Robinson, Wise, Myers, & Fillingim, 1998). Participants were recruited into one of two groups: the (1) NSSI group, or (2) no NSSI group. The NSSI group consisted of individuals engaging in NSSI in a recurrent manner (i.e., at least 2 lifetime episodes), with at least 1 current (i.e., past-year) behavior *or* thoughts/urges for NSSI.<sup>1</sup> The no NSSI group consisted of individuals who reported no history of NSSI.

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<sup>1</sup>Participants who reported only past-year thoughts/urges for NSSI (rather than behaviors) needed to demonstrate especially repetitive lifetime NSSI behaviors (i.e., 5 or more).

Participant flow is described in Table 1. The present study is based on data from a two-week daily diary study. The final sample eligible for the daily diary, and subsequently utilized in the current analyses, was 134 participants. The NSSI group consisted of 77 participants, and the no NSSI group consisted of 57 participants.

Of the final sample, the average age was 21.01 years ( $SD = 3.19$ ), with the majority (68.66%) identifying their racial background as White, 19.40% identifying as Asian/Southeast Asian, 6.72% identifying as Black/African American, 5.97% identifying as Hispanic/Latinx, 3.73% identifying as Multiracial, and 2.24% identifying as American Indian. Additional demographic characteristics of the final sample can be found in Table 2.

## **2.2 Procedure**

Participants were recruited via introductory psychology classes that included a research participation option, via the psychology departmental prescreen questionnaires, and via the surrounding community through posted flyers and online postings. The recruitment advertisement for the parent study stated that we were interested in examining how emotions affect pain perception. All prospective participants completed a phone screen to confirm inclusion and exclusion criteria. Those who met study criteria were invited to participate, and provided written informed consent.

The larger study consisted of several components. First, participants completed two in-person laboratory sessions. The initial session involved engaging in structured and semi-structured interviews administered by trained assessors. These interviews assessed current and past psychological symptoms, as well as three recent social interactions (to be used as a mood induction via random assignment). Participants also completed a range of

self-report questionnaires. The second session involved completing laboratory tasks (e.g., pain task) for the larger study.

Participants who completed both in-person sessions were eligible for the daily diary component. One day following their second in-person session (with rare exceptions due to experimenter error), participants were invited via email using Qualtrics survey software to participate in the daily diary. This consisted of completing daily entries reporting on social interactions and risky behaviors for a total of up to 14 consecutive days. Each day, participants received an automated email at 12:00pm with their unique diary link. Participants were encouraged to complete their entries close to the end of the day. Participants received an automated reminder email at 11:00pm if they had not already completed their entry for the day. Participants were instructed that entries submitted past 4:00am for the previous day were considered late, and would not count towards compensation; for the current analyses, in order to increase sample size, we included those entries that were submitted past 4:00am yet were submitted within 24 hours of 11:59pm of the respective entry day.<sup>2</sup> During the second in-person lab session, the experimenter provided participants with written instructions to take home with them to help orient to these procedures. Each day, diary entries were assessed for signs of risk (e.g., past-day reports of suicidality or self-injurious behaviors), and flagged participants were emailed a list of mental health resources and emergency phone numbers to manage this risk.

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<sup>2</sup>No significant group differences were found between individuals who submitted any “late” entries vs. those who did not on demographic characteristics (i.e., ethnic minority status, age, current psychiatric medication use). Furthermore, entry status (late vs. not) was not significantly associated with any dependent variables of interest.



Participants were compensated with either experimental credit or monetary compensation for their participation. Participants who completed all follow-up surveys were awarded a \$25 bonus, and were entered into a raffle to win a gift card. This study was approved by the University of Massachusetts Amherst Institutional Review Board.

## **2.3 Relevant Baseline Measures**

### **2.3.1 Demographics**

Participants completed a measure of demographic characteristics created for the current study. These variables were used to describe the sample, and considered as potential covariates (see 2.5.1 for details on covariate selection).

### **2.3.2 Psychopathology**

Trained graduate students and lab personnel administered the MINI International Neuropsychiatric Interview (MINI 7.0.2; Sheehan, 2016) to assess participants for DSM-5 psychiatric disorders. This interview has demonstrated good inter-rater ( $\kappa = .88-1.0$ ) and test-retest reliability ( $\kappa = .76-.93$ ), and had high concordance with the Composite International Diagnostic Interview in a clinical sample (CIDI; Lecrubier et al., 1997). Assessors also administered the Structured Clinical Interview for DSM-IV Axis II disorders (SCID-II; First, Spitzer, Gibbon, Williams, & Benjamin, 1994) to assess for BPD symptoms. The SCID-II has demonstrated good inter-rater reliability ( $\kappa = .77-.94$ ; Lobbestael, Leurgans, & Arntz, 2011) and internal consistency ( $\alpha = .71-.94$ ; Maffei et al., 1997). The SCID-II has also been compared to other established personality assessments and demonstrated high diagnostic power (Skodol, Rosnick, Kellman, Oldham, & Hyler, 1988). Assessment sessions were audio recorded to establish reliability on over 4% of the interviews, and all interviews were reviewed by at least one other independent reviewer;

any discrepancies that arose were discussed together as a team. Psychopathology variables were used to describe the sample, and considered as potential covariates.

### **2.3.3 Trait self-criticism**

Participants completed the Self-Rating Scale (SRS; Hooley et al., 2010) to assess the presence of a trait ‘defective self’ cognitive schema, or level of self-criticism. The SRS is an eight-item measure, with items directly relating to masochistic ideation, self-directed anger, and feelings of worthlessness (St. Germain & Hooley, 2012). Participants rated how strongly they agreed with each statement on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The SRS has demonstrated good internal consistency (Cronbach’s  $\alpha = .73-.88$ ) in samples of community adolescents, young adults, and adults (Glassman, Weierich, Hooley, Deliberto, & Nock, 2007; Glenn, Michel, Franklin, Hooley, & Nock, 2014; Hooley et al., 2010), and has been shown to discriminate between individuals who engage in NSSI and healthy controls (Hooley et al., 2010). In the current sample, the SRS demonstrated good internal consistency (Cronbach’s  $\alpha = .89$ ).

## **2.4 Relevant Daily Measures**

### **2.4.1 Social interaction diary**

At the start of each diary entry, participants were prompted to identify the most stressful or upsetting social interaction or event (that lasted 10 or more minutes) they experienced in the past 24 hours or since their last diary entry (Stepp, Pilkonis, Yaggi, Morse, & Feske, 2009). Participants rated various interpersonal qualities of this interaction, including how *distressing* they found it to be on a scale ranging from 0 (no distress at all) to 100 (extremely distressing). Participants also rated the following

characteristics on a scale from 1 (very little) to 10 (a great deal): *degree of disagreement, conflict, or tension*; and *degree of confusion or mixed feelings*.

Participants also rated their *emotional responses* during/immediately after this stressful interaction. Specifically, participants rated 33 different emotions reflecting both positive and negative emotions (Stepp et al., 2009). The rating scale ranged from 1 (not at all) to 10 (a great deal). For the current analyses, a theoretically-driven composite score was calculated for self-conscious emotions, including ashamed, embarrassed/self-conscious, humiliated, bad/immoral/wrong, unwanted/unwelcome, left out/rejected (Cronbach's  $\alpha$  = .67-.87 across the days of the study). A composite score was also calculated for ratings of both high and low arousal negative emotions across days of the study. The distinction between high and low arousal was informed by prior work (Klonsky, 2009). The low arousal negative emotion composite consisted of the following emotions: unwanted/welcome, disappointed/let down, that you used or exploited others, ashamed, shy/awkward, bored/dead inside, hopeless/discouraged, sad/blue, numb/without any feeling, treated badly/hurt, embarrassed/self-conscious, left out/rejected, empty/hollow, ignored/neglected, humiliated, and bad/immoral/wrong (Cronbach's  $\alpha$  = .84-.93 across the days of the study). The high arousal negative emotion composite consisted of: frustrated/irritated, enraged/furious, nervous/anxious, shaky/jittery, mad/angry, and tense/on edge (Cronbach's  $\alpha$  = .74-.88 across the days of the study). Of note, there were 25 entries (across 14 different participants) with missing data on these emotion variables; this was almost exclusively due to participants indicating they had 0 social interactions considered stressful that day.

### 2.4.2 Self-injury diary

Following the social interaction diary, participants were prompted to indicate whether they experienced an NSSI urge, engaged in NSSI behavior, or neither yesterday (i.e., between their last entry and when they went to sleep) and/or today (i.e., since waking up). If NSSI urges and/or behaviors were reported in the current day's entry for the previous day (i.e., following the previous day's entry yet prior to the participant going to sleep), a lagged variable was used to create a composite containing both the current day and the previous day's data (both referring to the same day). Binary variables were created for both NSSI urges and NSSI behaviors wherein each participant received either a "yes" (coded 1) or "no" (coded 0) for an instance of NSSI urges and NSSI behaviors each day.

Of note, we also examined a continuous NSSI urges variable, the results of which are presented in the Appendix. If an NSSI urge was endorsed for the present day, participants were prompted to complete a measure of NSSI urge characteristics (e.g., frequency, duration; Alexian Brothers Urge to Self-Injure Scale, ABUSI; Washburn et al., 2010). The specific item used for the current paper was a continuous measure of the highest-intensity urge experienced that day (i.e., "*at the most severe point, how strong was your urge to self-injure today?*"). Responses were indicated on a 7-point Likert scale ranging from 0 (none at all), 1 (slight, that is, a very mild urge), 2 (mild urge), 3 (moderate urge), 4 (strong urge, but easily controlled), 5 (strong urge, but difficult to control), to 6 (strong urge and would have self-injured if able to). NSSI urges from the previous evening were not recorded. Individuals who denied any NSSI urge that day were coded as 0. Given that the distribution of responses to this item approximated more of a

binary variable (93% of responses were recorded as 0), we present here the findings from use of the binary NSSI urge variable; results using the continuous NSSI urge variable modeled with a Poisson distribution can be seen in Table 7.

## **2.5 Data Analytic Plan**

### **2.5.1 Preliminary analyses**

Study variables were evaluated for normality and outliers. Variables that did not meet assumptions of normality were transformed accordingly. Descriptive statistics were calculated for study variables, in addition to psychopathology variables and other possible covariates. To determine possible covariates, we ran a series of hierarchical linear model (HLM) analyses with the potential covariate (including demographic and psychopathology variables) as the level-2 predictor (with no level-1 variables), and each dependent variable of interest (distress, conflict, confusion/mixed feelings, self-conscious emotions, low arousal negative emotion, high arousal negative emotion, and NSSI urge and behavior [within the NSSI group only]). Variables were only considered as statistical controls when they significantly predicted the dependent variable of interest, and were not significantly associated with the independent variable of interest (i.e., NSSI history; Miller & Chapman, 2001). Logistic models with a Bernoulli distribution were used for those models with binary outcomes.

### **2.5.2 Primary analyses**

**Aim 1a (full sample): examine whether the NSSI group reports daily social stressor features characterized by greater dysfunction than the no NSSI group.** To address this Aim and the following, we conducted a series of HLM analyses, which accounted for the nested structure of the data (days within persons). As with all following

models, Day was included as a control variable, was centered at day 0, and was allowed to vary across participants when statistically significant. The NSSI variable was dummy coded with the NSSI group coded as 1, and the no NSSI group coded as 0. In all models, Level 1 continuous variables were group-mean centered, and Level 2 continuous variables were grand-mean centered. Full maximum likelihood was used for dealing with missing data. Below are the HLM equations for this specific aim:

Level 1:

$$Distress_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Level 1:

$$Conflict_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Level 1:

$$Confusion_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

**Aim 1b (full sample): examine whether the NSSI group reports greater self-conscious and negative emotions in response to daily social stressors than the no NSSI group.** To address this aim, we conducted a series of HLM analyses. Below are the equations:

Level 1:

$$Self-conscious\ Emotions_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Level 1:

$$Negative\ Emotions\ Low_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Level 1:

$$Negative\ Emotions\ High_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

**Aim 2a (NSSI group only): examine whether greater-than-usual**

**dysfunctional social stressor features and emotional responses to daily social**

**stressors is associated with increased likelihood of daily NSSI urges.** To address this

aim, we conducted a series of HLM analyses. Given the binary nature of all outcome

variables in Aim 2, these were modeled with a Bernoulli distribution, and the adaptive

Gaussian quadrature estimates were used where possible (coefficients were exponentiated

to convert to odds ratio). Below are the equations:

Level 1:

$$NSSI\ Urge_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + \pi_{2i}(Distress_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

Level 1:

$$NSSI\ Urge_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + \pi_{2i}(Conflict_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

Level 1:

$$NSSI\ Urge_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + \pi_{2i}(Confusion_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

Level 1:

$$NSSI\ Urge_{ii} = \pi_{0i} + \pi_{1i}(Day_{ii}) + \pi_{2i}(Self-conscious\ Emotions_{ii}) + e_{ii}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

Level 1:

$$NSSI\ Urge_{ii} = \pi_{0i} + \pi_{1i}(Day_{ii}) + \pi_{2i}(Negative\ Emotions\ Low_{ii}) + e_{ii}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

Level 1:

$$NSSI\ Urge_{ii} = \pi_{0i} + \pi_{1i}(Day_{ii}) + \pi_{2i}(Negative\ Emotions\ High_{ii}) + e_{ii}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

**Aim 2b (NSSI group only): examine whether greater-than-usual**

**dysfunctional social stressor features and emotional responses to daily social**

**stressors is associated with increased likelihood of daily NSSI behaviors.** To address

this aim, we conducted a series of HLM analyses. Below are the equations:

Level 1:

$$NSSI\ Behavior_{ii} = \pi_{0i} + \pi_{1i}(Day_{ii}) + \pi_{2i}(Distress_{ii}) + e_{ii}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10}$$

$$\pi_{2i} = \beta_{20}$$

Level 1:

$$NSSI\ Behavior_{ii} = \pi_{0i} + \pi_{1i}(Day_{ii}) + \pi_{2i}(Conflict_{ii}) + e_{ii}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10}$$

$$\pi_{2i} = \beta_{20}$$

Level 1:

$$NSSI\ Behavior_{ii} = \pi_{0i} + \pi_{1i}(Day_{ii}) + \pi_{2i}(Confusion_{ii}) + e_{ii}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$



$$\pi_{1i} = \beta_{10}$$

$$\pi_{2i} = \beta_{20}$$

Level 1:

$$NSSI\ Behavior_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + \pi_{2i}(Self-conscious\ Emotions_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10}$$

$$\pi_{2i} = \beta_{20}$$

Level 1:

$$NSSI\ Behavior_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + \pi_{2i}(Negative\ Emotions\ Low_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10}$$

$$\pi_{2i} = \beta_{20}$$

Level 1:

$$NSSI\ Behavior_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + \pi_{2i}(Negative\ Emotions\ High_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10}$$

$$\pi_{2i} = \beta_{20}$$

**Aim 3 (Full sample): examine whether elevated trait self-criticism helps**

**account for the link between NSSI history and greater within-person emotional**

**responses to daily social stressors.** To address this aim, we conducted a series of HLM

analyses. Below are the equations:

Level 1:

$$Self-conscious\ Emotions_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + \beta_{02}(Self-criticism_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Level 1:

$$Negative\ Emotions\ Low_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + \beta_{02}(Self-criticism_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Level 1:

$$Negative\ Emotions\ High_{ti} = \pi_{0i} + \pi_{1i}(Day_{ti}) + e_{ti}$$

Level 2:

$$\pi_{0i} = \beta_{00} + \beta_{01}(NSSI_i) + \beta_{02}(Self-criticism_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

## CHAPTER 3

### RESULTS

#### 3.1 Preliminary Results

##### 3.1.1 Daily diary compliance and descriptive statistics

We explored compliance with the daily diary protocol. Out of a possible 1,876 entries (134 participants x 14 entries each), 1,559 entries (83.10%) were completed and in compliance with the protocol (e.g., submitted within 24 hours of the end of each respective day; participant completed at least 2 entries in total). An average of 7.25 ( $SD = 4.02$ ) entries were completed per person. There was an average of 24.30 hours ( $SD = 11.33$  hours) between each entry submitted. Data were visually inspected for abnormally short response durations (< 1 minute); no entries were excluded. See Table 3 for additional descriptive statistics of the diary entries and participants.

We also examined group (NSSI vs. no NSSI) differences in demographic characteristics using a series of chi-square analyses and analyses of variance (ANOVAs). Participants in the NSSI (vs. no NSSI) group were younger, more likely to identify as LGBTQ, less likely to have a graduate education, more likely to report current psychiatric medication use, and more likely to have a history of psychiatric treatment. See Table 2 for results of tests of group differences in demographic characteristics.

##### 3.1.2 Normality

All continuous dependent variables were evaluated for normality. In the full sample, all variables except low arousal negative emotional responses (skew = 2.21,  $SE = 0.06$ ; kurtosis = 4.53,  $SE = 0.13$ ) and self-conscious emotional responses (skew = 2.08,  $SE = 0.06$ ; kurtosis = 4.73,  $SE = 0.13$ ) demonstrated sufficient skew (< 2.0) and kurtosis

(< 4.0) values. As such, these two variables were log (base 10) transformed and subsequently demonstrated skew (low arousal negative emotion = 1.07,  $SE = 0.06$ ; self-conscious emotion = 0.95,  $SE = 0.06$ ) and kurtosis (low arousal negative emotion = 0.13,  $SE = 0.13$ ; self-conscious emotion = 0.12,  $SE = 0.13$ ) values that more closely approximated a normal distribution. For ease of interpretation, results are presented with the original, non-transformed variables as outcomes, and footnotes are included to indicate whether use of the transformed variables altered the pattern of findings at all.

### 3.1.3 Covariates

In terms of potential covariates for the HLM models, we explored the following demographic and psychopathology variables: age, ethnic minority status (coded ethnic minority = 0, White = 1), current psychiatric medication use (coded 0 = no, 1 = yes), current major depressive disorder (coded 0 = no, 1 = yes), current posttraumatic stress disorder (PTSD; coded 0 = no, 1 = yes), and current BPD diagnosis (coded 0 = no, 1 = yes). We found significant group differences (NSSI vs. no NSSI) in psychiatric medication use ( $\chi^2(1) = 10.28, p = .001$ ), major depressive disorder ( $\chi^2(1) = 5.62, p = .018$ ), and BPD ( $\chi^2(1) = 13.99, p < .001$ ). Therefore, these covariates were not included in any of the models that contained NSSI history as an independent variable (Aims 1a, 1b, and 3; Miller & Chapman, 2001). Current PTSD was significantly associated with the following level-1 dependent variables: conflict ( $\beta_{01} = 0.97, SE = 0.44, p = .029$ ), confusion/mixed feelings ( $\beta_{01} = 1.03, SE = 0.50, p = .042$ ), low arousal negative emotion ( $\beta_{01} = 1.04, SE = 0.26, p < .001$ ), high arousal negative emotion ( $\beta_{01} = 0.94, SE = 0.34, p = .007$ ), self-conscious emotions ( $\beta_{01} = 0.88, SE = 0.29, p = .002$ ), and NSSI urge (within just the NSSI sample;  $\beta_{01} = 0.94, SE = 0.34, p = .007$ ). Ethnic minority status was

significantly associated with high arousal negative emotion ( $\beta_{01} = 0.41$ ,  $SE = 0.18$ ,  $p = .024$ ). Age was not significantly associated with any of the dependent variables.

Therefore, all models containing the aforementioned dependent variables were tested both with and without their respective covariates; whether or not the pattern of findings changed by including these covariates was indicated by a footnote in the corresponding table.

## **3.2 Primary Results**

### **3.2.1 Aim 1a**

Results can be seen in Table 4. The average distress level reported by the no NSSI group at the beginning of the study was 25.50 (on a scale of 0-100). Average levels of distress characterizing daily social stressors did not significantly change over the course of the study for the no NSSI group. Consistent with our hypothesis, controlling for day of the study, the NSSI group reported stressful social interactions characterized by significantly greater distress (an average of 7.89 units) than the no NSSI group.

The average conflict level reported by the no NSSI group at the beginning of the study was 3.00 (on a scale of 1-10). Average levels of conflict characterizing daily social stressors significantly decreased over the course of the study for the no NSSI group. Consistent with our hypothesis, controlling for day, the NSSI group reported stressful social interactions characterized by significantly greater conflict (an average of 0.50 units) than the no NSSI group.

The average confusion/mixed feelings level reported by the no NSSI group at the beginning of the study was 3.32 (on a scale of 1-10). Average levels of confusion/mixed feelings characterizing daily social stressors significantly decreased over the course of the

study for the no NSSI group. Consistent with our hypothesis, controlling for day, the NSSI group reported stressful social interactions characterized by significantly greater confusion/mixed feelings (an average of 0.72 units) than the no NSSI group.

### **3.2.2 Aim 1b**

Results can be seen in Table 4. The average level of self-conscious emotions reported by the no NSSI group in response to daily social stressors at the beginning of the study was 1.83 (on a scale of 1-10). Average levels of self-conscious emotions in response to daily social stressors significantly decreased over the course of the study for the no NSSI group. Consistent with our hypothesis, controlling for day, the NSSI group reported significantly higher levels of self-conscious emotions (an average of 0.46 units) in response to daily social stressors than the no NSSI group.

The average level of low arousal negative emotions reported by the no NSSI group in response to daily social stressors at the beginning of the study was 1.85 (on a scale of 1-10). Average levels of low arousal negative emotions in response to daily social stressors significantly decreased over the course of the study for the no NSSI group. Consistent with our hypothesis, controlling for day, the NSSI group reported significantly higher levels of low arousal negative emotions (an average of 0.45 units) in response to daily social stressors than the no NSSI group.

The average level of high arousal negative emotions reported by the no NSSI group in response to daily social stressors at the beginning of the study was 2.39 (on a scale of 1-10). Average levels of high arousal negative emotions in response to daily social stressors did not significantly change over the course of the study for the no NSSI group. Consistent with our hypothesis, controlling for day, the NSSI group reported

significantly higher levels of high arousal negative emotions (an average of 0.44 units) in response to daily social stressors than the no NSSI group.

### **3.2.3 Aim 2a**

Results can be seen in Table 5. The likelihood of an individual with average levels of distress during daily social stressors at the beginning of the study reporting an NSSI urge was 0.14. Consistent with our hypothesis, controlling for day of the study, a 1-unit increase from one's own average in level of distress characterizing daily social stressors was associated with a 1.02-fold increase in the odds of an NSSI urge that day. The likelihood of an individual with average levels of conflict during daily social stressors at the beginning of the study reporting an NSSI urge was 0.17. Contrary to our hypothesis, controlling for day, level of conflict characterizing daily social stressors was not significantly associated with the odds of an NSSI urge. The likelihood of an individual with average levels of confusion/mixed feelings during daily social stressors at the beginning of the study reporting an NSSI urge was 0.12. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in level of confusion/mixed feelings characterizing daily social stressors was associated with a 1.28-fold increase in the odds of an NSSI urge that day.

The likelihood of an individual with average levels of self-conscious emotions during daily social stressors at the beginning of the study reporting an NSSI urge was 0.16. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in self-conscious emotions in response to daily social stressors was associated with a 1.32-fold increase in the odds of an NSSI urge that day. The likelihood of an individual with average levels of low arousal negative emotions during daily social

stressors at the beginning of the study reporting an NSSI urge was 0.16. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in low arousal negative emotions in response to daily social stressors was associated with a 1.49-fold increase in the odds of an NSSI urge that day. The likelihood of an individual with average levels of high arousal negative emotions during daily social stressors at the beginning of the study reporting an NSSI urge was 0.14. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in high arousal negative emotions in response to daily social stressors was associated with a 1.44-fold increase in the odds of an NSSI urge that day.

#### **3.2.4 Aim 2b**

Results can be seen in Table 5. The likelihood of an individual with average levels of distress during daily social stressors at the beginning of the study reporting NSSI behavior was 0.0003. Consistent with our hypothesis, controlling for day of the study, a 1-unit increase from one's own average in level of distress characterizing daily social stressors was associated with a 1.02-fold increase in the odds of an NSSI behavior that day. The likelihood of an individual with average levels of conflict during daily social stressors at the beginning of the study reporting NSSI behavior was 0.02. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in level of conflict characterizing daily social stressors was associated with a 1.28-fold increase in the odds of an NSSI behavior that day. The likelihood of an individual with average levels of confusion/mixed feelings during daily social stressors at the beginning of the study reporting NSSI behavior was 0.01. Contrary to our hypothesis,



controlling for day, level of confusion/mixed feelings characterizing daily social stressors was not significantly associated with the odds of NSSI behavior.

The likelihood of an individual with average levels of self-conscious emotions during daily social stressors at the beginning of the study reporting NSSI behavior was 0.02. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in self-conscious emotions in response to daily social stressors was associated with a 1.46-fold increase in the odds of an NSSI behavior that day. The likelihood of an individual with average levels of low arousal negative emotions during daily social stressors at the beginning of the study reporting NSSI behavior was 0.02. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in low arousal negative emotions in response to daily social stressors was associated with a 1.84-fold increase in the odds of an NSSI behavior that day. The likelihood of an individual with average levels of high arousal negative emotions during daily social stressors at the beginning of the study reporting NSSI behavior was 0.02. Consistent with our hypothesis, controlling for day, a 1-unit increase from one's own average in high arousal negative emotions in response to daily social stressors was associated with a 1.33-fold increase in the odds of an NSSI behavior that day.

### **3.2.5 Aim 3**

Results can be seen in Table 6. When controlling for NSSI history (present vs. absent) at the start of the study, a 1-unit increase in level of trait self-criticism from the sample's average was associated with a 0.02-unit increase in self-conscious emotions in response to daily social stressors. When controlling for trait self-criticism at the start of

the study, NSSI history was no longer significantly associated with self-conscious emotional responses to daily social stressors.

When controlling for NSSI history at the start of the study, a 1-unit increase in level of trait self-criticism from the sample's average was associated with a 0.03-unit increase in low arousal negative emotion in response to daily social stressors. When controlling for trait self-criticism at the start of the study, NSSI history was no longer significantly associated with low arousal negative emotional responses to daily social stressors.

When controlling for NSSI history at the start of the study, a 1-unit increase in level of trait self-criticism from the sample's average was associated with a 0.03-unit increase in high arousal negative emotion in response to daily social stressors. When controlling for trait self-criticism at the start of the study, NSSI history was no longer significantly associated with high arousal negative emotional responses to daily social stressors.

### **3.2.6 Exploratory analyses**

Given the disproportionate rates of LGBTQ status in the NSSI group, we examined specific associations between distinct LGBTQ categories and NSSI rates and levels of self-criticism. In the full sample, individuals who identified as any LGBTQ identity ( $M = 33.05$ ,  $SD = 10.64$ ) reported significantly higher levels of trait self-criticism than individuals who identified as straight ( $M = 24.06$ ,  $SD = 11.52$ ),  $F(1, 127) = 20.91$ ,  $p < .001$ . Individuals who identified as bisexual in particular ( $M = 33.48$ ,  $SD = 9.57$ ) reported significantly higher levels of trait self-criticism than individuals who identified as any other sexual orientation ( $M = 26.35$ ,  $SD = 12.02$ ),  $F(1, 130) = 9.58$ ,  $p = .002$ .

Within just the NSSI group, a similar pattern was found; individuals who identified as any LGBTQ identity ( $M = 35.29$ ,  $SD = 9.87$ ) reported significantly higher levels of trait self-criticism than individuals who identified as straight ( $M = 27.66$ ,  $SD = 12.12$ ),  $F(1, 71) = 8.81$ ,  $p = .004$ . There were no significant group differences between those who identified as bisexual and those who identified as any other sexual orientation on trait self-criticism,  $F(1, 73) = 2.55$ ,  $p = .114$ . Furthermore, there were no significant group differences between individuals who identified as any LGBTQ identity and individuals who identified as straight in lifetime NSSI frequency,  $F(1, 73) = 0.83$ ,  $p = .365$ , nor were there any group differences between individuals who identified as bisexual and those who identified as any other sexual orientation,  $F(1, 73) = 0.38$ ,  $p = .540$ .

## **CHAPTER 4**

### **DISCUSSION**

Given the high rates of NSSI among college-aged individuals (e.g., Hamza et al., 2013), and the negative outcomes associated with this behavior, including heightened suicide risk (e.g., Klonsky et al., 2013), NSSI is a major public health concern. Research on NSSI has proliferated in recent years, and several lines of work have converged in supporting the defective self model of NSSI (e.g., Fox et al., 2017; Hooley & St. Germain, 2014; Lear et al., 2019). This model offers a coherent theory of who is most likely to resort to recurrent engagement in NSSI. Namely, individuals who are prone to self-criticize, experience intense negative self-conscious emotions, and have generally low regard for themselves are especially likely to find NSSI to be an ego-syntonic way of self-punishing in response to distress. This model also has several implications for the daily lives of individuals who engage in recurrent NSSI. Specifically, this model indirectly suggests that social stressors may be especially potent in generating negative emotional reactions, especially self-conscious emotions, as individuals with recurrent NSSI are likely to be sensitive to interpersonal feedback, and this feedback may prime underlying negative self-beliefs. Understanding whether the experience of greater-than-usual social stressors and negative emotional reactions to such stressors is associated with increased likelihood of NSSI would help us identify contexts in which these already at-risk individuals should be considered at acute risk. Therefore, the current study examined whether individuals with recent, recurrent NSSI differ from those with no NSSI history in terms of self-conscious and negative emotional reactions to stressful social interactions in daily life, as well as dysfunctional features of these interactions. Furthermore, we

examined whether within-person increases in these social stressor features and emotional reactions would predict when NSSI urges and behaviors are most likely to occur in daily life.

The present study showed relatively comparable rates of NSSI to other similar daily diary studies with similar sample characteristics (i.e., college-aged; ranging from 15%-52% of participants; Lear et al., 2019; Selby, Franklin, Carson-Wong, & Rizvi, 2013; Turner, Cobb, et al., 2016; Turner, Yiu, et al., 2016). Of note, the NSSI group was associated with disproportionately more participants who identified as LGBTQ. In particular, the NSSI group endorsed higher rates of bisexual, pansexual, and other sexual orientation identities than the no NSSI group. Exploratory analyses revealed that both within the full sample and specifically within the NSSI group, individuals who identified as any LGBTQ identity reported higher levels of trait self-criticism than those who identified as straight. This sample is likely at elevated risk for NSSI for a number of reasons associated with societal marginalization, including frequent experiences of feeling like a burden to others (Muehlenkamp, Hilt, Ehlinger, & McMillan, 2015), and being victimized and discriminated against due to their minoritized identities, along with feelings of low connectedness to others (Busby et al., 2020).

Consistent with our hypotheses, findings from Aim 1a revealed that the NSSI group characterized their daily stressful social interactions as involving significantly greater distress, conflict, and confusion/mixed feelings on average than the no NSSI group. Of particular interest, the model including level of conflict was the best fit to the data. These findings fit with literature suggesting global interpersonal difficulties among individuals who engage in NSSI, such as greater social anxiety, more use of reassurance-

seeking and less use of support-seeking (Turner et al., 2017), lower family cohesion (Crowell et al., 2008) and support (Tatnell, Kelada, Hasking, & Martin, 2014), and high levels of rejection (Cawley et al., 2019). Findings in daily life suggest that those who engage in NSSI do not recruit social support to cope with distress, and perceive peer interactions to be less supportive (Turner et al., 2017). Given overarching social deficits among individuals who engage in NSSI (Turner, Chapman, & Layden, 2012; Turner et al., 2017), these individuals may be more susceptible to upsetting everyday social interactions and have difficulties effectively navigating such interactions, as well as more likely to turn to NSSI as a means of coping or conveying distress. Indeed, among those who engage in frequent NSSI, certain interpersonal styles such as domineering/controlling and intrusive/needy were associated with engaging in NSSI for motivations of influencing others, while vindictive/self-centered interpersonal styles were associated with engaging in NSSI for motivations of communicating to others (Turner et al., 2012). Also supporting this notion is research pointing to difficulties identifying and regulating emotions as mediating the links between family/peer relational issues and NSSI (Adrian, Zeman, Erdley, Lisa, & Sim, 2011; Cerutti, Zuffianò, & Spensieri, 2018). We also know that NSSI is more likely to occur in daily life in response to negative social experiences such as conflict, rejection, and criticism (Nock et al., 2009; Snir et al., 2015; Turner, Cobb, et al., 2016; Victor et al., 2019). Therefore, interventions that enhance social skills (e.g., Linehan, 1993) among those who engage in NSSI may better equip these individuals to more effectively handle tricky social interactions in everyday life, thereby strengthening their interpersonal functioning and reducing their likelihood of relying on recurrent NSSI.

Findings from Aim 1b further revealed that on average, the NSSI group reported significantly greater self-conscious emotions, and both high and low arousal negative emotions in response to daily social stressors than the no NSSI group, consistent with our hypotheses. Interestingly, the model including level of low arousal negative emotion was the best fit to the data. These findings are in line with studies indicating that in response to laboratory-based social stressors, individuals with NSSI histories report elevated rejection (Perini et al., 2019) and interpersonal sensitivity (Kim et al., 2015) and enhanced brain activation in response to rejection (Brown et al., 2017), as well as EMA studies that link daily rejection/criticism experiences to NSSI via increased negative emotion (Victor et al., 2019). Our findings stand in contrast to others suggesting no differences between individuals with vs. without NSSI in negative emotional reactivity to social stressors in daily life (Turner et al., 2017). Possible explanations for this discrepancy are differences in the sample severity (with Turner et al., 2017 requiring a higher threshold for lifetime NSSI frequency and more recent thoughts/urges), frequency of assessments (with Turner et al., 2017 utilizing more reports per day), or specific measures used to assess both negative emotion and daily social stressors. Perhaps these group differences disappear when examining a more severe NSSI sample, and when not collapsing across an entire day's worth of social events and emotions. Importantly, the current study was one of the first to specifically examine self-conscious emotional reactions to everyday social stressors among those who engage in NSSI. Our results support an important implication of the defective self model in that stressful social interactions may be one everyday context in which those who engage in NSSI experience an acute shameful or otherwise negative emotional response, consequently leading to

elevated risk for further NSSI. Clinical implications of these findings are that targeting both susceptibility to social stressors (by addressing skills deficits) and emotional reactivity to such stressors (by teaching effective emotion regulation skills) are vital in reducing daily NSSI risk. Low arousal negative emotions in particular (including such self-conscious emotions as ashamed, embarrassed, bad/immoral/wrong, and rejected) are an important treatment target within this population.

Findings from Aims 2a and 2b within the NSSI group revealed that consistent with our hypotheses, greater-than-usual levels of distress characterizing daily social stressors were associated with increased likelihood of both same-day NSSI urges and behaviors. Interestingly, greater-than-usual levels of confusion/mixed feelings characterizing daily social stressors was associated with increased likelihood of same-day NSSI urges, but this was not the case for NSSI behaviors. Furthermore, greater-than-usual levels of conflict characterizing daily social stressors was associated with increased likelihood of same-day NSSI behaviors, but not urges. These findings are somewhat parallel to other research pinpointing increases in social stress (rejection, criticism, isolation, conflict) as preceding NSSI urges/behaviors in daily life (Snir et al., 2015; Turner, Cobb, et al., 2016; Victor et al., 2019). Our findings may be more nuanced in suggesting that experiencing heightened confusion within a stressful interpersonal interaction may promote urges for NSSI, yet may not be potent enough to elicit NSSI behaviors, whereas interpersonal conflict may be sufficiently distressing enough to prompt an NSSI behavior. This behavior may serve to reduce distress associated with increased conflict, or could potentially serve an interpersonal function of communication or influence of others. Despite some evidence linking confusion about the self and



recurrent NSSI behavior (Muehlenkamp, Ertelt, Miller, & Claes, 2011), and the mediating role of identity confusion in linking low peer/maternal attachment and lifetime NSSI behavior (Gandhi et al., 2016), there has been minimal examination of confusion within relationships and NSSI. Further investigation into the mechanisms linking certain types of interpersonal stress to NSSI urges vs. behaviors is needed.

We also found that greater-than-usual self-conscious and negative (high and low arousal) emotional reactions to daily social stressors were associated with increased likelihood of both same-day NSSI urges and behaviors. Although numerous studies have found that higher-than-usual stress levels and negative affect predict subsequent NSSI urges/behaviors (Houben et al., 2017; Kiekens et al., 2020; Kranzler et al., 2018; Miller et al., 2019; Victor et al., 2019), this study is one of the few to examine emotional reactions to social stressors, as well as self-conscious emotional reactions specifically, as predictors of NSSI in daily life. The few that have focused in on self-conscious emotions (e.g., guilt) and related cognitions (e.g., self-critical and self-punishing thoughts) similarly found that within-person increases in self-conscious emotions predicted daily NSSI urge intensity and behavior (Lear et al., 2019), and self-critical cognitions predicted momentary (Burke et al., 2021) and daily (Lear et al., 2019) NSSI urge intensity/behavior. Taken together, findings from Aims 2a and 2b highlight the importance of focusing on within-person processes in understanding when individuals are at heightened risk for NSSI. Moreover, our findings suggest that experiencing more distressing and conflictual everyday social interactions than usual, as well as stronger-than-usual inward-focused negative emotional reactions, may place an at-risk individual at particularly elevated risk for engaging in NSSI behavior.

Finally, consistent with our hypotheses, results from Aim 3 suggested that elevated trait self-criticism accounted for the positive link between NSSI history and greater within-person self-conscious and negative (high and low arousal) emotional reactions to daily social stressors at the start of the study. Of note, the model predicting low arousal negative emotion best fit the data. These findings are perhaps not surprising given established links between NSSI and elevated self-criticism (e.g., Gilbert et al., 2010; Xavier, Pinto Gouveia, & Cunha, 2016). This also supports our theory based on the defective self model that individuals who are highly self-critical and hold defective views of themselves may be more prone to having strong emotional responses to stressful social interactions in everyday life due to heightened interpersonal sensitivity. Given that among the NSSI group, greater-than-usual self-conscious and negative emotional reactions to these daily social stressors were associated with both NSSI urges and behaviors, these findings underscore the importance of targeting self-critical thoughts and emotions among this population in a clinical context. With this evidence of a potential explanatory process (i.e., elevated trait self-criticism helps explain the link between NSSI history and heightened self-conscious and negative emotional responses to daily social stressors), conducting a formal mediation analysis will be needed to provide further support of this model.

This study had several limitations that warrant mention. First, participants completed only one assessment per day. Although daily diary methodology contains greater ecological validity than a one-time assessment in the laboratory (given that participants are responding in their real-world contexts to everyday social interactions over a span of up to 14 days), retrospective recall is not entirely eliminated given that

participants must reflect back on an entire day's worth of events. In addition, we cannot conclude that social stressors at one point in the day led to subsequent NSSI urges/behaviors at a later point in the day. Future studies employing EMA protocols with multiple prompts throughout the day are needed to explore the more nuanced sequelae of how NSSI unfolds in daily life. Second, this study relied exclusively on self-report measures, which may involve both biased recall and difficulties pinpointing the emotional and social context surrounding NSSI, especially considering established links between NSSI and difficulties differentiating negative emotions (Zaki, Coifman, Rafaeli, Berenson, & Downey, 2013). Future studies that incorporate both self-report and more objective markers of emotional reactivity (e.g., psychophysiological measures) will be helpful in corroborating laboratory-based evidence with more ecologically-valid data. Third, reports of NSSI, specifically behaviors, were relatively infrequent throughout the study. Although relatively consistent with other studies (e.g., Lear et al., 2019; Turner, Cobb, et al., 2016; Turner, Yiu, et al., 2016), findings must be replicated in other, larger samples to assess whether a similar pattern emerges. Finally, our sample was made up of college-aged women, and findings may therefore not be generalizable to samples of different age groups, males, or those with varying clinical severities. As such, replication of these findings will be needed in these other sample types.

These limitations notwithstanding, the current study constitutes an important step forward in research examining social and emotional contexts associated with imminent risk for NSSI in daily life. Findings from this study have important clinical implications. First, these findings provide support for what clinicians working with patients reporting NSSI are already doing – namely, targeting social difficulties by teaching skills such as

assertiveness and validation of others (Linehan, 1993), and targeting difficulties with emotion regulation by helping patients identify, tolerate, and modulate unwanted or distressing emotions (Gratz & Gunderson, 2006; Linehan, 1993). These interventions may help reduce the elevated levels of distress, conflict, and confusion characterizing everyday stressful social interactions experienced by those who engage in NSSI, as well as their self-conscious and negative emotional responses to such interactions. Reducing low arousal negative emotions in particular, including disappointment, shame, emptiness, and hopelessness, should be a high-priority treatment target among this population. Second, our findings highlight the utility, both in clinical and research contexts, of assessing an individual's deviation from their unique norm, rather than from their affiliated group norm, in understanding when increased concern is warranted. With the field moving more and more towards the use of mobile technology for clinical assessment and intervention, monitoring within-person fluctuations in interpersonal distress and conflict, as well as negative emotional responses, will be vital for the implementation of just-in-time interventions (Carpenter, Menictas, Nahum-Shani, Wetter, & Murphy, 2020) to prevent the occurrence of NSSI in everyday life. Third, our findings point to the necessity of targeting self-criticism among individuals with recurrent NSSI. Interventions have indeed been developed in recent years that target self-criticism and related constructs (Franklin et al., 2016; Hooley et al., 2018). Initial randomized controlled trials demonstrate improvements in self-criticism and NSSI outcomes, although treatment effects tend to dissipate over time (Franklin et al., 2016; Hooley et al., 2018). These findings suggest that self-criticism and negative self-directed emotions are

important intervention targets among those who engage in NSSI, and continued refinement of such interventions is needed.

Table 1: Participant and Diary Entry Flow

Participants	Description
<i>N</i> = 158	Enrolled in study
<i>n</i> = 2	Screened out due to exclusion criteria
<i>n</i> = 6	Withdrew after initial session
<i>n</i> = 12	Fell out due to attrition; did not complete lab session
<i>n</i> = 1	Incomplete lab session due to external circumstances
<i>n</i> = 3	Eligible for daily diary, but < 2 days of diary data
<i>n</i> = 1	Never sent daily diary due to experimenter error
<i>n</i> = 1	Completed 0 entries
<i>n</i> = 1	Completed 1 full entry
<i>N</i> = 134	Final sample for analyses
<i>n</i> = 77	NSSI group
<i>n</i> = 57	No NSSI group
Diary Entries	Description
<i>n</i> = 10	Excluded due to lateness (submitted past 24 hours following the end of the due date)
<i>n</i> = 22	Excluded due to incompleteness (missing >20% of data on at least 1 measure)
<i>n</i> = 21	Excluded for other reasons (e.g., duplicate entries)
<i>N</i> = 1559	Total number of entries for analyses

Table 2: Descriptive Statistics of Demographic Variables

Variable	Full sample ( <i>n</i> = 134)	NSSI group ( <i>n</i> = 77)	No NSSI group ( <i>n</i> = 57)	<i>F</i> or $\chi^2$
Age ( <i>M</i> , <i>SD</i> )	21.01 (3.19)	20.35 (2.25)	21.88 (3.97)	7.66**
Sexual orientation				16.97**
Straight	52.24%	41.56%	66.67%	
Bisexual	25.37%	31.17%	17.54%	
Lesbian or gay	8.21%	7.79%	8.77%	
Pansexual	5.22%	9.09%	0.00%	
Other	3.73%	6.49%	0.00%	
Asexual	2.99%	1.30%	5.26%	
Relationship status				0.09
Single	85.82%	85.71%	85.96%	
Living with partner	8.96%	9.09%	8.77%	
Legally partnered	2.99%	2.60%	3.51%	
Race/Ethnicity				3.91
White/Caucasian	68.66%	74.03%	61.40%	
Asian/Southeast Asian	19.40%	16.88%	22.81%	
Black/African American	6.72%	3.90%	10.53%	
Hispanic/Latinx	5.97%	6.49%	5.26%	
Multiracial	3.73%	3.90%	3.51%	
Native American	2.24%	2.60%	1.75%	
Education status				17.84**
High school graduate	4.48%	3.90%	5.26%	
Some college	72.39%	83.12%	57.89%	
College graduate	5.97%	6.49%	5.26%	
Some graduate school	10.45%	2.60%	21.05%	
Graduate or professional degree	4.48%	1.30%	8.77%	
Current psychiatric medication (yes)	34.33%	45.45%	19.30%	10.98**
Lifetime psychiatric treatment (yes)	44.03%	59.74%	22.81%	21.64***

\**p* < 0.05. \*\**p* < 0.01. \*\*\**p* < 0.001.

Table 3: Descriptive Statistics of Participants and Diary Entries

Participants	<i>N</i> (%) or <i>M</i> ( <i>SE</i> )
Reported NSSI urge at any point (NSSI sample only)	50 (64.94%)
NSSI urge intensity (NSSI sample only)	0.17 (0.03) <i>Min</i> : 0, <i>Max</i> : 5
Reported NSSI behavior at any point (NSSI sample only)	16 (20.78%)
Reported 0 social interactions > 10 minutes at any point	14 (10.45%)
Contained missing data for # of social interactions	4 (2.99%)
Reported social interactions that were 0% stressful at any point	95 (70.90%)
<b>Diary Entries</b>	
Days of reported NSSI urges (NSSI sample only)	77 (8.82%)
Days of reported NSSI behaviors (NSSI sample only)	25 (2.86%)
Entries containing 0 social interactions > 10 minutes	19 (1.22%)
Entries containing missing data for # of social interactions	4 (0.26%)
Entries containing social interactions rated as 0% stressful	351 (22.51%)
Entries containing missing data for % stressful	6 (0.38%)

*Note.* NSSI = nonsuicidal self-injury.



Table 4: Aims 1a and 1b: Group Differences in Daily Social Stressors and Emotions

Fixed Effects	Estimate	SE	p	Deviance
DV: Distress <sup>a</sup>				14381.44
Intercept ( $\beta_{00}$ )	25.50	2.18	<.001	
NSSI ( $\beta_{01}$ )	7.89	2.40	.001	
Day ( $\beta_{10}$ )	-0.14	0.17	.423	
DV: Conflict <sup>b</sup>				7043.59
Intercept ( $\beta_{00}$ )	3.00	0.20	<.001	
NSSI ( $\beta_{01}$ )	0.50	0.22	.025	
Day ( $\beta_{10}$ )	-0.04	0.02	.029	
DV: Confusion <sup>ab</sup>				7133.57
Intercept ( $\beta_{00}$ )	3.32	0.21	<.001	
NSSI ( $\beta_{01}$ )	0.72	0.25	.004	
Day ( $\beta_{10}$ )	-0.06	0.01	<.001	
DV: Self-conscious emotions <sup>bc</sup>				5029.01
Intercept ( $\beta_{00}$ )	1.83	0.12	<.001	
NSSI ( $\beta_{01}$ )	0.46	0.14	.001	
Day ( $\beta_{10}$ )	-0.02	0.01	.018	
DV: Negative emotion (low arousal) <sup>bc</sup>				4564.85
Intercept ( $\beta_{00}$ )	1.85	0.11	<.001	
NSSI ( $\beta_{01}$ )	0.45	0.13	<.001	
Day ( $\beta_{10}$ )	-0.02	0.01	.009	
DV: Negative emotion (high arousal) <sup>bd</sup>				5572.51
Intercept ( $\beta_{00}$ )	2.39	0.15	<.001	
NSSI ( $\beta_{01}$ )	0.44	0.17	.013	
Day ( $\beta_{10}$ )	-0.02	0.01	.151	

Note. SE = standard error. DV = dependent variable. NSSI = nonsuicidal self-injury.

<sup>a</sup>Day was fixed to 0 in this model given lack of significance of its variance component.

<sup>b</sup>This model was tested with current PTSD diagnosis as a covariate; the pattern of findings remained the same.

<sup>c</sup>When testing this model with the log (base 10) transformed outcome variable, the pattern of findings did not change.

<sup>d</sup>This model was tested with ethnic minority status as a covariate; the pattern of findings remained the same.

Table 5: Aims 2a and 2b: Links Between Daily Social Stressors and Emotions and NSSI Outcomes

Fixed Effects	OR	Estimate	SE	p	Deviance
DV: NSSI Urge <sup>a</sup>					2065.60
Intercept ( $\beta_{00}$ )	0.14	-1.96	0.24	<.001	
Day ( $\beta_{10}$ )	0.89	-0.11	0.03	<.001	
Distress ( $\beta_{20}$ )	1.02	0.02	0.01	<.001	
DV: NSSI Urge <sup>a</sup>					2061.75
Intercept ( $\beta_{00}$ )	0.17	-1.76	0.22	<.001	
Day ( $\beta_{10}$ )	0.89	-0.12	0.03	<.001	
Conflict ( $\beta_{20}$ )	1.09	0.08	0.06	.142	
DV: NSSI Urge <sup>a</sup>					2046.71
Intercept ( $\beta_{00}$ )	0.12	-2.08	0.32	<.001	
Day ( $\beta_{10}$ )	0.89	-0.11	0.09	.217	
Confusion ( $\beta_{20}$ )	1.28	0.24	0.05	<.001	
DV: NSSI Urge <sup>ab</sup>					2053.60
Intercept ( $\beta_{00}$ )	0.16	-1.80	0.22	<.001	
Day ( $\beta_{10}$ )	0.89	-0.12	0.03	<.001	
Self-conscious emotions ( $\beta_{20}$ )	1.32	0.28	0.12	.022	
DV: NSSI Urge <sup>ab</sup>					2048.42
Intercept ( $\beta_{00}$ )	0.16	-1.85	0.23	<.001	
Day ( $\beta_{10}$ )	0.90	-0.11	0.03	.001	
Negative emotion (low arousal) ( $\beta_{20}$ )	1.49	0.40	0.12	.002	
DV: NSSI Urge <sup>a</sup>					2047.00
Intercept ( $\beta_{00}$ )	0.14	-1.96	0.30	<.001	
Day ( $\beta_{10}$ )	0.90	-0.11	0.07	.118	
Negative emotion (high arousal) ( $\beta_{20}$ )	1.44	0.36	0.09	<.001	
DV: NSSI Behavior					1882.44
Intercept ( $\beta_{00}$ )	0.0003	-8.04	0.64	<.001	
Day ( $\beta_{10}$ )	1.01	0.01	0.06	.842	
Distress ( $\beta_{20}$ )	1.03	0.03	0.01	.005	
DV: NSSI Behavior					--
Intercept ( $\beta_{00}$ )	0.02	-3.97	0.43	<.001	
Day ( $\beta_{10}$ )	1.01	0.01	0.05	.807	
Conflict ( $\beta_{20}$ )	1.29	0.25	0.08	.001	
DV: NSSI Behavior					1772.81
Intercept ( $\beta_{00}$ )	0.01	-4.52	0.61	<.001	
Day ( $\beta_{10}$ )	1.01	0.01	0.05	.852	
Confusion ( $\beta_{20}$ )	1.13	0.12	0.09	.176	
DV: NSSI Behavior <sup>b</sup>					--
Intercept ( $\beta_{00}$ )	0.02	-3.92	0.43	<.001	
Day ( $\beta_{10}$ )	1.01	0.01	0.05	.842	

Self-conscious emotions ( $\beta_{20}$ )	1.50	0.40	0.14	.004	
DV: NSSI Behavior <sup>b</sup>					--
Intercept ( $\beta_{00}$ )	0.02	-4.10	0.45	<.001	
Day ( $\beta_{10}$ )	1.02	0.02	0.05	.680	
Negative emotion (low arousal) ( $\beta_{20}$ )	1.86	0.62	0.16	<.001	
DV: NSSI Behavior					--
Intercept ( $\beta_{00}$ )	0.02	-3.84	0.42	<.001	
Day ( $\beta_{10}$ )	1.01	0.01	0.05	.912	
Negative emotion (high arousal) ( $\beta_{20}$ )	1.35	0.30	0.13	.022	

*Note.* OR = odds ratio. SE = standard error. DV = dependent variable. NSSI = nonsuicidal self-injury. The Adaptive Gaussian Quadrature (AGQ) estimates are presented for all NSSI urge models except for confusion/mixed feelings and high arousal negative emotion, in which the EM Laplace-2 estimates are reported due to nonconvergence. Day was not allowed to vary across participants in the NSSI urge models given lack of significance of its variance component. The Penalized Quasi-Likelihood (PQL) estimates are presented for all NSSI behavior models due to nonconvergence except for confusion/mixed feelings, in which the AGQ estimates are reported, and distress, in which the EM Laplace-2 estimates are reported. Both Day and the respective independent variable were not allowed to vary across participants in the NSSI behavior models given difficulties with model convergence. HLM did not produce model fit statistics in some cases.

<sup>a</sup>This model was tested with current PTSD diagnosis as a covariate; the pattern of findings remained the same.

<sup>b</sup>When testing this model with the log (base 10) transformed predictor variable, the pattern of findings did not change.

Table 6: Aim 3: NSSI History and Trait Self-Criticism Predicting Emotional Responses to Daily Social Stressors

Fixed Effects	Estimate	SE	<i>p</i>	Deviance
DV: Self-conscious emotion <sup>ab</sup>				4882.19
Intercept ( $\beta_{00}$ )	1.95	0.12	<.001	
NSSI ( $\beta_{01}$ )	0.25	0.15	.087	
Self-criticism ( $\beta_{02}$ )	0.02	0.01	<.001	
Day ( $\beta_{10}$ )	-0.02	0.01	.018	
DV: Negative emotion (low arousal) <sup>ac</sup>				4423.14
Intercept ( $\beta_{00}$ )	1.97	0.11	<.001	
NSSI ( $\beta_{01}$ )	0.24	0.13	.074	
Self-criticism ( $\beta_{02}$ )	0.03	0.01	<.001	
Day ( $\beta_{10}$ )	-0.02	0.01	.008	
DV: Negative emotion (high arousal) <sup>ad</sup>				5395.12
Intercept ( $\beta_{00}$ )	2.53	0.15	<.001	
NSSI ( $\beta_{01}$ )	0.17	0.18	.331	
Self-criticism ( $\beta_{02}$ )	0.03	0.01	<.001	
Day ( $\beta_{10}$ )	-0.02	0.01	.124	

Note. SE = standard error. DV = dependent variable. NSSI = nonsuicidal self-injury

<sup>a</sup>This model was tested with current PTSD diagnosis as a covariate; the pattern of findings remained the same.

<sup>b</sup>When testing this model with the log (base 10) transformed outcome variable, the effect of NSSI was marginally significant ( $p = .052$ ).

<sup>c</sup>When testing this model with the log (base 10) transformed outcome variable, the effect of NSSI remained significant ( $p = .045$ ).

<sup>d</sup>This model was tested with ethnic minority status as a covariate; the pattern of findings remained the same.

## APPENDIX

### SUPPLEMENTAL ANALYSES

Table 7: Aim 2a: Links between Daily Social Stressors and Emotions and Continuous NSSI Urges

Fixed Effects	OR	Estimate	SE	<i>p</i>	Deviance
DV: NSSI Urge <sup>a</sup>					--
Intercept ( $\beta_{00}$ )	0.08	-2.57	0.32	<.001	
Day ( $\beta_{10}$ )	0.97	-0.03	0.04	.471	
Distress ( $\beta_{20}$ )	1.03	0.03	0.005	<.001	
DV: NSSI Urge <sup>b</sup>					--
Intercept ( $\beta_{00}$ )	0.12	-2.12	0.27	<.001	
Day ( $\beta_{10}$ )	0.95	-0.05	0.04	.195	
Conflict ( $\beta_{20}$ )	1.11	0.10	0.05	.044	
DV: NSSI Urge <sup>a</sup>					--
Intercept ( $\beta_{00}$ )	0.09	-2.41	0.31	<.001	
Day ( $\beta_{10}$ )	0.96	-0.04	0.04	.319	
Confusion ( $\beta_{20}$ )	1.30	0.26	0.06	<.001	
DV: NSSI Urge <sup>acd</sup>					2391.16
Intercept ( $\beta_{00}$ )	0.08	-2.48	0.28	<.001	
Day ( $\beta_{10}$ )	0.96	-0.04	0.02	.059	
Self-conscious emotions ( $\beta_{20}$ )	1.50	0.41	0.06	<.001	
DV: NSSI Urge <sup>ad</sup>					--
Intercept ( $\beta_{00}$ )	0.09	-2.40	0.30	<.001	
Day ( $\beta_{10}$ )	0.96	-0.04	0.04	.347	
Negative emotion (low arousal) ( $\beta_{20}$ )	1.75	0.56	0.10	<.001	
DV: NSSI Urge <sup>a</sup>					--
Intercept ( $\beta_{00}$ )	0.08	-2.50	0.31	<.001	
Day ( $\beta_{10}$ )	0.98	-0.02	0.04	.590	
Negative emotion (high arousal) ( $\beta_{20}$ )	1.58	0.46	0.08	<.001	

*Note.* OR = odds ratio. SE = standard error. DV = dependent variable. NSSI = nonsuicidal self-injury. The Penalized Quasi-Likelihood (PQL) estimates are presented for all models due to nonconvergence except self-conscious emotions, in which the Adaptive Gaussian Quadrature (AGQ) estimates are reported. HLM did not produce model fit statistics in some cases.

<sup>a</sup>This model was tested with current PTSD diagnosis as a covariate; the pattern of findings remained the same.

<sup>b</sup>This model was tested with current PTSD diagnosis as a covariate; conflict was no longer significant with this covariate in the model.

<sup>c</sup>Both Day and the independent variable were not allowed to vary across participants given lack of significance of their variance components.

<sup>d</sup>When testing this model with the log (base 10) transformed predictor variable, the pattern of findings did not change.

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