

# **Proximal Factors Associated with Non-Suicidal Self-Injury in Daily Life**

**by**

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## **Abstract**

The primary objective of this research was to examine factors that predict urges for non-suicidal self-injury (NSSI) and the transition from urges to NSSI behaviour. Specifically, I examined the types of stressful events, negative emotions, and cognitive appraisals that increase or decrease the likelihood of NSSI urges and behaviours. Participants who reported NSSI at least twice in the last month ( $N = 55$ ) completed online daily diaries to report on their experiences, emotions, and thoughts over 14 days. Interpersonal stressors were more strongly associated with NSSI urges than were non-interpersonal stressors. Contrary to hypotheses, low and high-arousal negative emotions did not significantly differ in their association with NSSI urges and behaviours. Maladaptive cognitive patterns such as rumination, catastrophizing, and self-blame were all positively associated with NSSI urges, and rumination and catastrophizing were also positively associated with NSSI behaviours. Conversely, distress tolerance and emotion-regulation self-efficacy were negatively associated with NSSI urges and behaviours.

Furthermore, emotion regulation self-efficacy was the only factor significantly associated with lower likelihood of NSSI behaviours on days when NSSI urges were present. These findings suggest the importance of specific contextual, emotional, and cognitive factors in future research aiming to better understand NSSI risk and suggests particular targets for consideration in efforts to refine and improve treatment.

**Keywords:** non-suicidal self-injury, risk-factors, protective-factors, stressors, emotions

## **Dedication**

To Zachary, love Mama

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## List of Acronyms

NSSI	Non-suicidal Self-Injury
BPD	Borderline Personality Disorder
DBT	Dialectical Behaviour Therapy
ESM	Experience Sampling Methods
DSM-V	Diagnostic and Statistical Manual – 5 <sup>th</sup> Edition
HLM	Hierarchical Linear Modelling

# Chapter 1.

## Introduction

Defined as the direct and deliberate destruction of body tissue in the absence of intent to die and for purposes that are not socially sanctioned (International Society for the Study of Self- Injury, n.d; Nock & Prinstein, 2004; Nock & Favazza, 2009), non-suicidal self-injury (NSSI) is a serious and widespread health problem that has been increasing in the last two decades (Wester, Trepal, & King, 2017). Prevalence rates for NSSI can be as high as 14-47% among adolescents (Ross & Heath, 2002; Muehlenkamp, Claes, Havertape, & Plener, 2012; Swannell, Martin, Page, Hasking, & St John, 2014), 20% among adult clinical populations (Briere & Gill, 1998), and 50- 80% among persons with borderline personality disorder (BPD) (Snir, Rafaeli, Gadassi, Berenson, & Downey, 2015; Soloff, Lis, Kelly, Cornelius, & Ulrich, 1994; Znarini et al., 2007). NSSI is not only a problem among these specific populations, however. As much as 4-6% of the general population (Briere & Gill, 1998; Klonsky, 2011; Rodham & Hawton, 2009; Swannell, et al., 2014), and 14-35% of college students engage in NSSI (Favazza, 1996; Gratz, 2001;Whitlock, Eckenrode, & Silverman, 2006; Whitlock et al., 2011). In one study (Andover, 2014), as many as 23% of adults from across the US acknowledged intentionally hurting themselves without suicidal intent at least once in their lifetime. Prevalence rates range widely due to differences in defining NSSI and differing assessment methods. A review of all epidemiological studies, however, revealed the mean lifetime prevalence of NSSI (after adjustment for methodological factors) was estimated to be 15.4% in adolescents, 10.5% in young adults and 4.2% in adults (Swannell et al., 2014) All together, NSSI remains among the leading causes of death and injury worldwide (Nock, Borges, et al., 2008; World Health Organization [WHO], 2008).

Although the absence of suicidal intent is a crucial part of the definition of NSSI and these behaviours are distinct from suicidal behaviours, NSSI is also a significant risk factor for suicide (Klonsky et al., 2013; Whitlock et al., 2013). Patients who frequently engage in NSSI are more likely to attempt suicide than non-self-injurers (Alper & Peterson, 2001; Cuellar & Curry, 2007; Klonsky, May, & Glenn, 2013) by as much as 30-fold in some studies (Cooper et al., 2005) and 15-fold in others (Sakinofsky, 2005). Among individuals with NSSI

histories, as many as 70% have also engaged in suicidal behaviour (Brausch & Gutierrez, 2010; Paul, Tsypes, Eidlitz, Ernhout, & Whitlock, 2015). Certain characteristics, such as using a greater variety of NSSI methods and experiencing less pain during NSSI, are associated with a history of attempted suicide (Nock et al, 2006; Matney et al., 2018). Furthermore, longitudinal research suggests that NSSI predicts later suicide attempts and completed suicides (Prinstein et al., 2008). In fact, a recent meta-analysis revealed that a prior history of NSSI is the strongest identified risk factor for future suicide attempts (Franklin et al., 2015). One theory (Joiner, 2002) postulates that as individuals engage in NSSI, they habituate to the unpleasant aspects (e.g., seeing blood, physical pain), and the positive aspects of hurting themselves become more reinforcing over time. This theory explains how repeated NSSI makes individuals more capable of carrying out injurious actions against themselves, which puts individuals at a much higher risk for later suicide. Two other theories, the Gateway theory (e.g., Brausch & Gutierrez, 2010; Grandclerc, Labrouhe, Spodenkiewicz, Lachal, & Moro, 2016) and the Third Variable theory, have also been suggested to explain the strong link between NSSI and suicidal behaviours. Empirical investigations have lent support to all three theories, but they each have their criticisms as well (see Hamza, Stewart, and Willoughby, 2012 for a review). This has led to the emergence of an integrated theory to attempt to explain, and offer testable predictions, about the processes whereby NSSI is linked to suicidal behaviour (Hamza et al., 2012). Given the clear increased risk for suicide, it is imperative the pathways that lead to NSSI be better understood to inform treatment and help individuals stop engaging in such damaging behaviours.

## **1.1. Characteristics, Correlates, and Risk factors for NSSI**

An abundance of recent research has yielded a wealth of knowledge about the phenomenology, risk factors, characteristics, and functions of NSSI. In terms of the onset of NSSI, one study found that 32.8% of patients first harmed themselves as children (12 years of age or younger), 30.2% as adolescents, and 37% as adults (Zanarini et al., 2006), with the average age of onset being 13-15 years (Whitlock et al., 2006). Thirty-eight percent of participants reported first getting the idea from their peers, while 13% credited the media, 20% reported they got idea on their own, and 28.3% were unable to recall from where the idea was conceived (Deliberto & Nock, 2008). Research findings have suggested that when

NSSI begins in childhood, the course of NSSI may be particularly severe (Zanarini et al., 2006).

Upwards of 14 different types of NSSI have been identified, but by far the most prevalent types include self-cutting, burning, and scratching one's skin (Ross & Heath, 2002; Whitlock, et al., 2006). The types and number of methods used are related to other individual differences among those who engage in NSSI. For example, self-cutters report significantly more anxiety than people who engage in other types of NSSI, despite similar levels of depression (Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005). Additionally, a greater number of methods used has been associated with increased clinical severity (e.g., Klonsky & Olino, 2008) and suicide attempts (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Turner, Layden, Butler, & Chapman, 2013).

Although NSSI has a robust association with certain psychiatric disorders (e.g., borderline personality disorder, eating disorders, etc.), NSSI occurs across multiple disorders and among non-clinical populations. For example, Castille et al. (2007) found that their NSSI sample included persons with mood (56.4%) and anxiety disorders (30.4%), posttraumatic stress disorder (4.3%), and eating disorders (4.3%). A study of adolescent inpatients, however, found that 12% of self-injuring individuals did not meet criteria for any specific mental disorder (Nock et al., 2006). Together, these findings have led some to argue that NSSI should constitute its own diagnostic syndrome (Muehlenkamp, 2005; Selby et al., 2012), and NSSI was included as a condition for further study in the fifth edition of the Diagnostic and Statistical Manual (DSM-5; American Psychological Association, 2013).

Studies have provided mixed results in terms of gender differences in NSSI rates. Studies on adolescents more commonly reveal higher NSSI rates among females (e.g., Brunner et al., 2007; Hawton, Rodham, Evans, & Whetherall, 2002; Sourander et al., 2006), whereas studies on a wide range of adult ages have found no gender differences (e.g., Briere & Gill, 1998; Gratz 2001; Klonsky et al., 2003). A recent meta-analysis demonstrated that, across studies, the odds of engaging in NSSI are higher for women than men (Bresin & Shoenleber, 2015), although the effect size is considered small (Chen et al., 2010). The largest gender gap was found among clinical samples, compared with community and college samples (Bresin & Shoenleber, 2015).

Caucasians may be at increased risk for NSSI as compared to other ethnicities (Muehlenkamp & Gutierrez, 2004, 2007; Jacobson & Gould, 2007); however, other researchers have reported no differences in NSSI prevalence among varying ethnicities (Brausch & Gutierrez, 2010; Jacobson et al., 2008; Plener et al., 2009).

Certain experiences have been suggested as risk factors for NSSI, including childhood maltreatment (Gratz, Conrad, & Roemer, 2002; Paivio & McCulloch, 2004; Zoroglu et al., 2003) and family history of suicidal ideation (Deliberto & Nock, 2008). At a trait level, several studies have demonstrated characteristics common among individuals who engage in NSSI, such as emotional inexpressivity (Gratz, 2006; Polk & Liss, 2007), affect intensity/reactivity (in combination with other risk factors; Gratz, 2006), negative urgency (Claes et al., 2015a; Peterson & Fischer, 2012), emotion dysregulation (Gratz & Romer, 2008; Muehlenkamp et al., 2012b; Ross et al., 2009), problems in identity formation (Claes et al., 2015b), mood and personality disorder symptoms (Yiu et al., 2014), and negative attitudes toward one's body (Muehlenkamp et al., 2011; Turner et al., 2015).

## **1.2. Functions of NSSI**

In addition to understanding the behaviour of NSSI and the characteristics of individuals who engage in this behaviour, another important question is *why* do people deliberately injure themselves? Findings from several studies have elucidated up to 13 distinct functions of NSSI (Klonsky, 2007; Klonsky & Glenn, 2009), including self-punishment, feeling generation, resisting urges for suicide, and communication with others (Briere & Gil, 1998; Brown et al., 2002; Nock & Prinstein, 2004; Shearer, 1994). From these, evidence most consistently supports an affect-regulation model of NSSI (Chapman et al., 2006; Klonsky, 2007). By far the most commonly reported reason for engaging in NSSI is to reduce negative affect (Briere & Gil, 1998; Klonsky, 2009; Turner, Chapman, & Layden, 2012). In addition, self-report and laboratory studies also consistently demonstrate that negative affect precedes NSSI, and that affect improves following NSSI. Most people report experiencing a rapid and dramatic reduction of tension following an act of NSSI (Bockian, 2002; Gratz, 2003; Klonsky et al., 2003; Mangnall, 2006). In fact, one study showed that even imagining that one is engaging in NSSI decreases physiological arousal among self-injurers (Haines, Williams, Brain, & Wilson, 1995). Likewise, imagery of NSSI or proxies for

NSSI (e.g., self-administered shocks) performed in the laboratory reduce negative affect or physiological arousal (see Klonsky, 2007 for a review).

There is also biological evidence that supports these reported effects; physiological stress reduction experienced after an episode of NSSI may last as long as 24 hours (Crowe & Bunclark, 2000). Sachsse, von der Heyde, and Huether (2002) further demonstrated the physiological stress reduction that follows an act of NSSI by assessing the urine cortisol level of one self-injuring woman each night. Whenever her cortisol level rose above 20 µg, she engaged in NSSI and subsequently experienced an immediate return to her baseline low cortisol levels. The authors concluded that episodes of NSSI may be a response to hyperactivity of the neuroendocrine systems that are sensitive to stress. These findings underscore the suggestion that for some people, NSSI is an effective coping strategy to reduce stress; however, not all research supports this conclusion. A study of the antecedents and consequences of NSSI using experience sampling methods to assess emotional state at several time points throughout each day (Muehlenkamp et al., 2009) indicated that although negative affect significantly increased leading up to an episode of NSSI, this negative affect did not significantly decrease following NSSI behaviour. Instead, negative affect remained constant, and positive affect significantly increased. The authors suggested that the relief from negative emotional tension frequently reported by individuals may actually be accounted for by the increase in positive emotions, or relief may be predominantly a positive physiological/emotional experience. They suggested that these positive emotions might mitigate the distress of the negative affect; therefore, the result is a feeling of relief or release. They also postulated that the subjective improvement in negative affect following NSSI behaviour may be caused by biological reactions of the endogenous opioid system to the injury inflicted (Russ, et al., 1992; Winchel & Stanley, 1991), which can produce subjective experiences of positive affect.

### **1.3. Stressors and NSSI**

Although we are beginning to understand the various functions or consequences associated with NSSI, important questions remain about proximal antecedents to NSSI urges and behaviours. Understanding what events precipitate NSSI is key to helping individuals avoid engaging in these dangerous behaviours. Although NSSI urges or behaviours occur in the context of a wide variety of stressors, evidence suggests that

individuals who engage in NSSI are particularly vulnerable to stressors in the interpersonal domain. In fact, interpersonal stressors appear to be among the most common precipitants of NSSI among individuals with and without BPD (Jones et al., 1979; McQuillan 2004; Welch & Linehan 2002; Wyder 2006). Findings from extant research have also shown that the experience of social problems predicts engagement in NSSI specifically for interpersonal functions, such as to communicate with someone or to obtain help (Nock & Mendes, 2008; Nock & Prinstein, 2004). Furthermore, one study showed that individuals who engage in NSSI are high in rejection sensitivity (Baumkirchner, 2010), and many studies have demonstrated that people with histories of NSSI also have insecure attachments (Farber, 2008; Whitlock et al., 2006). This insecure attachment, perhaps a result of the high incidence of childhood maltreatment/trauma among this population, can also lead to problems in interpersonal relationships (Crouch & Wright, 2004). Consistent with this idea, individuals who engage in NSSI (compared with non-NSSI controls) report greater peer alienation (Klonsky et al., 2003; Rao, 2001), and increased social conflict and isolation compared with non-self-injuring youth (Sourander et al., 2006). Evidence suggests that NSSI may predict relationship problems, specifically among females (Burke et al., 2015; Lundh et al., 2011). Furthermore, NSSI often arouses strong negative reactions in other people. Thus, engaging in this behaviour may itself disrupt supportive relationships (Favazza, 1998).

Although cross-sectional data suggest that interpersonal stressors may play a stronger role in NSSI than non-interpersonal stressors (Rosen, Walsh, & Rode, 1990; Shaw Welch & Linehan, 2002), and that negative interpersonal events often serve as precipitants to NSSI behavior (Prinstein, Guerry, Browne, & Rancourt, 2009), this possibility has only recently been explored among day to day episodes of NSSI. For example, findings from one study using ecological momentary assessment (EMA) suggested that NSSI thoughts often occurred when adolescents felt rejected by others (Nock, Prinstein, & Sterba, 2009). Similarly, feelings of perceived rejection/isolation rose in the hours preceding NSSI and decreased following NSSI (Snir et al., 2015). Turner and colleagues (2016) found in their online daily diary study that interpersonal conflict was positively associated with same-day NSSI urges and likelihood of NSSI behaviours (after controlling for average daily negative affect). A within-day association between interpersonal conflict and NSSI, however, does not necessarily indicate that the NSSI directly resulted from this conflict. This finding needs to be



clarified in future research by taking into account temporal relationships between stressors and NSSI urges or behaviours.

## 1.4. Emotions and NSSI

Given the substantial evidence supporting the affect regulation model of NSSI described above, emotions likely play a key role in the trajectory towards NSSI. Multiple studies have shown that individuals who engage in NSSI experience more frequent and more negative emotions in their daily lives than individuals who do not engage in NSSI (see Fliege, Lee, Griim, & Klapp, 2009 for a review). Prior studies have also demonstrated that self-injurers report higher levels of subjectively experienced emotional distress in response to stressful events (Najmi, Wegner, & Nock, 2007; Nock, Wedig, Holmberg, & Hooley, 2008). Furthermore, people who engage in NSSI report more difficulties identifying, understanding, and expressing their emotions than individuals without a history of NSSI (Gratz, 2006; McKay, Gavigan, & Kulchysky, 2004; Paivio & McCulloch, 2004; Zlotnick, et al., 1996).

Several studies have shown that negative affect significantly increases and positive affect significantly decreases in the time immediately preceding NSSI behaviours (Muehlenkamp et al., 2009). Although the circumstances and emotional states precipitating NSSI are complex, there appears to be strong evidence that the primary antecedent of an instance of NSSI is some form of tension build up (e.g., Bockian, 2002; Fliege et al., 2009).

Although much of the extant research has focused on aggregate categories like *negative emotions*, it is likely that not all negative emotions are similarly strongly associated with NSSI. Studies have demonstrated that certain discrete emotional states are more commonly experienced before experiencing NSSI urges (Bresin, Carter, & Gordon, 2013) or engaging in NSSI behaviour. For example, findings from a study of adolescent self-injurers showed that more than two-thirds indicated feeling hostility and anxiety prior to acts of NSSI (Ross & Heath, 2003).

Furthermore, the self-injurers in this study had greater levels of extrapunitive hostility (e.g., they were cynical, resentful, easily angered) and intropunitive hostility (e.g., high levels of self-doubt, guilt, self-criticism) than did non-NSSI controls. This tendency to become easily angered and to experience strong self-dislike and guilt at the same time may result in

individuals directing these hostile feelings against the self and engaging in NSSI. These results support a hostility model of NSSI outlined by Herpertz, Sass, and Favazza (1997), which postulates that individuals resort to NSSI because of an inability to overtly express anger, which, in turn, leads to rising tension. Contrarily, however, Arney and colleagues (2011), found a significant quadratic slope around NSSI events for negative affect as a whole and guilt specifically, but not for hostility. This means that participants experienced an increase in negative affect and guilt in the hours leading up to engagement in NSSI, and that these emotions decreased following NSSI behaviour.

Consistent with findings described above, a study using experience sampling methods to study NSSI among adolescents found the odds of engaging in NSSI were significantly increased in the presence of feeling rejected, anger towards oneself, self-hatred, numb/nothing, and anger toward another (Nock et al., 2009). Although thoughts of NSSI occurred most often when participants reported feeling sad/worthless, the odds of NSSI behaviours actually decreased in the presence of these emotional states. Although illuminating, these studies did not attempt to explain why certain emotions have positive or negative relationships with NSSI. One possible explanation involves other characteristics of emotions.

In addition to valence (positive or negative), emotions can also be classified according to level of arousal. The valence of an emotion refers to the hedonic quality or pleasantness of an emotion (Feldman, 1995), whereas arousal refers to the perception of physical intensity or activation that is associated with that emotion (Russell, 1991). For example, sadness is a negative, low arousal emotion, whereas anger is a negative, high-arousal emotion (Feldman, 1995; Klonsky, 2009; Yik, Russell, & Steiger., 2011). Similarly, happy is a high-arousal, positive emotion, and relaxed is a low-arousal, positive emotion.

Although an abundance of research evidence supports the affect regulation function of NSSI (Chapman et al., 2006, Klonsky, 2007; Nock et al., 2009), it is not clear whether self-injury influences, or is influenced by, emotional valence, arousal, or both. One study demonstrated that affective states classified as positive in valence and low in arousal significantly increased following an episode of NSSI (Klonsky, 2009). Furthermore, following NSSI, decreases in negatively-valenced, high-arousal affective states most strongly predicted lifetime frequency of cutting. Similarly, other studies have shown that the most common emotional antecedents to NSSI thoughts (Humber, Emsley, Pratt, & Terrier, 2013)

and behaviours are high arousal emotions such as anger and anxiety (Chapman, & Dixon-Gordon, 2007), and tension or strong pressure (Kleindeinst et al., 2008). The two-dimensional model of affective states might explain why certain emotions have stronger relationships with self-injurious behaviours. Although a wide range of negative emotions might lead to NSSI urges, negatively-valenced, high-arousal emotions may be especially associated with NSSI behaviour. Individuals may feel a greater need to obtain relief from this physiological arousal, and/or heightened arousal may provide the energy necessary to perform NSSI. This two-dimensional affective model requires more empirical exploration to better understand the relationship between emotions and NSSI urges or behaviours.

## **1.5. Cognitions and NSSI**

Emotions play a key role in the trajectory towards NSSI, but several cognitive patterns have significant associations with self-injury as well (including suicidal behaviour and NSSI). For example, individuals who engage in NSSI report thoughts related to hopelessness (McGee, Williams, & Nada-Raja, 2001), helplessness (Bancroft et al., 1979; D’Zurilla, Chang, Nottingham, & Faccini, 1998), and being a burden to loved ones (Brown & Vinokur, 2003; Joiner et al., 2002). Furthermore, these types of thoughts might interfere with individuals' motivation to stop themselves from self-harming (Rudd, Joiner, & Rajab, 2001). Additionally, individuals with a history of NSSI tend to be lower in self-esteem (Groholt, Ekeberg, Wichstrom, & Haldorsen, 2005; McGee et al., 2001), higher in reported perfectionistic traits (Donaldson, Spirito, & Farnett, 2000), and higher in self-criticism and self-blame (Donaldson et al., 2000; Faza & Page, 2003; Garnefski, Kraaij, & Spinhoven, 2001b; Glassman et al., 2007) than individuals who do not engage in NSSI. Research has also demonstrated that those who self-injure often exhibit a cognitive pattern of catastrophizing (Garnefski et al., 2001b) and ruminating (Garnefski, Teerds, Kraaij, Legerstee, & van den Kommer, 2004; Watkins & Teasdale, 2004). The emotional cascade model proposes that behavioural dysregulation in people with BPD may be precipitated by vicious cycles of intense rumination and negative affect that transact and become so aversive the individual resorts to NSSI as a distraction from intense rumination (Selby, Anestis, & Joiner, 2008; Selby, Anestis, Bender, & Joiner, 2009). In this model, NSSI is seen as a way to escape the cycle after negative emotion has escalated to an unbearable level. Findings from one recent study showed that NSSI history among university students was associated with greater initial increases in negative affect following a rumination induction,

relative to those without NSSI histories (Arbuthnott, Lewis, & Bailey, 2014). It is still unclear, however, whether thinking in these ways in the moment makes an individual who is prone to NSSI more or less likely to experience NSSI urges or to engage in NSSI when urges are present.

## **1.6. Protective Factors and NSSI**

Despite evidence that NSSI can regulate or reduce uncomfortable emotions, individuals who self-injure do not do so every time they experience a stressful event or painful emotions. This may have to do with the variety of negative short and long-term consequences that often result from NSSI, such as feelings of shame and guilt (Chapman & Dixon-Gordon, 2007; Kleindienst et al., 2008; Leibenluft et al., 1987) or negative reactions from others (Favazza, 1998). Little is known, however, about what factors might protect against NSSI. This is an important question. If certain thought patterns or coping strategies decrease the likelihood of NSSI, then these processes can be explored and fostered through treatment interventions. Although research in this area is limited, one can theorize about what factors may be important in enabling an individual to resist engaging in NSSI behaviour, or even ceasing this behaviour altogether based on known risk factors, correlates, and functions of self-harm. For example, some studies have shown that a mindful, non-judgemental attitude towards emotions, cognitions, and bodily sensations prevents the escalation of negative thoughts into suicidal thinking and repetition of NSSI (Williams et al., 2005). In fact, those with NSSI histories can be distinguished from their non-self-injuring counterparts in the extent to which they view emotions as tolerable or acceptable (Gratz & Roemer, 2004). Distress tolerance, defined as the perceived or actual ability to withstand aversive experiential states (e.g., negative emotional or physiological) (Brown et al., 2005; Marshall-Berenz et al., 2010; Simons & Gaher, 2005), may therefore be an important factor protecting against NSSI. Dialectical behaviour therapy (DBT), a well-established treatment for individuals who often engage in NSSI (Linehan, 1993), aims to increase distress tolerance through the teaching of specific skills designed to help individuals get through painful situations without resorting to behaviours (such as NSSI) that might make things worse in the long-term. Yet to date, the relationship between distress tolerance and NSSI has not been empirically investigated in microlongitudinal studies.

A second key focus in DBT is developing emotion regulation skills such that patients strengthen their ability to manage and influence their emotions effectively (Linehan, 1993). Given that the most commonly endorsed function of NSSI is to relieve uncomfortable emotions, being capable of regulating emotions in other ways may be especially critical in abstaining from NSSI. This could be quite difficult to assess via an online diary study, however. Another key finding in the literature is that individuals with a history of NSSI self report higher levels of impulsivity (Glenn & Klonsky, 2010; Herpertz et al., 1997) than individuals without NSSI histories. Yet, laboratory studies using behavioural measures of impulsivity (e.g., the continuous performance task) have found no significant differences between individuals with and without a history of NSSI (Glenn & Klonsky, 2010; Janis & Nock, 2009). Nonetheless, one study (Castille et al., 2007) found that having an underlying schema that one lacks self-control and is impulsive distinguished individuals who do and do not engage in NSSI. Taken together, these findings suggest that what people believe about their own abilities, such as impulse control or possibly emotion-regulation, may be especially important in predicting NSSI outcomes.

Likewise, if individuals believe they can resist urges for NSSI and regulate their emotions via other methods, perhaps they will indeed be more successful in doing so. Such a finding would be in keeping with self-efficacy theory (Bandura, 1977), but to my knowledge this concept has not been explored in NSSI research. It does seem likely that receiving DBT skills training increases both emotion regulation ability and emotion regulation self-efficacy, and each may contribute to the reduction in maladaptive behaviours consistently demonstrated following DBT (e.g., Kliem et al, 2010; van Goethem, Mulders, de Jong, Arntz, & Egger, 2015). Further research, however, needs to examine whether factors such as distress tolerance and emotion regulation self-efficacy lead to resisting NSSI urges in the moment.

## Chapter 2.

### Current Study

Despite the increased understanding of differences that exist between people who do and do not engage in NSSI, and what function NSSI serves, important questions remain. People who engage in NSSI do not do so every time they experience a negative stressor, or every time they feel a negative emotion. Furthermore, individuals who self-injure often resist acting on their thoughts or urges for NSSI. Yet, to date, there is very little knowledge about immediate contextual factors that precede NSSI urges and behaviour. The purpose of this research, therefore, was to use microlongitudinal research methods (online daily diary entries) to investigate the factors that, in the short-term, either increase or decrease the likelihood of NSSI urges or behaviours. A daily diary design has several advantages over traditional cross-sectional, retrospective studies of life events and mood. First, most traditional stress and coping studies require participants to recall their experiences over weeks or months, which might lead to systematic recall bias (Tennen & Affleck, 2002). In daily diary studies, there is a relatively short lag between experiencing and reporting, which should result in more valid assessment of the proximal factors related to NSSI urges and behaviours. This study compares four different potential scenarios: 1) days when participants reported NSSI urges and NSSI behaviour in response to a stressful event, 2) days when participants reported NSSI urges but no NSSI behaviour in response to a stressful event, 3) days when participants reported neither NSSI urges nor behaviour in response to a stressful event, and 4) days when participants reported NSSI behaviour but no urges in response to a stressful event. I explored the features of stressors and emotions, and specific thought processes or beliefs about those stressors and emotions, to determine what factors differentiate scenarios one and four (where participants engage in NSSI behaviour) from scenarios two and three (where participants do not engage in NSSI behaviour). I was especially interested in identifying factors that predict the transition from NSSI urges to engagement in NSSI behaviour (i.e., differentiate scenarios one and two). As there is limited research on proximal risk factors for NSSI, some aspects of this study were exploratory. I did, however, test some tentative hypotheses about the relationships I expected to find among these variables.

## **2.1. Aim #1 – Stressors and NSSI**

The first aim of this research was to clarify which stressful experiences are most strongly and uniquely predictive of NSSI. Given the particular vulnerability to interpersonal disturbances common among individuals who engage in NSSI, I hypothesized that:

**Hypothesis 1A** – Compared with non-interpersonal stressors (such as the loss of a job), interpersonal stressors (such as rejection or the break-up of a relationship) will have stronger associations with NSSI urges and actions.

**Hypothesis 1B** – When NSSI urges are present, interpersonal stressors will more strongly predict NSSI behaviour than will non-interpersonal stressors.

## **2.2. Aim #2 – Emotions and NSSI**

The second aim of this study was to clarify the emotional states that predict NSSI. Building upon previous research demonstrating that specific emotions are more strongly associated with NSSI, I expected that:

**Hypothesis 2A** - Compared with low-arousal negative emotions (such as sadness), high- arousal negative emotions (such as anger) would be stronger predictors of NSSI urges and actions.

**Hypothesis 2B** - When NSSI urges are present, high-arousal emotions would more strongly predict the transition to NSSI behaviour than will low-arousal emotions.

## **2.3. Aim #3 – Cognitive Processes and NSSI**

In addition to the specific types of stressors and emotions people experience, other important factors that may influence the transition from urges to NSSI include thoughts and beliefs about their stressful situations and emotional reactions. Therefore, the third aim of this research was to examine the cognitive processes, which in the moment, were most strongly predictive of urges and NSSI. Research has identified several cognitive processes that are associated with a history of NSSI. Therefore, I expected that:

**Hypothesis 3A**—Rumination, catastrophizing, and self-blame thoughts would predict urges and NSSI.

**Hypothesis 3B** – When NSSI urges are present, rumination, catastrophizing, and self-blame thoughts would predict NSSI.

## **2.4. Aim #4 – Protective Factors and NSSI**

The fourth aim was to explore what factors may play a protective role against NSSI. Based on clinical treatments that have demonstrated efficacy in reducing NSSI, I expected that:

**Hypothesis 4A** -Higher distress tolerance and emotion-regulation self-efficacy would negatively predict urges and NSSI.

**Hypothesis 4B** - Higher distress tolerance and emotion regulation self-efficacy would negatively predict NSSI when urges are present.



## Chapter 3.

### Method

#### 3.1. Participants and Recruitment

Participants were recruited from online social networking sites such as Facebook©, LiveJournal©, and Reddit©, which have several online communities for people who engage in NSSI. Potential participants answered initial questions via email to verify they met the following inclusion criteria: 1) aged 19 or older, 2) living in the United States or Canada, 3) had daily access to a computer with an Internet connection for at least two consecutive weeks, and 4) were currently engaging in NSSI (as defined by the participant having self-injured more than once in the past month).

Eligible individuals ( $N = 63$ ), completed an initial questionnaire package, after which they were invited to begin a 2-week daily diary study. Most of those individuals ( $N = 55$ ) chose to participate in the diary portion of the study. Chi square analyses, which are robust to unequal group sizes (McHugh, 2013), indicated that participants included in the diary study did not significantly differ from the larger parent sample on gender, age, ethnicity, sexual orientation, country of residence, education level, or religious affiliation. Self-reported frequency of NSSI also did not differentiate participants who did or did not complete the diary study ( $B = -.119$ ,  $SE = .285$ ,  $p = .676$ ). The sample was 70.9% female, and 51% of participants lived in Canada and the remaining 49% lived in the United States. Participants ranged in age from 19 to 59 years ( $M = 26.86$  years); 22% were aged 20 or younger, 33% were aged 21-25, 24% were aged 26-30, 15% were aged 31-35, and 7% were aged 36-59. Most participants (64%) identified themselves as Caucasian, while 11% identified as Asian, 7% as Hispanic, 5% as South Asian, and 2% each as Black, First Nations, and South East Asian. Most participants (68%) described themselves as heterosexual, and 18% identified as bisexual, 7% as homosexual, and 7% as "other." Twenty-two percent of the sample described themselves as atheists, while 73% identified with a religion (protestant and catholic most common). Moreover, 11% of participants described themselves as being "very religious." The majority (55%) of the sample had some level of college education, with 24% having completed undergraduate degrees and 3.6% having completed graduate degrees.

**Table 3.1. Participant Demographic Characteristics.**

Age	M = 26.86 (SD = 7.5)
% Female	70.9
% Caucasian	64
% Heterosexual	68
% Living in Canada	51
% College Education	55
% Very Religious	11

### **3.2. NSSI Characteristics**

Most participants reported engaging in NSSI 2-3 times a week on average, and only 20 % indicated they self-injured less than once per week. The most common method of NSSI was cutting (endorsed by 84% of participants), followed by hitting oneself (62%), scratching (58%), burning (40%), piercing the skin (35%), banging one’s head (29%), removing skin (26%), and scalding (13%). When asked to report their most frequently used method of NSSI, the majority of participants endorsed cutting (64%), followed by scratching and hitting oneself (9%) and banging one’s head (7%). In this sample, 35% of participants reported having used illicit drugs. A minority of participants (29%) indicated that they typically feel no pain during self-injury.

Although most participants acknowledged that the frequency (55.6%) and intensity (65.1%) of their self-injury had increased over time, the majority (55.6%) indicated they did not feel anything like “withdrawal” if they went without engaging in NSSI for a while. Participants reported most often engaging in NSSI to reduce uncomfortable feelings (77.7%), stop sadness (77.2%), avoid a task (73%), decrease tension (69.9%), make their mood more comfortable (63.9%), and stop shame (63.5%). Participants reported that, before self-injuring, they most often felt unreal (71%), guilty (67.8%), depressed (67.2%), or lonely/isolated/abandoned (52.5%). Despite highly endorsing the function of stopping sadness, only 14.7% of participants endorsed often feeling sad before engaging in NSSI.

This odd result further underscores the need to assess affect in the moment via experience sampling methods to fully understand the role emotions play in NSSI.

### 3.3. Power

Current techniques for estimating power in multilevel analyses are limited, and typically assume random assignment to conditions (e.g., Raudenbush et al., 2011) or require that the researcher provide estimates for several population-based parameters (e.g., covariance of constructs of interest) based on previous research (Bolger, Stadler, & Laurenceau, 2011; Snijders & Bosker, 1993, 2011). Such an approach was not possible given the paucity of research on proximal emotional and cognitive predictors of NSSI. Therefore, to inform sample size requirements, I examined the sample size and observation schedules for previously published intensive longitudinal studies of NSSI. This information is summarized in Table 3.2. Based on these examples, I recruited 55 participants for this study.

**Table 3.2. Sample sizes in previously published studies using intensive longitudinal methods.**

Study	N	# of days	# of observations per day	# of possible observations	# of actual observations
Nock et al., 2009	30	14	2	>840	1227
Anestis et al., 2012	131	14	6	>11,004	Not reported
Humber et al., 2013	21	6	6	756	565
Victor & Klonsky, 2013	18	14	1	252	Not reported
Bresin, Carter, & Gordon, 2013	61	14	1	854	613
Bresin, 2014	61 (NSSI group)	14	1	Not reported	Not reported
Snir et al., 2015	94	21	5	9,870	Not reported
Hochard, Heym, & Townsend, 2015	43 (NSSI Group)	5	2	360	328
Turner et al., 2016	60	14	1	840	735
Kleiman et al., 2017 (Study 1)	54	28	4	6,048	2,891

Kleiman et al., 2017 (Study 2)	36	Ave = 10	4	Not reported	
AVERAGE OF ABOVE	47	14	3	N/A	N/A
<b>Current Study</b>	<b>55</b>	<b>14</b>	<b>1</b>	<b>770</b>	<b>537</b>

### 3.4. Procedure

All procedures were approved by the Ethics Review Board at Simon Fraser University. This study involved a one-time online questionnaire battery and a two-week period of online daily diary entries. The initial questionnaires included demographic questions, and a detailed assessment of NSSI, psychopathology, and treatment history. Participants also completed other measures that are outside the scope of this dissertation. Upon completion of the initial questionnaires, individuals were invited to participate in the daily diary portion of the study.

Participants could use any computer to access the questionnaires online using a unique password and ID. Participants were emailed a link to access the diary entries along with instructions to log in and complete the questionnaires once at the end of each day (i.e., before they go to bed) for 14 days. In selecting the length of any study, it is important to balance the time needed to capture the behaviours of interest with the finding that compliance with experience sampling methods (ESM) decreases after two weeks of assessments (Broderick, Schwartz, Shiffman, Hufford, & Stone, 2003). The period of 14 days was chosen to capture multiple instances of NSSI urges, and at least one episode of NSSI behaviour for the majority of participants, while at the same time minimizing attrition. Indeed, 51 of the 55 participants (92.7%) reported NSSI urges at least once throughout the study (average of 4.53 days with NSSI urges per person), and 55% reported engaging in NSSI (average of 1.88 NSSI acts per person). These proportions are similar to those in other two-week diary studies investigating NSSI behaviours in similar samples (e.g., Nock, Prinstein, & Sterba, 2009; Turner et al., 2016).

Several strategies were used to minimize attrition and missing data. Studies of similar length to the present study have reported good compliance rates, with as many as 83.3% of participants being fully compliant with data entries (Nock et al., 2009). Previous research has also demonstrated the utility of an incentive system for increasing complete

data. For example, one ESM study offered participants an extra \$50 for completing at least 85% of the prompts (Muehlenkamp et al., 2009) Based on this model, participants in this study received \$10 per week of the diary study, or \$15 per week if they completed diary entries on 6 of the 7 days that week. All participants received an additional \$15 for completing the pre-study measures. Thus, participants received between \$35 and \$45 for the entire study, depending on the number of entries they completed. As these participants were recruited online, compensation was provided through online gift cards to amazon.com. All participants were sent a reminder email after the first week, providing a summary of how many diary entries they submitted and how much money they earned for the first week. In this email, they were also reminded to complete entries every day for the second week of the study. Additionally, participants who failed to complete two diary entries in a row were sent an email indicating that we did not receive submissions for a couple days and encouraging them to continue answering the questionnaires each day for the remaining study days.

Participants were instructed to log into the diary study at the end of each day (i.e., before they go to bed). They then answered a series of structured sets of questions about their experiences, thoughts, feelings, urges, and behaviours throughout that day. In this design, responses are interval-contingent, (respond each day) as opposed to event contingent (e.g., respond whenever you feel urges for NSSI) and allowed me to collect data on each of the four scenarios I wished to compare when testing my hypotheses. The questions were structured to resemble event-contingent study designs, however. The daily questions specifically modeled the chain analysis procedure that is used in Dialectical Behaviour Therapy (Linehan, 1993) to assess and understand maladaptive behaviours. Participants were asked to report the most stressful thing that happened to them each day, and to answer all subsequent questions pertaining to that particular stressful event. For example, participants were asked to rate the emotions they felt during and immediately after that stressful event, as well as what thoughts they had about that specific event and the feelings they had in response to that stressor. The computerized questionnaire was programmed such that participants only answered the sets of questions that were relevant for that day. For example, participants who reported urges for NSSI responded to a set of questions about resisting those urges, while those participants who did not report urges skipped that section of questions for that day. This reduced demand on participants.

### **3.5. Measures**

All questionnaires were administered using Remark Web Survey 5, a software package for online data collection. This software program allows for branching to different sets of questions based on answers to previous questions. All data submitted through Remark Web Survey is stored on a secure server located at Simon Fraser University. Identifying information was stored separately from the de-identified survey responses. I downloaded the responses each day and automatically exported the data for analysis with SPSS 24 student version. The measures described below are part of a larger protocol that goes beyond the scope of this dissertation.

#### **Stressors/Triggers.**

Participants were asked to rate (on a scale of 0 = did not experience to 5 = extremely bothered) how much they were bothered today by 18 stressful events or experiences compiled using items from a daily stressor checklist used in several previous ESM studies (Gunthert et. al, 1999, 2002; Tolpin et al., 2004). Items on this scale have already been categorized as “interpersonal” (seven items, such as “an argument or conflict with someone”) and “non-interpersonal” (seven items, such as “financial problems or unexpected expenses”). I used this classification to test my hypotheses concerning interpersonal stressors. In addition to these items, I added four items to measure internal events, such as thoughts or memories that may be distressing. It is imperative to assess for more than just external stressors, as research shows that NSSI often occurs in the context of distressing internal experiences (Rudd, 2004).

Participants were then asked to identify one thing they experienced that day as the most upsetting, stressful, or difficult. As previously mentioned, they were asked to refer to this experience throughout the remainder of the questions. This stressor represents what DBT therapists refer to as the “prompting event” in therapeutic chain analyses (Linehan, 1993) and allowed me to examine what types of stressors were more associated with NSSI urges or behaviours.

## **Thoughts about Stressors.**

Participants completed the Cognitive Emotion Regulation Scale Short form (CERQ-Short; Garnefski & Kraaij, 2006) about the stressful experience identified in the previous section. This measure is based on the original Cognitive Emotion, Regulation Scale (CERQ: Garnefski, Kraaij & Spinoven, 2001). Participants were asked to rate each thought on a scale of one to five where 1 = did not think this at all and 5 = thought this completely, which is a slight variation from the usual instructions to rate how often they have the following thoughts after experiencing stressful life events. This modification was necessary for this study to identify what thoughts they were having that day. The CERQ has been used both to assess a general coping style and a specific response to a specific event (Garnefski, Baan, & Kraaij, 2005; Garnefski, Legerstee, Kraaij, van den Kommer, & Teerds, 2002; Kraaij, Garnefski, & Van Gerwen, 2003). It has demonstrated strong factorial validity that was invariant across subgroups (age, gender, patient status, etc.), discriminated between psychiatric patients and non- patients, and has correlated with similar measures such as the coping inventory for stressful situations (Garnefski et al., 2002b). The short form of this scale has 18 items, which can be subdivided into nine subscales (self-blame, other-blame, positive reappraisal, catastrophizing, rumination, putting into perspective, positive refocusing, acceptance, and planning) on which scores can range from 2 to 10 (Garnefski & Kraaij, 2006). The subscales of particular interest in this study are rumination, catastrophizing, and self-blame, as these are the specific thought processes I expect to predict urges and NSSI. The maladaptive thoughts subscale demonstrated a high level of internal consistency in this sample ( $\alpha = .924$ ), and each of the individual subscales of interest in this study demonstrated adequate internal consistency ( $\alpha$ s = .742 to .886).

## **Emotions.**

Next, participants were asked to rate the degree to which they were feeling specific emotions during or after the stressful event they identified in the first section. I used items from the list of affective states published by Klonsky (2009), because they had already been classified as positive or negative in valence, and low or high in arousal level.

## **Distress Tolerance.**

Distress tolerance is a general construct consisting of one's evaluations and expectations regarding the experience of negative emotional states. Some researchers have operationalized this construct such that it includes (1) tolerability and aversiveness, (2) appraisal and acceptability, (3) tendency to absorb attention and disrupt functioning, and (4) regulation of emotions, specifically, the consequent strength of action tendencies to either avoid or immediately attenuate the experience (Simons & Gaher, 2005). I used the Distress Tolerance Scale (DTS; Simons & Gaher, 2005) to assess the degree to which participants perceived the emotions they experienced that day as tolerable or intolerable. In this portion of the study, the 15 items were modified slightly such that they refer only to participants' momentary beliefs about their current emotions, such as "I could not handle feeling distressed or upset today." Items were scored such that higher scores are seen as positive or adaptive, as they reflect higher tolerance of distress. . Internal consistency for the DTS was high in this sample ( $\alpha = .952$ ).

## **Emotion Regulation Efficacy Beliefs.**

Another factor that may relate to NSSI urges and behaviour is the extent to which people believe they are capable of regulating their emotions. Based on the language used in larger measures of emotion regulation self-efficacy (e.g., Emotion Regulation Self Efficacy Scale, ERSES; Tamir et al., 2007), a single item asked participants "If you really wanted to decrease the emotions you described feeling as a result of the most upsetting, stressful, or difficult thing that happened to you today, how confident were you that you could decrease the amount of emotion that you felt or showed today?" They rated their confidence on a scale from 0 = cannot do at all, to 100 = certain can do it.

Urges. Next, all participants were asked to rate how strongly they felt the desire, during or after experiencing the stressful event they listed in the first section, to engage in a list of various behaviours. They were asked to first indicate (yes or no) if they experienced urges for several listed behaviours, and then to rate the strength of their urges using the scale one = no urge/desire at all to five = extremely strong urge/desire. Further instructions directed participants to only answer "yes" if they experienced desire or intent to engage in this behaviour, and not when they only experienced brief, passing thoughts about NSSI. I used a compilation of items used in previous research (e.g., Chapman, Rosenthal, & Leung,



2009) that capture a range of maladaptive behaviours including “harm yourself,” which is the crucial item in this study. Further sub-questions asked them to rate how strongly they felt a desire to harm themselves in specific ways that are consistent with the definition of NSSI (e.g., cut self, pick at skin, burn self, etc.). Participants also answered other follow-up questions that are not within the scope of this dissertation.

## **Actions.**

Regardless of whether they reported urges, all participants were asked every day if they engaged in any of several listed behaviours, including the specific NSSI behaviours described above. Patients in treatment often report engaging in NSSI even when the behaviour was not necessarily immediately preceded by urges. This procedure also acted as a potential fail- safe mechanism so that no episode of NSSI got missed due to participants entering the wrong number and activating the skipping rules.

## Chapter 4.

### Data Analytic Plan

To account for the nesting of repeated observations within individuals, I ran hierarchical linear models (HLM) to test my hypotheses using HLM 7.03 software (Bryk, Raudenbush, & Congdon, 2010). The dependent variables in this study are dichotomous (NSSI urges or behaviours, yes or no). Thus, I used a Bernoulli distribution and a logit link function to derive multilevel logistic regressions. Analyses involved two-level models, with observation days nested within individuals, for NSSI urges and NSSI actions. A main advantage of using this approach is that individuals with missing Level 1 data still contribute to parameter estimates, therefore minimizing bias and maximizing power (Singer, 1998). For all HLM models, I used LaPlace EM estimation, as this approach provides unbiased estimates even when the outcome is rare or population variance is high (Pinheiro & Bates, 1995). Given that NSSI is a low-probability event, this approach is well-suited to my analyses. The resulting coefficients can be interpreted as the log odds of the outcome.

I used random effects models to allow for between-person variability in slopes and intercepts. For all hierarchical models, time was uncentered and modeled as 0 at the intercept, and entered as the number of days from baseline to the completion of the diary period. Even though I have no hypotheses about the effects of time in this study, I included time in the HLM models because doing so can reduce bias in the estimates (Bolger & Laurenceau, 2013). All dichotomous predictors (e.g., gender) were dummy-coded and uncentered. All continuous Level-1 predictors (e.g., emotion scores) were standardized (i.e., z-score transformed) within individuals across time. All coefficient estimates are presented with robust standard errors, and the results below represent the population-average model as opposed to the unit-specific model. These specifications are less sensitive to misspecification and distributional assumptions, and are more appropriate for my goal of detecting an effect across the sample as a whole, rather than merely within each individual.

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#### **4.1. Analyses for Aim 1: Clarify which stressors are associated with NSSI urges and behaviours**

The first aim of this research was to clarify which stressful experiences are most strongly associated with NSSI urges and actions. Given the particular vulnerability to disturbances in the interpersonal realm common among individuals who engage in NSSI, I hypothesized that:

**Hypothesis 1A** –Compared with non-interpersonal stressors (such as the loss of a job), interpersonal stressors (such as rejection or the break-up of a relationship) would have a stronger association with NSSI urges and behaviours.

To test hypothesis 1A, I first examined the correlations between each stressor and NSSI urges or behaviours. I then created a dummy coded variable indicating whether the stressor participants identified as the most difficult or upsetting thing for them that day fell into the interpersonal, non-interpersonal, or internal category. I also created dummy coded variables to indicate whether participants reported NSSI urges or NSSI actions on any given

day. I then conducted chi square tests to determine if the proportion of NSSI urges or acts across the three stressor types was different than the expected distribution. I was interested to see if NSSI urges or actions were overrepresented among observations with interpersonal stressors.

Next, I examined whether type of stressor significantly predicts NSSI urges or NSSI actions in a series of HLM models, including any Level-2 covariates as necessary. For example:

$$\begin{aligned} \text{Level-1 Model} \quad \text{NSSI}_{T_i} &= \pi_{0i} + \pi_{1i}^*(\text{TIME}_{ti}) + \pi_{2i}^*(\text{INTERPER}_{ti}) + \\ &\quad \pi_{2i}^*(\text{NON}_{ti}) + \pi_{3i}^*(\text{INTERNAL}_{ti}) \end{aligned}$$

$$\begin{aligned} \text{Level-2 Model} \quad \pi_{0i} &= \beta_{00}(\text{COVARIATE}_{ti}) + r_{0i} \pi_{1i} \\ &= \beta_{10} + r_{1i} \pi_{2i} \\ &= \beta_{20} + r_{2i} \pi_{3i} \\ &= \beta_{30} + r_{3i} \end{aligned}$$

One factor that may be important to control for is the strength of NSSI urges, as it makes sense logically that stronger urges may be more likely to result in NSSI actions. I therefore ran models where stressors and strength of NSSI urges were included, to see if stressor type offered predictive value independently of urge strength.

To test whether interpersonal stressors are a stronger predictor of NSSI urges or behaviours, I used a 2-step approach. I first examined the odds ratios for each stressor and the 95% confidence intervals for those odds ratios, with non-overlapping confidence intervals indicating that stressor types confer differing levels of risk for NSSI urges or behaviours. Cumming (2009) found that confidence intervals just touching actually correspond to significance at  $p = .01$ . It is, therefore possible, he argues, for two confidence intervals to overlap and still represent a statistically significant difference, as long as the percentage of overlap is less than half of the average CI arm length. If a small degree of overlap in the confidence intervals was found in this study, I performed a significance test of the difference in the odds ratios by creating an interaction term and entering that term into the multilevel models, along with the two independent variables (Norton, Wang, & Ai, 2004). The p value of the interaction term serves as the significance of the difference in odds ratios.

To test Hypothesis 1B, I repeated the above HLM analyses only among the subsample of observations where self-injurious urges were present to see if interpersonal stressors more strongly predicted the transition from urges to NSSI compared with non-interpersonal stressors.

## 4.2. Analyses for Aim 2: Clarify the emotional contexts associated with NSSI urges and behaviours

The second aim was to clarify the specific emotional contexts that increase the likelihood of NSSI urges and behaviour. Building upon previous research demonstrating that specific emotional states are more strongly associated with NSSI, I expected that:

Hypothesis 2A - Compared with low-arousal negative emotions (such as sadness), high-arousal negative emotions (such as anger) would be stronger predictors of NSSI urges and behaviours.

In order to test hypothesis 2A, I computed composite variables to represent each classification of emotions, according to the 2-dimensional model (e.g., “high arousal-negative emotions” and “low arousal-positive emotions,” etc). Emotion Models examined the association between type of emotions at Time<sub>T</sub> and NSSI urges or behaviour at Time<sub>T</sub>, controlling for the level 1 effect of time and any relevant level 2 covariate. For example:

$$\text{Level-1 Model} \quad \text{NSSI}_T = \pi_{0i} + \pi_{1i}^*(\text{TIME}_{ti}) + \pi_{2i}^*(\text{HIAROUS}_{ti}) + \pi_{3i}^*(\text{LOWAROUS}_{ti})$$

$$\begin{aligned} \text{Level-2 Model} \quad \pi_{0i} &= \beta_{00} + \beta_{01}^*(\text{COVARIATE}_i) + r_{0i} \pi_{1i} \\ &= \beta_{10} + r_{1i} \pi_{2i} = \beta_{20} + r_{2i} \pi_{3i} \\ &= \beta_{30} + r_{3i} \end{aligned}$$

I also ran models where both emotions and strength of NSSI urges were included, to see if emotional arousal level offered predictive value independent of urge strength.

To test whether high-arousal negative emotions are a stronger predictor of NSSI urges or behaviours than low-arousal negative emotions, I used a two-step approach. I first examined the odds ratios and the 95% confidence intervals for those odds ratios. Non-overlapping confidence intervals indicate that emotional arousal levels confer different levels

of risk for NSSI urges or behaviours. If a small degree of overlap in the confidence intervals was found there might still be a significant difference between them, according to Cumming (2009). I, therefore, performed a significance test of the difference in the odds ratios by creating an interaction term and entering that term into the multilevel models, along with the two independent variables (Norton, Wang, & Ai, 2004). The  $p$ -value of the interaction term serves as the significance of the difference in odds ratios.

In order to test Hypothesis 2B, I repeated the above analyses among the subsample of observations where NSSI urges were reported, to see if high-arousal emotions predicted the transition to NSSI behaviour than low-arousal emotions.

### 4.3. Analyses for Aim 3: Clarify the cognitive processes associated with NSSI urges and behaviours

The third aim was to examine the cognitive processes which, in the moment, are associated with NSSI urges and behaviour. I again used a series of hierarchical logistic regression models to test my hypotheses that maladaptive thought patterns (including rumination, catastrophizing, self-blame) would predict both NSSI urges and behaviours. Again, I included strength of urges in models predicting NSSI behaviours. I again repeated these analyses among the subsample of observations where NSSI urges were reported, in order to examine which cognitive processes, if any, predict the transition from NSSI urges to NSSI behaviours. Multilevel cognitive models were built such as the example provided below:

$$\text{Level-1 Model} \quad \text{NSSI}_{T_i} = \pi_{0i} + \pi_{1i}^*(\text{TIME}_{ti}) + \pi_{2i}^*(\text{RUM}_{ti}) + \pi_{3i}^*(\text{CATASTRO}_{ti})$$

$$\begin{aligned} \text{Level-2 Model} \quad \pi_{0i} &= \beta_{00} + \beta_{01}^*(\text{COVARIATE}_i) + r_{0i} \pi_{1i} \\ &= \beta_{10} + r_{1i} \pi_{2i} \\ &= \beta_{20} + r_{2i} \pi_{3i} = \beta_{30} + r_{3i} \end{aligned}$$

### 4.4. Analyses for Aim 4: Clarify the factors associated with lower likelihood of NSSI urges and behaviours

I also ran HLM models using possible protective factors (distress tolerance and emotion regulation self-efficacy) to see if these types of beliefs were associated with

reduced risk of NSSI urges or behaviours, offered additive predictive value over strength of NSSI urge, and reduced risk of NSSI when urges were present. For example:

$$\text{Level-1 Model} \quad \text{NSSI}_{T_i} = \pi_{0i} + \pi_{1i}^*(\text{TIME}_{ti}) + \pi_{2i}^*(\text{SELF-EFFICACY}_{ti})$$

$$\text{Level-2 Model} \quad \pi_{0i} = \beta_{00} + \beta_{01}^*(\text{COVARIATE}_i) + r_{0i} \quad \pi_{1i} = \beta_{10} + r_{1i}$$

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

Although my analytic plan involved running multiple hierarchical models, I opted to maintain the traditional significance cut-off of ( $p < .05$ ) rather than shrinking it to minimize familywise error. My approach does increase the possibility of type I error (claiming a statistical difference where none really exists), but it limits the possibility of type II error (retaining the null when it is false and thereby missing an important difference). Given that this study was one of the first of its kind to examine proximal risk or protective factors for NSSI, particularly cognitive processes, it can be considered somewhat exploratory. Type II error can more problematic in exploratory research given that replication and follow-up investigations are less likely to stem from non-significant results (Fiedler, Kutzner, & Krueger, 2012). Furthermore, Fiedler et al. (2012) argue that false negatives are harder to detect in the current scientific system than false positives. Thus, false negatives warrant more concern and preventative efforts.



# Chapter 5.

## Results

### 5.1. Preliminary Analyses

**Diary Compliance.** Participants submitted 537 out of a possible 770 diary entries, with an average of 9.76 entries per person. Although this level of completion was, unfortunately, lower than anticipated, diary compliance was not significantly related to any demographic variable (age  $p = .12$ , gender  $p = 0.70$ , residence  $p = 0.58$ ), nor self-reported NSSI frequency ( $r = .053$ ,  $p = 0.68$ ). NSSI urges were reported on 203 days, with 93% of participants reporting NSSI urges on at least one day, and averaging 4.63 urges per person. Participants reported 115 NSSI behaviours during the observation period, averaging 1.88 NSSI acts per person. Together, this sample reported NSSI urges on 38% of the study days, actions on 21% of the days, and they acted on NSSI urges 57% of the time these urges were present.

**Descriptive statistics and data transformations.** I examined the descriptive statistics, including measures of central tendency and normality of the distribution for all variables prior to standardization. As shown in Table 4.1, all variables demonstrated acceptable skewness and kurtosis. Therefore, no logarithmic transformations were conducted. Inspection of Q-Q plots and histograms revealed no extreme outliers (i.e., cases with a standardized residual larger than 3.0 or smaller than -3.0). I used Mahalanobis'  $D_2$  to screen for multivariate outliers among the IVs.

**Table 5.1 Descriptive statistics for (non-dichotomous) Primary Study Variables.**

Variable	N	Min	Max	Mean	SD	Skew	Kurtosis
NSSI urges	537	1	5	2.21	1.48	.82	-.84
ERSES	537	1	11	5.84	2.99	.05	-1.01
CERQ Rumination	537	2	10	5.92	2.59	-.13	-1.17
CERQ Self-blame	537	2	10	5.70	2.82	-.01	-1.39

CERQ Catastrophizing	537	2	10	5.26	2.71	.18	-1.31
CERQ Other-blame	537	2	10	4.82	2.78	.44	-1.24
CERQ Maladaptive	537	2	9.5	5.43	2.08	-.10	-1.08
High Arousal Negative Emotions	537	1	5	2.71	1.06	.10	-.99
Low Arousal Negative Emotions	537	1	5	2.42	1.12	.32	-1.14
High Arousal Positive Emotions	537	.75	3.75	1.30	.80	1.41	.70
Low Arousal Positive Emotions	537	1	5	1.75	1.15	1.46	.77
DTS Tolerability	537	3	15	9.71	3.70	-.002	-1.09
DTS Absorption	537	3	15	9.42	3.62	.02	-.97
DTS Regulation	537	3	15	9.52	3.67	.03	-1.11
DTS Appraisal	537	6	30	19.36	5.77	-.10	-.75
DTS Total Score	537	3.75	18.75	12.0	3.91	.02	-.94

Note: ERSES = Emotion Regulation Self-Efficacy Scale, CERQ = Cognitive Emotion Regulation Questionnaire, DTS = Distress Tolerance Scale

**Missing data.** Examining each of the variables of interest revealed that in no case was there greater than 6% of the data missing from the days on which participants recorded observations, and most variables had less than 2% missing data. I performed Little’s MCAR test to determine if it is likely any missing data is missing at random, as opposed to having a pattern in its missingness. The MCAR test indicated the data is very likely to be missing at random ( $\chi^2=1597.47, p = .869$ ) therefore HLM analyses will still produce unbiased parameter estimates (Black, Harel, & Matthews, 2011) and nothing further needed to be done regarding missing data.

**Correlations among independent variables.** Given that multicollinearity can be a problem when building regression models, it was important to assess the correlations among the main variables of interest in this study. The CERQ subscales measuring maladaptive thought patterns (e.g., rumination, catastrophizing, etc.) were moderately intercorrelated (average ICC = .507). All four subscales of the DTS were highly intercorrelated (average ICC = .932), therefore only the total score or individual subscale scores were used in building the HLM models. However, the different cognitive process variables (CERQ, DTS, and ERSES) were not significantly correlated with each other (average ICC = .075), and were entered into regression models as unique predictors.

**Potential covariates.** Prior to the primary analyses, I assessed the need to control for any level-2 variables, such as gender, age, ethnicity, or sexual orientation. Each covariate was entered into a separate model as a moderator of the intercept, which would mean they were significantly associated with baseline variability in NSSI outcomes. None of the above person-related characteristics was found to be significantly associated with NSSI urges, nor were they significantly associated with the engagement in NSSI behaviours while urges were present. Identifying as female (OR = .393, 95%CI [.176, .875],  $p = .023$ ) was negatively associated with NSSI actions, and was therefore included as a covariate in all relevant models.

**Decomposition of variance at level 1 and level 2.** Unconditional means models were used to decompose the variance (Singer, 1998), and Intraclass Correlation Coefficients (ICCs) were calculated in order to examine the relative contribution of between and within-subject variance among the continuously distributed variables of interest in this study. ICCs close to .50 indicate that within-subject processes account for roughly half the variance, and support the use of hierarchical models. When the variance component associated with the intercept ( $r_0$ ) is significantly different than zero, as was the case with all variables of interest in this study, then the inclusion of additional predictors is supported to better account for within- and between- subject variance. See Table 5.2 for study variable ICCs.

**Table 5.2 ICCs for continuous variables.**

Variable	ICC
NSSI Urges	.303
High Arousal Negative Emotions	.507
Low Arousal Negative Emotions	.627
CERQ Maladaptive Composite Score	.620
CERQ Rumination Subscale	.532
CERQ Catastrophizing Subscale	.496
CERQ Self-Blame Subscale	.442
CERQ Other-Blame Subscale	.429
DTS Total Score	.433
DTS Tolerability	.390
DTS Absorption	.389
DTS Regulation	.429
DTS Appraisal	.367
Emotion Regulation Self-Efficacy	.457

## 5.2. Results for Aim 1: Clarify which stressors are associated with NSSI

In line with expectations, when NSSI urges were reported, the stressor that participants selected as being the most difficult or upsetting that day were more often interpersonal (32.5% of the time) than they were non-interpersonal (26.6%). However, internal stressors (such as worrying about something) were selected as often as interpersonal stressors (also 32.5% of the time). Interestingly, 8.4% of the time NSSI urges were reported, participants denied experiencing any stressor at all. When NSSI actions were reported, the precipitating stressor was described as an internal event 33% of the time, an interpersonal event 31.3% of the time, and non- interpersonal 26.1% of the time. Ten percent of the time, no stressor of any kind was reported as leading to NSSI.

The dummy coded variable indicating stressor type was significantly related to NSSI urges ( $r=.105$ ,  $p = .015$ ). Of the 18 listed stressors, three interpersonal stressors were significantly positively correlated with the presence of NSSI urges. None of the non-interpersonal stressors was significantly positively correlated with NSSI urges; however, two were negatively correlated with NSSI urges. Two of the four internal stressors were also positively correlated with NSSI urges in across the sample. See Table 5.3 for all significant relationships between reported stressors and NSSI urges.

**Table 5.3 Relationships between stressors and NSSI urges.**

Stressor	Correlation $r =$	Significance $p =$
<b>Interpersonal</b>		
Someone let you down	.093	.03
Someone was displeased with you	.107	.013
Tension in any relationship	.167	.000
<b>Non-interpersonal</b>		
Personal injury or illness	-.098	.024
Car trouble or traffic	-.097	.025
<b>Internal</b>		
Worrying	.198	.000
Negative thoughts about the future	.255	.000

Only two interpersonal stressors and one non-interpersonal stressor were significantly positively correlated with NSSI acts. The same two internal events that were

associated with NSSI urges were again significantly related to NSSI actions. See Table 5.4 for all significant correlations.

**Table 5.4 Relationships between stressors and NSSI actions**

Stressor	Correlation <i>r</i> =	Significance <i>p</i> =
<b>Interpersonal</b>		
Argument or conflict with friend or family member	.094	.029
Tension in any relationship	.202	.000
<b>Non-Interpersonal</b>		
School-related stressor	-.116	.007
Car trouble or traffic	-.098	.024
Financial problems	.088	.041
<b>Internal</b>		
Worrying about something	.126	.004
Negative thoughts about the future	.182	.000

In order to investigate whether interpersonal stressors were more strongly associated with NSSI urges or behaviours than other types of stressors, I also created dummy coded variables to indicate whether participants reported NSSI urges or NSSI actions on any given day. A chi square test indicated that the distribution of NSSI urges across stressor types was significantly different than would be expected by chance ( $\chi^2 = 42.102, p = .000$ ). Crosstabs revealed higher than expected NSSI urges among observations with both interpersonal stressors and internal stressors, and fewer than expected with non-interpersonal stressors. Likewise, the distribution of NSSI behaviours across stressor types was also significantly different than expected ( $\chi^2 = 17.258, p = .001$ ). Crosstabs again indicated higher than expected NSSI behaviours among observations with interpersonal and internal stressors, and fewer than expected NSSI behaviours among observations with non- interpersonal stressors. To test hypothesis 1B that interpersonal stressors would predict the transition to NSSI behaviour when NSSI urges are present, I conducted the same chi square analysis selecting only the days in which NSSI urges were reported, but this test was not significant  $\chi^2 = .393, p = .943$ ).

To account for the nesting of observations within individuals, I ran hierarchical linear models using a Bernoulli distribution and a logit link function to derive multilevel logistic regressions. Table 4.5 shows the first three models where I attempted to predict NSSI urges using the three dummy coded stressor variables as independent predictors. Stressor Model

1 showed that an interpersonal stressor significantly increased the likelihood of reporting NSSI urges ( $p = .020$ ,  $OR = 1.70$ ), while Stressor Model 2 revealed that a non-interpersonal stressor decreased the likelihood of reporting NSSI urges ( $p=.045$ ,  $OR = .674$ ). In Stressor Model 3, an internal stressor (such as worrying about something) significantly increased the likelihood of reporting NSSI urges ( $p = .018$ ,  $OR = 1.70$ ). A comparison of the 95% confidence intervals of the odds ratios suggest that the odds ratio for interpersonal stressors [1.091, 2.649] is completely non-overlapping with the confidence interval for non-interpersonal stressors [0.459, 0.965]; therefore the odds ratios significantly differ and NSSI urges were more likely to be reported on days which an interpersonal stressor versus a non-interpersonal stressor was selected as the most stressful event. Interpersonal stressors do not appear to be stronger predictors of NSSI urges than internal events, however, as the confidence intervals for the odds ratios greatly overlap [1.099, 2.629]. Also of note, is that time was significant in this model. As is not uncommon in diary studies of NSSI (e.g, Maas, Hietbrink, Rink, &Keijers, 2013), participants were slightly less likely to report NSSI urges as the study progressed.

**Table 5.5 Stressor Models predicting NSSI urges at Time<sub>T</sub>.**

NSSI Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ (df)	$p$
Stressor Models 1-3						
Intercepts	-.09-.15	.21-.22	.90-1.16	0.59 to 1.78	-.44 to .73 (50)	.47-.66
Time(s) <sub>T</sub>	-.07	.02	.92-.93	0.90 to 0.97	-3.6 to -3.8 (50)	<.001
Interpersonal <sub>T</sub>	.53	.22	1.70	1.09 to 2.65	2.4 (50)	.020
Non-interpersonal <sub>T</sub>	-.41	.18	.67	0.46 to 0.97	-2.20 (50)	.032
Internal <sub>T</sub>	.53	.22	1.70	1.10 to 2.63	2.44	.018

Note: To conserve space, multiple similar models are grouped together in tables according to hypothesis. The values for intercepts and time are very similar across each model, and are therefore presented as a small range of values rather than listing each discrete point.

Before conducting analyses assessing the relationship between stressor type and NSSI actions, I first wanted to explore whether strength of NSSI urges predicted NSSI behaviour. As can be seen in Table 5.6, stronger urges were indeed associated with greater likelihood of engaging in NSSI behaviour ( $p <.001$ ,  $OR = 2.31$ ).

**Table 5.6 Urges predicting NSSI Behaviours at Time<sub>T</sub>**

NSSI Behaviours	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ (df)	$p$
Urges only Model						
Intercept	-.092	.35	.912	0.448 to 1.856	-.26(48)	.796
Covariate (Gender)	-1.68	.41	.187	0.082 to 0.426	-4.09 (48)	<.001
Time <sub>T</sub>	-.017	.01	.983	0.956 to 1.010	-1.27 (49)	.211
NSSI urges	.837	.12	2.31	1.803 to 2.957	6.80 (49)	<.001

Stressor models 4-6 tested the association between stressor type and NSSI actions (shown in Table 5.7). The presence of an interpersonal stressor (Stressor Model 4) marginally increased the odds of reporting NSSI actions, but this was not significant ( $p = .061$ , OR = 1.34). There was no significant association between selecting a non-interpersonal stressor and NSSI actions (Stressor Model 5). Unlike urges, internal stressors (Stressor Model 6) were not significantly related to NSSI actions ( $p = .206$ ). None of the stressor variables were significant when included in a model with NSSI urges ( $ps = .364-.838$ ).

**Table 5.7 Stressor models predicting NSSI behaviours at Time<sub>T</sub>**

NSSI Behaviours	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ (df)	$p$
Stressor Models 4-6						
Intercept	-.379 to -.489	.33	.616	0.32 to 1.39	- 1.14 to - 1.50 (49)	.141 to .257
Covariate (Gender)	-.874 to -.897	.37 to.39	.414	0.19 to 0.90	-2.29 to - 2.35 (49)	.023 to .026
Time <sub>T</sub>	-.041 to -.042	.01	.958	0.93 to 0.99	-2.86 to -3.08 (50)	.003 to .006
Interpersonal	.294	.15	1.34	0.99 to 1.83	1.91 (50)	.061
Non-interpersonal	-.14	.15	.869	0.64 to 1.18	-.92 (50)	.362
Internal	.260	.20	1.30	0.86 to 1.95	1.28 (50)	.206

I repeated the initial analyses described above among the subsample where NSSI urges were reported, to assess whether dummy coded stressor type predicted the transition from NSSI urges to NSSI behaviours, but none of the stressor variables were significant ( $ps = .675-.944$ ).

### 5.3. Results for Aim 2: Clarify the specific emotional contexts that are associated with NSSI

Table 5.8 shows results for models using emotion variables to predict NSSI urges. Consistent with hypothesis 2A, a composite variable of high-arousal negative emotions significantly predicted NSSI urges (Emotion Model 1,  $p = <.001$ ). As expected, low-arousal negative emotions also significantly predicted NSSI urges (Emotion Model 2,  $p = <.001$ ). Contrary to my hypothesis, however, when both predictors were included in the same model, only the low-arousal negative emotions remained significant (Emotion Model 3,  $p <.001$ ). The high-arousal negative emotions were no longer a significant predictor ( $p = .164$ ).

**Table 5.8 Emotion Models predicting NSSI urges at Time<sub>T</sub>**

NSSI Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	t (df)	p
Emotion Models 1-2						
Intercepts	-.11 to -.19	.21	.83 to .90	0.55 to 1.37	-.51 to -.89 (49)	.376 to .612
Time <sub>T</sub>	-.03 to -.04	.02	.96 to .97	0.92 to 1.01	-1.45 to -2.23 (49)	.031 to .152
HighArousalNeg	.48	.11	1.61	1.29 to 2.00	4.36 (49)	<.001
LowArousalNeg	.66	.09	1.93	1.60 to 2.33	7.0 (49)	<.001
Model 3: Additive effects						
Intercept	-.18	.21	.84	.56 to 1.27	-.86 (49)	.395
Time <sub>T</sub>	-.03	.02	.97	.93 to 1.0	-1.68 (49)	.099
HighArousalNeg	.14	.10	1.15	.94 to 1.4	1.414 (49)	.164
LowArousalNeg	.55	.08	1.73	1.48 to 2.03	6.98 (49)	<.001

As can be seen in Table 5.9, high-arousal negative emotions (Emotion Model 4,  $p <.001$ ) and low-arousal negative emotions (Emotion Model 5,  $p <.001$ ) also each predicted engagement in NSSI behaviours, including gender in the model as a level 2 covariate. When included in the model at the same time (Emotion Model 6), both high-arousal negative emotions ( $p = .017$ , OR = 1.29) and low-arousal negative emotions ( $p = .036$ , OR = 1.23) continued to be significantly associated with an increased likelihood of NSSI behaviour that day.

**Table 5.9 Emotion Models predicting NSSI behaviours at Time<sub>T</sub>**

NSSI Behaviours	$\gamma$ Estimate	SE	OR	95% CI of OR	t (df)	p
Emotion Models 4-5						



Intercepts	-.41 to -.44	.31	.64 to .66	0.35 to 1.24	-1.32 to -1.45 (48)	.153 to .193
Covariate (Gender)	-1.13 to -1.01	.36	.32 to .36	0.16 to 0.75	-2.80 to -3.12 (48)	.003 to .007
Time $\tau$	-.01 to -.02	.02	.98 to .99	0.95 to 1.02	-.88 to -1.65 (49)	.106 to .383
HighArousalNeg	.38	.10	1.47	1.20 to 1.80	3.77 (49)	<.001
LowArousalNeg	.38	.09	1.47	1.22 to 1.76	4.24 (49)	<.001
Model 6: Additive effects						
Intercept	-.48	.29	.62	0.35 to 1.10	-1.67 (48)	.101
Covariate (Gender)	-1.0	.32	.37	0.19 to 0.70	-3.13 (48)	.003
Time $\tau$	-.01	.02	.99	0.96 to 1.02	-.67 (49)	.507
HighArousalNeg	.26	.10	1.29	1.05 to 1.59	2.47 (49)	.017
LowArousalNeg	.20	.09	1.23	1.01 to 1.48	2.16 (49)	.036

The 95% confidence intervals for the two odds ratios [1.18, 1.80] and [1.22, 1.76] greatly overlapped so the odds ratios are likely to not significantly differ from one another. Their interaction term was not significant ( $p = .979$ ) providing further evidence that, contrary to hypotheses, high and low arousal negative emotions did not significantly differ in their association with NSSI behaviours. High arousal negative emotions remained a significant predictor for NSSI behaviours, even when including strength of NSSI urges in the model ( $p = .048$ , OR = 1.17), whereas low-arousal negative emotions did not ( $p = .052$ , OR = 1.16). However, their confidence intervals again overlapped and neither emotion variable remained significant when they were both in a model with NSSI urges ( $ps > .118$ ).

Contrary to hypothesis 2B, neither high-arousal emotions (Emotion Model 7,  $p = .985$ ) nor low-arousal negative emotions (Emotion Model 8,  $p = .403$ ) significantly predicted the transition to NSSI behaviour when urges were present (See Table 5.10). No variable, including strength of NSSI urges, predicted acting on NSSI urges when they were all in the model simultaneously ( $ps > .115$ ).

**Table 5.10 Emotion Models predicting transition from NSSI urges to NSSI behaviours.**

Acting on Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Emotion Models 7-8						
Intercepts	-.05 to .02	.23 to .24	.95	.59 to 1.61	-.20 to .11 (43)	.843 to .916
Time $\tau$	-.002 to -.004	.02	1.0	.95 to 1.05	-.09 to -.21 (43)	.832 to .929

HighArousalNeg	.002	.12	1.0	.78 to 1.29	.02 (43)	.985
LowArousalNeg	-.12	.14	.89	.67 to 1.18	-.84 (114)	.403
Model 9: Additive effects						
Intercept	.02	.24	1.02	0.63 to 1.64	.075 (43)	.940
Time <sub>T</sub>	-.01	.02	.99	0.95 to 1.04	-.27 (43)	.786
HighArousalNeg	.16	.14	1.18	0.89 to 1.56	1.17 (43)	.248
LowArousalNeg	-.25	.16	.78	0.57 to 1.06	-1.61 (43)	.115

#### 5.4. Results for Aim 3: Clarify the cognitive processes that are associated with NSSI

I first created a variable representing the composite score of the maladaptive thought subscales on the CERQ (rumination, catastrophizing, self-blame, and other blame). In Cognitive Model 1 shown in Table 5.11, this composite variable of maladaptive thoughts significantly predicted NSSI urges ( $p < .001$ ). Next, I wanted to tease apart what specific thought patterns might be driving this effect, so I ran models with each subscale separately. Cognitive Models 2-5 show that rumination ( $p < .001$ ), catastrophizing ( $p = .003$ ), and self-blame ( $p = .015$ ) each significantly predicted NSSI urges. For comparison sake, other-blame did not significantly predict NSSI urges (Cognitive Model 6,  $p = .190$ ). I then entered all three hypothesized predictors into the model simultaneously. Cognitive model 7 showed that only rumination remained a significant predictor with the other variables in the model, with catastrophizing showing a trend that might be significant with higher power to detect additive effects in such a complex model.

**Table 5.11 Cognitive Models predicting NSSI urges.**

NSSI Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Cognitive Models 1-6						
Intercepts	-.01 to -.10	.20 to .21	.96 to .99	.63 to 1.47	-.07 to -.206 (49)	.838 to .946
Time <sub>T</sub>	-.05 to -.06	.02	.94 to .95	.91 to .98	-2.66 to -3.25 (49)	.002 to .004
Maladaptive Thoughts	.36	.10	1.44	1.19 to 1.74	3.81 (49)	<.001
Catastrophizing	.29	.09	1.33	1.11 to 1.60	3.16 (49)	.003
Rumination	.34	.09	1.40	1.17 to 1.69	3.73 (49)	<.001
Self-blame	.23	.09	1.26	1.05 to 1.52	2.53 (49)	.015
Model 7: Additive effects						
Intercept	-.10	.21	.90	.60 to 1.36	-.515 (49)	.609

Time <sub>T</sub>	-.05	.02	.95	.92 to .99	-2.66 (49)	.010
Catastrophizing	.17	.10	1.19	.98 to 1.44	1.82 (49)	.075
Rumination	.25	.09	1.28	1.07 to 1.53	2.78 (49)	.008
Self-blame	.11	.09	1.12	.94 to 1.34	1.29 (49)	.204

The above analyses were conducted again, this time predicting NSSI behaviour and including gender as a level-2 covariate (see Cognitive Models 8-12 in Table 5.12). The composite of maladaptive thoughts ( $p = .007$ ), as well as the individual subscales for rumination ( $p = .008$ ) and catastrophizing ( $p = .034$ ), each significantly predicted an increased likelihood of NSSI actions. Different than the results for urges, however, neither self-blame ( $p = .120$ ), nor other-blame ( $p = .341$ ) were significant predictors of engaging in NSSI behaviour. I again entered all three hypothesized predictors into the model simultaneously. Cognitive model 13 (also shown in Table 5.12) showed that nothing remained significant in such a complex model. When including strength of NSSI urges in each separate model, the composite of maladaptive thoughts ( $p = .008$ , OR = 1.20) and the self-blame subscale ( $p = .043$ , OR = 1.15) remained significant predictors of NSSI actions, while rumination ( $p = .079$ ), catastrophizing ( $p = .265$ ), and other-blame ( $p = .344$ ) were not. When rumination, self-blame, and catastrophizing were included simultaneously, only strength of urges remained significant in predicting NSSI behaviours.

**Table 5.12 Cognitive Models predicting NSSI behaviours.**

NSSI Behaviours	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Cognitive Models 8-12						
Intercepts	-.39 to -.43	.33	.65 to .66	.34 to 1.8	-1.18 to -1.31 (48)	.196 to .245
Covariate (Gender)	-.90 to -.96	.37 to .38	.38 to .41	.18 to .86	-2.37 to -2.54 (48)	.014 to .022
Time <sub>T</sub>	-.03 to -.04	.01 to .02	.96 to .97	.94 to 1.0	-1.94 to -2.59 (49)	.013 to .058
Maladaptive Thoughts	.24	.09	1.27	1.07 to 1.5	2.83 (49)	.007
Catastrophizing	.19	.09	1.21	1.01 to 1.44	2.19 (49)	.034
Rumination	.18	.06	1.19	1.05 to 1.35	2.78 (49)	.008
Self-blame	.13	.08	1.14	.97 to 1.35	1.58 (49)	.120
Cognitive Model 13: Additive effects						
Intercept	-.51	.31	.60	.33 to 1.11	-1.66 (48)	.103
Covariate (Gender)	-.79	.35	.45	.23 to .91	-2.29 (48)	.026
Time <sub>T</sub>	-.02	.01	.98	.96 to 1.01	-1.40 (49)	.169

Catastrophizing	.12	.10	1.09	.95 to 1.25	1.21 (49)	.233
Rumination	.08	.07	1.07	.92 to 1.25	.95 (49)	.348
Self-blame	.07	.07	1.13	.93 to 1.36	1.25 (49)	.219

In order to test Hypothesis 3B, I repeated the above analyses selecting only the cases (N = 205) where participants reported NSSI urges, to see what variables might predict the transition to NSSI behaviours. As can be seen in Table 5.13, none of the maladaptive thoughts composite ( $p = .828$ ), rumination ( $p = .783$ ), catastrophizing ( $p = .836$ ), or self-blame ( $p = .762$ ) were significant individual predictors detected by the reduced level of power in this subsample. This was true whether NSSI urges were included in the models or not.

**Table 5.13 Cognitive Models predicting transition from NSSI urges to NSSI behaviours.**

Acting on urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Cognitive Models 14-17						
Intercepts	-.00 to -.05	.22 to .24	.95 to 1.0	.61 to 1.68	-.24 to .11 (43)	.810 to .998
Time $\tau$	-.00 to -.01	.02 - .03	.99 to 1.0	.94 to 1.05	-.41 to -.04 (43)	.682 to .966
Maladaptive Thoughts	-.04	.16	.96	.69 to 1.34	-.22 (43)	.828
Catastrophizing	-.03	.12	.98	.77 to 1.24	-.21 (43)	.836
Rumination	-.03	.12	.97	.76 to 1.23	-.28 (43)	.783
Self-blame	-.05	.16	.95	.69 to 1.31	-.31 (43)	.762
Cognitive Model 18: Additive effects						
Intercept	.08	.25	1.08	.65 to 1.79	.303 (43)	.763
Time $\tau$	-.02	.03	.98	.93 to 1.04	-.602 (43)	.550
Catastrophizing	-.05	.14	.95	.72 to 1.25	-.386 (43)	.701
Rumination	-.03	.13	.97	.75 to 1.25	-.273 (43)	.786
Self-blame	-.07	.15	.93	.68 to 1.27	.458 (43)	.649

## 5.5. Results for Aim 4: Examine factors that protect against NSSI

In order to examine Hypothesis 4A, I examined the role of distress tolerance in predicting NSSI urges. Table 5.14 shows the DTS total score significantly predicted NSSI urges (Adaptive Model 1,  $p < .001$ ) such that higher scores (and therefore higher distress tolerance) were associated with a lowered likelihood of reporting NSSI urges. I then added each of the four specific DTS subscales into Adaptive Models 2-4, which showed that

tolerability ( $p < .001$ ), absorption ( $p < .001$ ), regulation ( $p < .001$ ), and appraisal ( $p = .001$ ) each significantly reduced the likelihood of NSSI urges being reported that day. I included all the subscales together in Adaptive Model 6 to test for additive effects, but none of them remained significant with the others in the model ( $ps > .171$ ). This finding is not surprising, given that these variables are highly correlated with each other, as was previously reported.

**Table 5.14 Distress Tolerance predicting NSSI urges.**

NSSI Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Adaptive Models 1-5: Distress Tolerance						
Intercepts	-.02 to -.07	.20 to .21	.93 to .97	.62 to 1.47	-11. to -.33 (49)	.740 to .911
Time $\tau$	-.05 to .06	.02	.94 to .95	.91 to .99	-2.76 to -3.64 (49)	<.001 to .008
Distress Tolerance	-.37	.10	.69	.57 to .85	-3.56 (49)	<.001
Tolerability	-.36	.09	.70	.58 to .84	-3.88 (49)	<.001
Absorption	-.35	.09	.71	.59 to .85	-3.75 (49)	<.001
Regulation	-.34	.09	.71	.60 to .85	-3.93 (49)	<.001
Appraisal	-.35	.10	.71	.58 to .87	-3.38 (49)	.001

Next, I examined the role of distress tolerance in predicting NSSI behaviours (Adaptive models 6-12). Similar to the models predicting NSSI urges, the DTS total score ( $p = .004$ ), and each of the individual subscales for tolerability ( $p < .001$ ), absorption ( $p = .009$ ), regulation ( $p < .001$ ), and appraisal ( $p = .032$ ) were significantly associated with NSSI behaviours such that higher scores (and therefore higher distress tolerance in the moment) were associated with a lowered likelihood of reporting NSSI behaviours (See Table 5.15 for full results). Once again, no variable remained significant when all were included in the model simultaneously, as is not surprising given the high probability of multicollinearity among these subscale scores. When including NSSI urges in the model, neither the DTS total score nor any specific DTS subscale continued to predict NSSI behaviours, although regulation did approach significance ( $p = .053$ , OR = .875).

**Table 5.15 Distress Tolerance protecting against NSSI behaviours.**

NSSI Behaviours	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Adaptive Models 6-12: Distress Tolerance						
Intercepts	-.39 to -.49	.32 to .35	.62 to .68	.32 to 1.33	-1.15 to -1.51 (48)	.138 to .255

Covariate (Gender)	-.81 to -.96	.37 to .39	.38 to .44	.18 to .96	-2.06 to -2.53 (48)	.015 to .039
Time $\tau$	-.03	.01	.97	.94 to 1.0	-2.01 to -2.50 (49)	.016 to .050
Distress Tolerance	.28	.09	.76	.63 to .91	-3.00 (49)	.004
Tolerability	-.33	.09	.72	.61 to .86	-3.69 (49)	<.001
Absorption	-.25	.09	.78	.65 to .94	-2.72 (49)	.009
Regulation	-.27	.07	.76	.66 to .89	-3.67 (49)	<.001
Appraisal	-.21	.10	.81	.67 to .98	-2.21 (49)	.032

In order to test Hypothesis 4B, I repeated the above analyses selecting only the cases where participants reported NSSI urges, to see what variables might predict the transition to NSSI behaviours. Table 5.16 shows that none of the distress tolerance variables, total score ( $p = .271$ ), tolerability ( $p = .124$ ), absorption ( $p = .347$ ), regulation ( $p = .089$ ), or appraisal ( $p = .574$ ), were significant individual predictors detected by the reduced level of power in this subsample. This was true whether NSSI urges were included in the models or not ( $ps > .183$ ).

**Table 5.16 Distress Tolerance protecting against transition to NSSI Behaviours.**

Acting on Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Adaptive Models 13-17: Distress Tolerance						
Intercepts	-.10 to -.19	.23 to .24	.83 to .91	.51 to 1.44	-.43 to -.81 (43)	.418 to .668
Time $\tau$	.001 to .002	.02	1.0	.96 to 1.05	-.08 to .05 (43)	.758 to .971
Distress Tolerance	-.15	.14	.86	.65 to 1.13	-1.12 (43)	.271
Tolerability	-.19	.12	.83	.65 to 1.06	-1.57 (43)	.124
Absorption	-.13	.14	.88	.66 to 1.16	-.95 (43)	.347
Regulation	-.19	.11	.82	.66 to 1.03	-1.74 (43)	.089
Appraisal	-.08	.14	.92	.69 to 1.23	-.57 (43)	.574

Consistent with hypothesis 4A, higher emotion regulation self-efficacy significantly lowered the likelihood of NSSI urges (See Adaptive Model 18 in Table 5.17,  $p = .002$ ) and NSSI actions (See Adaptive Model 19 in Table 5.18,  $p < .001$ , OR = .722). Unlike the other variables in this study, it continued its association with reduced likelihood of NSSI behaviours even when the model included NSSI urges (Adaptive Model 20,  $p = .049$ , OR = .88).

**Table 5.17 Adaptive Models protecting against NSSI Urges.**

NSSI Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Adaptive Model 18: Emotion Regulation Self-Efficacy						
Intercepts	.05	.20	1.06	.70 to 1.59	.267 (49)	.790
Time $\tau$	-.07	.02	.93	.90 to .97	-3.98 (49)	<.001
Emotion Regulation Self-Efficacy	-.30	.09	.74	.62 to .90	-3.20 (49)	.002

**Table 5.18 Adaptive Models protecting against NSSI Behaviours**

NSSI Behaviours	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Adaptive Model 19: Emotion Regulation Self-Efficacy						
Intercept	-.25	.34	.78	.40 to 1.53	-.75 (48)	.456
Covariate (Gender)	-1.10	.38	.33	.16 to .71	-2.91 (48)	.005
Time $\tau$	-.04	.01	.96	.93 to .99	-3.10 (49)	.003
Emotion Regulation Self-Efficacy	-.33	.07	.72	.63 to .84	-4.52 (49)	<.001
Adaptive Model 20: Emotion Regulation Self-Efficacy and NSSI urges						
Intercept	-.12	.35	.89	.44 to 1.79	-.33 (48)	.742
Covariate (Gender)	-1.55	.39	.21	.10 to .47	-3.96 (48)	<.001
Time $\tau$	-.01	.01	.99	.96 to 1.01	-1.09 (49)	.280
Emotion Regulation Self-Efficacy	-.13	.06	.88	.77 to .99	-2.02 (49)	.049
NSSI Urges	.75	.12	2.11	1.67 to 2.67	6.38 (49)	<.001

As a test of hypothesis 4B, I repeated the above analyses selecting only observations on which NSSI urges were reported ( $N = 203$ ). Consistent with my hypothesis, emotion regulation self-efficacy was again significantly associated with a reduced likelihood of acting on NSSI urges (See Adaptive Model 21 in Table 5.19,  $p = .015$ ,  $OR = .75$ ). Once strength of NSSI urges was added to the model, however, neither predictor remained significantly associated with NSSI behaviours.

**Table 5.19 Models protecting against the transition to NSSI Behaviours**

Acting on Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Adaptive Model 21: Emotion Regulation Self-Efficacy						
Intercept	-.09	.23	.91	.58 to 1.45	-.40 (43)	.694
Time $\tau$	-.01	.02	.99	.95 to 1.04	-.32 (43)	.753
Emotion Regulation Self-Efficacy	-.28	.11	.75	.60 to .94	-2.54 (43)	.015
Adaptive Model 22: ERSES and NSSI Urges						
Intercept	-.14	.25	.87	.52 to 1.45	-.56 (43)	.580
Time $\tau$	-.01	.02	.99	.95 to 1.03	-.54 (43)	.592
Emotion Regulation Self-Efficacy	-.20	.12	.82	.64 to 1.05	-1.62 (43)	.113
NSSI Urges	.16	.17	1.18	.83 to 1.67	.94 (43)	.354

Finally, I included both adaptive process variables (DTS total score and ERSES) into Adaptive Model 23 to test for additive effects. As can be seen in Table 5.20, only distress tolerance continued to significantly reduce the likelihood of NSSI urges ( $p = .005$ , OR = .734). Emotion regulation self-efficacy was no longer a significant predictor with the other variable in the model ( $p = .143$ ).

**Table 5.20 Protective factors against NSSI urges.**

NSSI Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ ( $df$ )	$p$
Adaptive Model 23: Additive Effects						
Intercept	-.06	.20	.95	.63 to 1.42	-.28 (49)	.784
Time $\tau$	-.05	.02	.95	.92 to .99	-2.86 (49)	.006
Distress Tolerance	-.31	.11	.73	.59 to .91	-2.92 (49)	.005
Emotion Regulation Self-Efficacy	-.14	.09	.87	.71 to 1.05	-1.49 (49)	.143

Next, I included both adaptive variables into Adaptive Model 24 to assess their additive value in predicting NSSI behaviours. Distress tolerance ( $p = .045$ , OR = .83) and emotion regulation self-efficacy scores ( $p = .012$ , OR = .83) were each associated with a reduced likelihood that NSSI behaviours were reported (See Table 5.21). Neither was significantly associated with NSSI behaviours when controlling for strength of NSSI urges ( $ps > .093$ ), however.



**Table 5.21 Additive Adaptive model protecting against NSSI behaviours.**

NSSI Behaviours	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ (df)	$p$
Adaptive Model 24 Additive Effects						
Intercept	-.37	.32	.69	.36 to 1.32	-1.15 (48)	.258
Covariate (Gender)	-.94	.35	.39	.19 to .80	-2.65 (48)	.011
Time $\tau$	-.03	.01	.97	.95 to 1.0	-1.94 (49)	.059
Distress Tolerance	-.18	.09	.83	.67 to .99	-1.99 (49)	.045
Emotion Regulation Self-Efficacy	-.17	.07	.84	.72 to .96	-2.60 (49)	.012

As a final test of hypothesis 4B, I added both protective factors simultaneously to check for additive effects in predicting likelihood of acting on NSSI urges. Only emotion regulation self-efficacy was significantly associated with reduced risk for NSSI behaviours (See Adaptive Model 25 in Table 5.22,  $p = .035$ , OR = .78)

**Table 5.22 Additive Adaptive model predicting transition to NSSI behaviours.**

Acting on Urges	$\gamma$ Estimate	SE	OR	95% CI of OR	$t$ (df)	$p$
Adaptive Model 25 Additive Effects						
Intercept	-.12	.23	.89	.55 to 1.41	-.53 (43)	.601
Time $\tau$	-.01	.02	.99	.95 to 1.04	-.25 (43)	.802
Distress Tolerance	-.06	.14	.94	.71 to 1.24	-.45 (43)	.659
Emotion Regulation Self-Efficacy	-.25	.12	.78	.61 to .98	-2.17 (43)	.035

The major findings of this study, as they relate to each of my hypotheses, are summarized in Table 5. 23.

**Table 5.23 Summary of findings.**

Hypothesis	Supported? NSSI Urges	Supported? NSSI Behaviours	Supported? Transition
1A: Interpersonal stressors will have stronger associations with NSSI than will non-interpersonal stressors	<b>Yes</b>	<b>No</b>	N/A
1B: Interpersonal stressors will predict transition from NSSI urges to NSSI Actions	N/A	N/A	<b>No</b>

2A: High-arousal negative emotions will be stronger predictors of NSSI than will low- arousal negative emotions	<b>No</b> Both were associated	<b>No</b> The did not significantly differ	N/A
2B: High arousal negative emotions will predict transition from NSSI urges to NSSI actions	N/A	N/A	<b>No</b>
3A: Maladaptive thoughts will predict NSSI urges and behaviours	<b>Yes</b> for all, especially rumination	<b>Yes</b> For all except self-blame	N/A
3B: Maladaptive thoughts will predict transition from NSSI urges to NSSI actions	N/A	N/A	<b>No</b>
4A: Distress tolerance will be negatively associated with NSSI urges and behaviours	<b>Yes</b>	<b>Yes</b>	N/A
4A: Emotion Regulation Self-Efficacy will be negatively associated with NSSI urges and behaviours	<b>Yes</b>	<b>Yes</b>	N/A
4B: Distress tolerance will be negatively associated with NSSI behaviours when urges are present	N/A	N/A	<b>No</b>
4B: Emotion Regulation Self-Efficacy will be negatively associated with NSSI behaviours when urges are present	N/A	N/A	<b>Yes</b>

## Chapter 6.

### Discussion

Non-suicidal self-injury is a wide-spread and serious problem affecting people across genders, ages, and diagnostic categories (Zetterqvist, 2015). Although research on NSSI has exploded in recent years, and much is now known about the form, function, and correlates of self-injurious behaviour, it is still unclear what immediate contextual factors send individuals on a trajectory towards NSSI compared with some other behaviour (either adaptive or maladaptive). This study contributes to the extant literature by providing an analysis of NSSI urges and actions as they occur in the daily lives of individuals who are actively engaging in this behaviour. This study is the first of its kind to examine the association of NSSI urges and behaviours with particular thoughts and feelings stemming from a specific prompting event.

#### 6.1. Implications for stressors in NSSI

Given that individuals do not engage in NSSI every time they experience a negative event, an important question is what might be different about stressors that do or do not result in NSSI urges or behaviours. Consistent with previous research suggesting a unique vulnerability to disruptions in interpersonal relationships, participants in this study were indeed more likely to report NSSI urges when the prompting event was interpersonal, compared with something non- interpersonal. Although only marginally significant, results suggest that NSSI behaviours may also be more likely following a stressful interpersonal event, as opposed to a non-interpersonal stressor. This finding is consistent with previous research that has asserted interpersonal stressors are often precipitants of NSSI (e.g., Turner et al., 2016), but it may be unwise to focus only on stressful external events. Perhaps an even more interesting finding in this study is that internal events, such as worrying, appeared equally relevant in predicting NSSI urges and behaviours. Unfortunately, the items used in this study were rather vague (e.g., “worrying about something”) so I cannot classify these worries as interpersonal or non-interpersonal, or make any distinctions between differing worry content. This would be an area for future research. Although internal events

are not often investigated as stressors in empirical research on NSSI, this finding is consistent with what we hear clinically. Patients often report feeling confused about their self-harm or suicidal ideation because “nothing happened” that day to set it off. In fact, it may be crucial to help patients increase awareness of these internal events that seem particularly linked to NSSI, in order to help them reduce or avoid these behaviours. Future research and treatment developments should include adequate attention to the distress, urges, and behaviours that may result from internal stressors as opposed to purely external events.

## **6.2. Implications for emotions in NSSI**

The role of emotions is another important facet to understand along the pathway to NSSI behaviours. Although there is wide support for affect regulation models of NSSI (Chapman et al., 2006; Klonsky et al., 2007, Nock et al., 2009), previous research has suggested that all emotions have equal impact when it comes to NSSI urges and behaviours. Studies have shown that anger, hostility, and anxiety seem particularly linked with NSSI (e.g., Humber et al., 2013). Other emotions, such as sadness, may have more complex relationships whereby they may increase NSSI urges, but actually decrease NSSI behaviour (Nock et al., 2009). These findings suggested that perhaps a two-dimensional model, taking into account level of arousal and the valence of the emotion, may add important understanding to the role that emotions play in NSSI. The results of this study did not support this hypothesis, however. One possible reason for this is statistical. Understandably, high-arousal negative emotions and low-arousal negative emotions were highly correlated with each other. It is therefore possible that these two variables were too similar to each other, and this may have affected my power to detect differences in their effects. Another possibility has to do with the emotion categories used in this study. The feeling of being unreal/unaware of surroundings/outside my body was included in the low-arousal negative emotion category. However, dissociative states have been shown to be one of the strongest predictors of NSSI (Gratz, Conrad, & Romer, 2002). In the current sample, feeling “unreal” was identified as the most common precipitant for NSSI episodes, and was endorsed by 71% of participants. It might also be an interactive effect of emotional state and intended function of NSSI. For example, high-arousal negative emotions might have a strong relationship with NSSI actions that are performed primarily to reduce emotions. If an individual engages in NSSI in order to stop periods of numbness or

detachment, however, then these low-arousal negative emotions are likely to play a stronger role in NSSI that functions to generate feelings (Turner, Chapman, & Layden, 2012). Although the intended function of NSSI was assessed in this study, the small numbers of NSSI actions associated with various specific functions preclude formal investigation of these relationships.

### **6.3. Implications for cognitive processes in NSSI**

Perhaps the greatest contribution of this study is the examination of the cognitive processes that, in the moment, are associated with an increased likelihood of NSSI urges or actions. Thought patterns that are widely considered maladaptive, such as ruminating, catastrophizing, and self-blaming (Garnefski et al., 2002), were all associated with NSSI urges in this study. Furthermore, maladaptive thoughts in general, and ruminating and catastrophizing specifically, increased the likelihood of NSSI behaviours. These findings are in support of the emotional cascade model, which posits that NSSI functions as a way to escape a powerful cycle of increasing negative rumination and aversive emotional states (Joiner et al., 2004) and suggest that these particular cognitive processes may be critical targets for clinical intervention. A central tenet in cognitive behavioural therapy (CBT) posits that, although one cannot always prevent stressful events from happening, one can change the way they think about those events. The skill of cognitive restructuring is often explicitly taught to help participants disengage from negative thinking patterns that contribute to their emotional and behavioural difficulties, including NSSI and suicidal behaviour (e.g., Berk, Henriques, Warman, Brown, & Beck, 2004; Brown, Ten Have, Henriques, Xie, Hollander, & Beck, 2005; Rudd, Joiner, & Rajab, 2001). Likewise, DBT encourages patients to check the facts (Linehan, 1993), which provides a direct alternative to catastrophizing. CBT has been deemed “probably efficacious” in treating individuals who self-injure (Glenn et al., 2015; Muehlenkamp, 2006), but treatments are typically not aimed at NSSI specifically (Klonsky, 2007; Washburn et al., 2012). Originally developed as a treatment for suicidal women, DBT has long demonstrated its efficacy at reducing NSSI among persons with BPD and in other clinical populations (see Kliem et al., 2010 for a meta-analysis). Although I did not investigate whether the use of particular CBT or DBT skills reduced NSSI risk, the results do suggest clinicians should consider individuals to recognize when they are engaging in these unhelpful thought patterns, and to use these thoughts as a signal to initiate other skills to help them cope effectively without resorting to NSSI behaviours.

## 6.4. Implications for protective factors in NSSI

This study was one of the first to examine the effect of adaptive or helpful cognitive processes, such as distress tolerance, on NSSI outcomes. Previous research has indicated that individuals who engage in NSSI can be distinguished from their non-self-injuring counterparts in the extent to which emotions are tolerated or accepted (Gratz & Roemer, 2004), and theories suggest that individuals low in distress tolerance (perceived or behaviorally-observed) may be more likely to utilize negative reinforcement opportunities when presented with negative stimuli (Trafton & Gifford, 2011). In this study, higher reported tolerance of distress was significantly associated with reduced NSSI urges and behaviours. Results suggest that rating the distress that resulted from experiencing a stressful event as more tolerable, being less absorbed by that distress, appraising one's emotions as more acceptable, and feeling less urgency to escape one's emotions all reduced the likelihood that NSSI urges or behaviours were reported that day. This is one of the first studies to demonstrate a relationship between distress tolerance in the moment and NSSI outcomes, thereby lending support to the importance of developing these skills in order to reduce NSSI. Of note, this study only included participants' self-reported distress tolerance, and did not measure their actual ability to withstand an aversive state. Previous investigations, however, found that perceived emotional distress tolerance was more strongly associated with disordered eating behaviours than was an individual's actual ability to tolerate physical or psychological discomfort during laboratory tasks (Anestis, Lavender, Marshall- Berenz, Gratz, Tull, & Joiner, 2011). This finding suggests that perceived emotional distress tolerance may be what is most important. Future research is needed to explore emotional distress tolerance further. For instance, perhaps certain emotions are generally more tolerable than others, or there may be patterns of tolerability that vary among individuals. In addition to the valence and arousal level associated with emotions, it might be critical to learn more about the relationship individuals have with certain emotions and what might make them seem tolerable in any given moment.

Similarly, perhaps the key finding from this study is the importance of self-efficacy when it comes to regulating emotions. Higher emotion regulation self-efficacy was negatively associated with NSSI urges and behaviours, suggesting that it may be one critical factor that differentiates whether or not individuals will resort to NSSI in the context of stressful situations and painful emotions. Even more importantly, self-efficacy was the only factor

significantly negatively associated with NSSI behaviours when NSSI urges were present. This lends further support to affect regulation models of NSSI (Chapman et al., 2006; Klonsky et al., 2007, Nock et al., 2009), suggesting that individuals may engage in NSSI as a last resort to regulate uncomfortable emotions when they believe they have no ability to do so through other means. If participants believed they could reduce or change the emotions they were experiencing, however, they seemed more likely to do so without resorting to NSSI. This finding is consistent with Tice, Bratslavsky, and Baumeister's study (2001) demonstrating that participants who underwent a distressing mood induction and were in the mood-freeze condition (i.e., were led to believe their moods were temporarily unchangeable) did not engage in behaviours thought to serve emotion- regulation functions (such as eating fatty foods, instant vs. delayed gratification, or frivolous procrastinating), whereas distressed participants who believed their moods were changeable did. Although it is not known how NSSI might be affected by a mood-freeze manipulation, it follows that people might be less likely to even attempt emotion regulation through more adaptive methods if they do not believe they will be effective. This raises several questions for future research. For example, we need to identify the factors that contribute to someone having higher emotion-regulation self-efficacy in the moment. Recognizing specific thought patterns or coping behaviours that can bolster feelings of self-efficacy in the moment may inform therapeutic interventions. Another important question to investigate is whether or not emotion-regulation self-efficacy is affected by therapy in general or emotion regulation skills training specifically. It is also unclear how exactly emotion-regulation self-efficacy reduces NSSI risk. One possibility is that emotion regulation self-efficacy could be related to a willingness to try other types of coping behaviours instead of NSSI, but this and other potential mechanisms need to be further investigated. It is also likely that emotion regulation self-efficacy and NSSI interact, such that relying on NSSI might reduce self-efficacy by not allowing individuals to learn that other strategies are also effective for regulating their emotions. Understanding the role of emotion- regulation self-efficacy, and how to promote it in the context of NSSI urges, would be an exciting area for future research to explore.

## **6.5. Limitations**

Each of the findings above should be considered in the context of the several notable limitations in this study. First, I did not complete full diagnostic assessments. Thus, I cannot comment on participants' psychopathology or examine group differences in disorders

that might be of interest, such as BPD. Although NSSI is particularly associated with certain psychological disorders, the behaviour also occurs in non-clinical populations. Furthermore, there has been a movement in recent years to view NSSI as its own clinical syndrome, leading to Nonsuicidal Self-Injury Disorder (NSSID) being presented in the most recent version of the Diagnostic and Statistical Manual (DSM-V) after many suggestions and revisions of the criteria (Zetterqvist, 2015). There is value, then, in the investigation of NSSI separate from clinical disorders, but including psychopathology in future investigations might uncover some important differences. Second, I did not recruit or exclude participants on the basis of previous or current involvement in treatment, which may influence the hypothesized relationships among variables in this study. As this was one of the first studies to explore the emotional or cognitive factors that, in the moment, increase or decrease likelihood of engaging in NSSI behaviour, I wanted to simply explore these relationships among a general sample of individuals who are currently self-injuring. An interesting next step would be to explore whether these relationships are different among individuals with different psychopathology, or if they are affected by psychological treatment. Finally, although I am not aware of any direct research on this, it is possible that individuals who belong to online communities dedicated to NSSI may be different than the general population of self-injurers. Thus, any conclusions from this study may not be generalizable to individuals who actively engage in NSSI but do not participate in these online groups. It is also possible that participants in certain online groups (such as ones that are focused on helping people stop NSSI) may differ in important ways from participants recruited from other online groups (such as those who have a more pro-NSSI atmosphere). The small sample size in this study precluded me from testing for differences among recruitment subgroups.

Demographically, this sample was primarily made up of young adults and was predominantly female. Thus, it may not represent a homogeneous sample of people who engage in NSSI. Additionally, although this sample size was comparable to several other recently published diary studies on NSSI, the small number of participants likely limited statistical power. This was especially the case for analyses relying on a subgroup of the sample, such as only looking at observations where NSSI urges were reported.

Although daily diary studies offer rich data concerning the association among experiences and behaviours as they occur in real life, there are several limitations in this data. First, contemporaneous models cannot be used to definitively examine causal



relationships among variables. Although the method of anchoring all questions based on the experience of one stressful event attempted to inform temporal sequencing of events, I cannot conclude that the stressful events caused the emotions, thoughts, or that any of those observed variables caused the NSSI outcomes. I cannot rule out the possibility that other unmeasured variables may account for the NSSI urges or behaviours that were reported. It is also possible that, if participants experienced more than one distressing event in a day, their thoughts or emotions from that event might blend in or otherwise influence their answers about the prompting event they selected. I did run analyses using variables that represented cumulative levels of stress experienced that day, and the pattern of results was largely the same. There is also still some retrospective bias involved in this study, particularly if the event in question happened early in the day and participants did not complete the diary entry until bed time that night. A single data entry point at the end of each day was selected in order to minimize burden on participants and reduce the potential for missing data. More frequent assessment periods could further reduce retrospective bias and might obtain a cleaner report on the trajectory from stressor to NSSI outcomes without as much possible interference by other events, thoughts, and emotions. One final caveat when it comes to analytical limitations is the approach to handling type I and type II error when running multiple models. Given that this study was one of the first of its kind to examine proximal risk or protective factors for NSSI, particularly cognitive processes, I opted to maintain the traditional significance cut-off of ( $p < .05$ ) rather than shrinking it to minimize familywise error. My approach does increase the possibility of type I error (claiming a statistical difference where none really exists), but it limits the possibility of type II error (retaining the null when it is false and thereby missing an important difference). Type II error can be more problematic in exploratory research given that replication and follow-up investigations are less likely to stem from non-significant results (Fiedler, Kutzner, & Krueger, 2012). Furthermore, Fiedler et al. (2012) argue that false negatives are harder to detect in the current scientific system and therefore warrant more concern. I therefore offer the conclusions drawn from this study as tentative, and hope they will spur other research to strengthen or clarify these findings.

## **6.6. Contributions to the field**

Despite the above limitations, this study has many strengths, such as the use of microlongitudinal methods to reduce the retrospective nature common in most self-report

studies. Secondly, this study focused on individuals who are actively engaging in NSSI, as opposed to those who have only a history of NSSI. This reduces any retrospective bias that may be involved when participants are asked to report on NSSI behaviours that occurred several months or even years ago. Furthermore, many studies include individuals who have only briefly experimented with NSSI and have since ceased the behaviour. Research has demonstrated that people who have only attempted suicide once are actually more similar to non-attempters than they are to multiple attempters (e.g., Miranda et al., 2008). Thus, the possibility exists that a similar difference exists among people who self-injure a few times versus repeatedly over a longer period of time. Although some researchers have begun to classify a specific group of frequent self-injurers (Gratz & Roemer, 2008), it is not yet clear what other differences may exist in the form or function of NSSI among individuals who engage in this behaviour at varying levels of frequency. For example, it is possible that those who only engage in NSSI a handful of times may be more motivated by interpersonal functions (such as proving to others how much they are hurting or trying to fit in with other friends who self-injure) as opposed to other functions. Although research is only beginning to differentiate factors that initially lead to NSSI from those that maintain the behaviour over time, it is important to attend to these potentially meaningful sample characteristics so that important predictive relationships are not masked by including distinct subgroups of self-injurers in the same samples. Finally, the online nature of this study allowed me to recruit a more diverse, and hopefully representative, sample than one limited to a specific geographic region.

This study seeks to answer the question of what makes distressing events and emotions more or less likely to prompt NSSI urges, and what factors increase or decrease the risk of engaging in NSSI behaviour, and is the first to do so using a daily diary method modeled after a DBT behavioural chain analysis. As such, the results of this research have important implications for understanding the process of NSSI, suggest important areas for future research, and can help clinicians better perform risk-assessments and crisis management. This study may aid clinicians in treating self-injury by identifying what cognitive processes might be the most toxic for these individuals (rumination and catastrophizing), and thus need to be targeted in therapy. This is also one of the only studies to formally investigate cognitive protective factors against NSSI, expanding upon previous research which has mostly elucidated what specific activities or strategies people use to resist acting on NSSI urges. By shedding light on the processes that help individuals

successfully resist NSSI (distress tolerance and emotion regulation self-efficacy), this study again points to important targets for future research and therapeutic intervention. Treatment refinements informed by these findings may improve outcomes, potentially reduce escalation to suicidal behaviours, and improve the quality of life of persons who self-injure.

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