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Subjective pain during NSSI as an active agent in suicide risk

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ABSTRACT

Non-suicidal self-injury (NSSI) has been identified as a correlate and predictor of suicidal ideation and attempts. Given the high-rates of NSSI presence among adolescents and young adults, it is important to identify specific characteristics of NSSI that might place individuals who engage in this behavior at highest risk for suicidal behavior. NSSI is thought to increase the acquired capability for suicide via habituation to self-harm, though the NSSI characteristics most responsible for this relationship are unclear. The current study examined three characteristics of NSSI (frequency, number of methods, and subjective pain) that may help to elucidate this risk relationship. University students ($N=997$) with a history of NSSI completed measures assessing lifetime NSSI frequency, number of NSSI methods employed, and subjective experience of pain during NSSI, as well as suicide attempt (SA) history. Results indicated that NSSI frequency, number of NSSI methods, and subjective pain experienced during NSSI were each positively associated with SA history. Further, subjective pain experienced during NSSI moderated the relationship between NSSI frequency and SA history, such that the association between NSSI frequency and SA history was stronger for individuals who experienced lower levels of subjective pain.

1. Introduction

Suicide is the third leading cause of death among 10–24 year olds (Nock et al., 2013) and is a serious public health concern. Suicidal behaviors refer to any behaviors engaged in with any intent to die (e.g., suicide attempts [SA]) (Nock and Favazza, 2009). Non-suicidal self-injury (NSSI) is a related, but distinct, construct; NSSI is defined as the intentional self-injury of one's tissue *without* any associated intent to die (Klonsky and Muehlenkamp, 2007; Nock, 2009). Importantly, NSSI has been identified as a strong correlate of SAs (Andover and Gibb, 2010; Klonsky et al., 2013), and further, as a predictor of future suicidal ideation and SAs (Hamza et al., 2012; Whitlock et al., 2013; Wilkinson et al., 2011). Given this link, and the high-rate of NSSI presence among adolescents and young adults (e.g., 10–51%; Hilt et al., 2008; Ogle and Clements, 2008), it is important to identify the specific characteristics of NSSI that place individuals who engage in this behavior at highest risk for SA, thus better informing the direction of resources.

According to Joiner (2005)'s Interpersonal–Psychological Theory of Suicide (IPTS), in order to engage in suicidal behavior one must not only have a strong desire for suicide, theorized to occur because of the experience of thwarted belongingness and perceived burdensomeness, but also must have an *acquired capability* for suicide. Individuals are theorized to acquire the capability for suicide upon habituating to the fear and pain associated with enacting such lethal suicidal behavior. The IPTS posits that acquired capability can be attained through painful and traumatic experiences, or engagement in specific painful and provocative behaviors, such as NSSI (Van Orden et al., 2008; Anestis et al., 2011). Specifically, the IPTS suggests that NSSI predisposes one to be at greater risk for SA via habituation to the pain and fear needed to carry out suicidal acts (Joiner, 2005). Preliminary research is supportive of this theory and the implication for the NSSI–SA relationship (Stanley et al., 2001; Franklin et al., 2011). For example, individuals who endorse low-sensitivity to pain and greater acquired capability for suicide are more likely to report a history of SA (Van Orden et al., 2008). Individuals with a history of NSSI report higher pain tolerance and greater acquired capability for suicide than those without a history of NSSI (Franklin et al., 2010; Hooley et al., 2010). Recent research has also found that past year engagement in NSSI longitudinally predicts increases in acquired capability (Willoughby et al., 2015). Furthermore, individuals with a history of both NSSI and SA were more confident in their competency and courage to be able to carry out a lethal SA compared to suicide attempters without a history of NSSI (Stanley et al., 2001). More recent theories of suicidal behavior also have incorporated the notion of acquired capability within their frameworks and have found support for its role in differentiating between suicide ideators and attempters (e.g., 3 Step Theory; Klonsky and May, 2015).

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If NSSI reduces one's hesitancy to engage in SA, then the greater frequency with which one engages in NSSI, the more powerful the erosion of the fear and pain associated with enacting a lethal SA. The majority of extant research indicates that NSSI frequency is indeed associated with SA (Andover and Gibb, 2010; Darke et al., 2010; Paul et al., 2015). However, a few studies have suggested a relationship inconsistent with these findings. It was found that SA risk may increase up to a certain point among those engaging in NSSI (e.g., 50 incidents of NSSI), but decrease thereafter (Whitlock and Knox, 2007; Paul et al., 2015). Moreover, it also has been suggested that there is no relationship between the frequency of NSSI behavior and risk for SA (Nock et al., 2006). Research is thus needed to clarify the relationship between NSSI frequency and SA risk, particularly given its theoretical relevance to the IPTS' account of acquired capability (Joiner, 2005).

Among those who engage in NSSI, employing a greater number of NSSI methods may also influence habituation to fear and pain. Engaging in numerous NSSI methods could lead to more diverse painful and provocative experiences, aiding in the erosion of fear for several forms of pain, which is thought of as a natural barrier to suicide (Joiner, 2005; Victor and Klonsky, 2014). Moreover, using several NSSI methods may influence the development of versatility in willingness and ability to engage in self-inflicted harm (Victor and Klonsky, 2014). Several studies have found that a greater number of NSSI methods predict suicidal behavior (for a meta-analytic review, see Victor and Klonsky (2014)). In fact, a recent meta-analysis found a moderate effect size for the number of NSSI methods as a correlate of SA, surpassing the effect of various psychopathologies (Victor and Klonsky, 2014).

In addition to the strong evidence for increased risk of SA among those with greater NSSI frequency and employed methods, research has directly tested the influence of pain in the association between NSSI and SA. Supporting the IPTS' account of acquired capability, individuals with a history of NSSI, compared to those without, demonstrated higher pain thresholds and endured pain for longer (e.g., pain tolerance) (Hooley et al., 2010; Germain and Hooley, 2013). The specific variable of pain tolerance, as opposed to pain threshold (time elapsed from onset of pain stimuli to the experience of pain) or perceived pain intensity, has been postulated as an important factor in pain habituation as it relates to acquired capability (Van Orden et al., 2010; Franklin et al., 2011). Despite the preliminary support for the particular importance of lab-measured pain tolerance in the acquired capability for suicide, there has been some research, although limited, suggesting that the role of subjective pain experienced during NSSI acts may be equally important in measuring acquired capability. In examining subjective pain, individuals who reported an absence of pain during NSSI had a history of twice as many SAs as those reporting any pain during NSSI, suggesting that individuals experiencing an absence of pain might have an extremely elevated habituation to pain, signifying a heightened acquired capability for suicide (Nock et al., 2006). This is the only study to our knowledge, however, that has directly examined the role of subjective pain during NSSI and its relationship with SA.

Although there is a dearth of literature in this area, research has indirectly indicated mixed evidence regarding the relationship between subjective pain experienced during NSSI and SA. Klonsky and Olino (2008) identified classes of self-injurers based on NSSI methods, functions, and additional descriptive features (e.g., pain analgesia). It was found that one class of self-injurers who had a greater proportion of members endorse a SA history also had the *lowest* proportion of individuals that endorsed pain analgesia. One potential reason for these conflicting findings is that these studies were limited by their dichotomous measure of subjective pain experience (absence versus presence) when research indicates that self-injurers experience a wide range of pain presence during NSSI episodes (Lindholm et al., 2011). Therefore, there is potentially a more nuanced relationship between degree of pain experienced and SA history that may better inform theory about the association between NSSI and suicidal behavior.

1.1. Current study

Three main characteristics of NSSI have been identified that may influence the role of NSSI engagement in the habituation to the fear and pain required to carry out SAs: NSSI frequency, number of NSSI methods, and subjective pain experienced during NSSI acts. Although there is a strong literature demonstrating a predictive relationship between NSSI frequency and SA (Andover and Gibb, 2010; Darke et al., 2010; Paul et al., 2015), it does not account for all variability in the presence of SA; thus, it is important to consider the number of NSSI methods used and pain experienced during NSSI as they relate to SA (Joiner, 2005; Klonsky and Olino, 2008; Van Orden et al., 2010; Victor and Klonsky, 2014). As such, in the current study, we hypothesized that each of these three characteristics would be individually associated with SA. We further hypothesized that the number of NSSI methods employed would significantly moderate the relationship between NSSI frequency and SA, such that a greater number of methods would amplify the association between NSSI frequency and SA. We also hypothesized that subjective pain would significantly moderate the association between NSSI frequency and SA; however, we did not specify a direction for this interaction, given the previously outlined contradictory findings in the extant literature.

2. Method

2.1. Participants

A total of 997 participants were drawn from a larger study sample consisting of 5042 undergraduate students from a large urban university. All participants endorsed having engaged in at least one act of NSSI throughout their lifetime. Participants (67% female) were aged 18–41 (M=20.64, SD=2.88). Approximately 66% of the sample identified as Caucasian, 9% African American, 11% Asian, 6% biracial, 5% as “other” and 3% indicated they preferred not to answer, which is representative of the general student body at the university where the study was conducted.

2.2. Measures

2.2.1. Non-suicidal self-injury

The presence of NSSI was assessed with the Form and Function of Self-Injury (FAFSI; Jenkins et al., 2011). The FAFSI is a self-report measure consisting of two sections. Only the first section was used in the current study, which inquires about 13 different forms, or methods, of NSSI, in addition to participants' subjective experience of NSSI. Participants are asked if they have engaged in several NSSI behaviors and the number of times they have engaged in each method throughout their lifetime. Participants are asked, “Have you ever, *intentionally or on purpose,* hurt yourself in the following ways, *without the intention of killing yourself?*” Potential NSSI acts included: cutting self, carving skin, burning self, swallowing something to make them self sick, pinching self, banging head, poking self, scratching/scraping self, biting self, pulling own hair, inserting objects into skin, hitting/punching self, and “anything else to hurt [them]self”. In order to reduce variability in NSSI frequency estimates, number of lifetime NSSI acts were categorized (Whitlock et al., 2013; Burke et al., 2015) by the following frequencies: 1 act, 2–4 acts, 5–10 acts, 11–20 acts, 21–49 acts, and 50 or more acts. To examine number of NSSI methods, a sum was

created based on each (different) NSSI behavior endorsed. Participants also were asked about their subjective experience of pain during NSSI ("In general, how much pain do you experience when you hurt yourself?"). Response options consisted of: 1=*no pain*; 2=*a little pain*; 3=*moderate pain*; 4=*severe pain*. The internal consistency of the FAFSI has been supported (Jenkins et al., 2011). In the current sample, the internal consistency of NSSI behavior was strong (KR-20=0.81).

2.2.2. Suicide behavior

The Suicide Behavior Questionnaire – Revised (SBQ – R; Osman et al., 2001), a 4-item self-report measuring suicide-related outcomes, such as suicidal ideation, suicide planning, and suicidal behavior, was used to assess the presence of SAs. Only the item regarding lifetime SAs was used in the current study (e.g., "I have attempted to kill myself."). The measure's internal consistency has been established in an undergraduate sample, $\alpha=0.76$ (Osman et al., 2001).

2.3. Procedures

Participants completed a series of self-report measures as part of a larger study on aggression and self-aggression on a secure website. The overall study consisted of 5402 participants; for inclusion in the current study analyses, participants had to endorse at least one lifetime act of NSSI. All participants provided informed consent, completed the same study procedures, and received course credit for their participation. The Institutional Review Board approved all study procedures.

2.4. Data analysis

First, to assess NSSI characteristics within our sample, we used two one-way ANOVAs examining differences on number of NSSI methods and subjective pain between NSSI frequency groups, while controlling for gender. Post-hoc Tukey's HSD tests were used to examine all significant group differences. To test our first hypothesis, we used three one-way ANOVAs, controlling for gender and age, to examine differences in NSSI frequency, number of NSSI methods, and subjective pain between those with and without a history of SAs. Post-hoc Tukey's HSD tests were used to examine significant group differences on NSSI frequency. Finally, to examine our primary interaction hypotheses, we used a moderation analysis. The moderation model assessed both number of NSSI methods and subjective pain as moderators of the relationship between NSSI frequency and SA history, while controlling for gender and age. This model was tested using the PROCESS SPSS macro (Hayes, 2013). Significant interactions were examined via conditional effects and further probed using the Johnson–Neyman technique (Hayes and Matthes, 2009), while holding all other study variables (and interactions) constant.

3. Results

3.1. NSSI and suicide attempt characteristics

On average, participants reported engaging in 2.1 different NSSI methods (range=1–11, SD=1.63); females reported using more methods (M =2.26, SD=1.70), on average, than males (M=1.78, SD=1.37), t (995)=−4.40, $p<0.001$. The most common NSSI method reported by females was cutting self (57%), followed by banging head (28%), pinching self (25%), and scratching/scraping self (24%); for males, the most common method was banging head (51%), followed by cutting self (24%), burning self (22%), and hitting/punching self (19%). The mean level of subjective pain reported among all participants was 2.16 (SD=0.74). Participants' lifetime NSSI acts were categorized into the following six frequency categories: 1 act (n=129), 2–4 acts (n=240), 5–10 acts (n=211), 11–20 acts (n=132), 21–49 acts (n=116), and 50 or more acts (n=169). Participants in each NSSI frequency category were compared on demographic variables. Gender varied across NSSI groups, $p=0.05$, with follow-up χ^2 showing that those with 50 or more acts of NSSI were more likely to be female. NSSI groups varied with respect to race, $p=0.01$, with follow-up χ^2 showing a higher proportion of white versus non-white participants in the 21–49 and 50 or more groups than in the other NSSI groups. There were no significant differences between groups on age, $p=0.19$.

Group differences were found on number of NSSI methods used, $p=<0.001$, $\eta^2=0.06$, between the six frequency categories. Post-hoc Tukey HSD tests revealed significant differences between all groups, except between those with 1 act and 2–4 acts. Participants in the greater NSSI frequency categories reported using a greater number of NSSI methods. There were group differences found on subjective levels of pain as well, $p<0.001$, $\eta^2=0.07$. Post-hoc Tukey HSD tests revealed significant differences between all groups, except between those with 1 act and 2–4 acts, those with 5–10 acts and 11–20 acts, and between those with 21–49 acts and 50 or more acts. Participants in the greater NSSI frequency categories reported experiencing higher levels of subjective pain during NSSI. See Table 1.

Participants were classified as having a history of suicide attempts (SA) if they endorsed at least one SA throughout their lifetime (n=128). Individuals with and without a history of SAs were compared on demographic variables. Individuals with a history of SAs were more likely to be female (79% female), χ^2 (1, N=997)=7.89, $p=0.01$, and older (M=21.53, SD=3.92), t (995)=−3.94, $p<0.001$, compared to those without a history of SAs (66% female; age M=20.48, SD=2.63). There were no significant differences in race between SA groups, χ^2 (4, N=978)= 9.03, $p=0.06$.

3.2. Suicide attempt history and NSSI variables

Initial correlational analysis of the study variables showed that all variables were significantly correlated (r's=0.19–0.64, all

Table 1
NSSI characteristics as a function of NSSI frequency.

	1 Act (n=129)	2–4 Acts (n=240)	5–10 Acts (n=211)	11–20 Acts (n=132)	21–49 Acts (n =116)	50+ Acts (n=169)	F/χ^2 Statistic
Gender+	0.61[a]	0.68[a]	0.66[a]	0.66[a]	0.71[a]	0.78[b]	11.52*
Age	20.57 (3.13)[a]	20.78 (3.08)[a]	20.56 (2.72)[a]	20.63 (3.17)[a]	20.33 (2.42)[a]	20.69 (2.61)[a]	1.50
NSSI methods	1.00 (0.00)[a]	1.26 (0.46)[a]	1.71 (0.88)[b]	2.61 (1.21)[c]	3.12 (1.37)[d]	3.86 (2.23)[e]	74.06***
Subjective pain	1.87 (0.77)[a]	1.99 (0.71)[a]	2.18 (0.70)[b]	2.19 (0.63)[b]	2.47 (0.68)[c]	2.38 (0.77)[c]	13.17 ***

Note: different superscripts represent statistically significant group differences at $p<0.01$; +% female; NSSI methods=number of different NSSI methods used.

* $p<0.05$.
** $p<0.01$.
*** $p<0.001$.

Table 2
NSSI characteristics as a function of suicide attempt status.

	No SA ($N=869$)	SA ($n=128$)	F statistic
NSSI frequency	3.25 (1.64)	4.22 (1.60)	3.06*
NSSI methods	1.92 (1.44)	3.4 (2.19)	5.54***
Subjective pain	2.12 (0.70)	2.52 (0.86)	13.17**

Note: NSSI=non-suicidal self-injury; SA=suicide attempt(s); NSSI methods=number of different NSSI methods used.

* $p<0.05$.
** $p<0.01$.
*** $p<0.001$.

p's <0.05). There were significant differences in NSSI frequency between those with and without a history of SAs, $p=0.03$, $\eta^2=0.46$. Post-hoc Tukey HSD tests revealed that individuals with 50+ acts of NSSI were more likely to have a SA history than those with 1 act ($p<0.001$), 2–4 acts ($p<0.001$), or 5–9 acts ($p=0.001$). Similarly, those with 21–49 acts were more likely to have a SA history than those with 1 act ($p=0.002$), 2–4 acts ($p=0.001$), or 5–9 acts ($p=0.02$). Individuals with 11–20 acts of NSSI were more likely than those with 2–4 acts ($p=0.03$) to have a history of SA. Those with a history of SAs were more likely to have engaged in a greater number of NSSI methods, $p<0.001$, $\eta^2=0.63$, and were more likely to experience greater subjective pain during NSSI, $p=0.01$, $\eta^2=0.88$, compared to those without a SA history. See Table 2.

A moderation model including all study variables demonstrated significant direct effects of NSSI frequency ($p=0.01$), number of NSSI methods ($p<0.001$), and subjective pain ($p<0.001$) on SA history; participants with greater NSSI frequency, greater number of NSSI methods, and greater subjective pain during NSSI were all more likely to have a history of SAs. Subjective pain was a significant moderator of the relationship between NSSI frequency and SA history ($p=0.03$). Number of NSSI methods showed a similar, albeit non-significant trend towards moderating the relationship between NSSI frequency and SA history ($p=0.06$). See Table 3. For the significant interaction, conditional effects were examined. At low levels of pain, there was a positive, significant relationship between NSSI frequency and SA, $b=0.38$, t (996)=2.63, $p=0.009$, which was also true at average levels of pain, $b=0.24$, t (996)=1.99, $p=0.05$. At high-levels of pain, there is no relationship between NSSI frequency and SA, $b=0.09$, t (996)=0.73, $p=0.46$. See Fig. 1. Results of the Johnson–Neyman Technique produced consistent findings. At the lowest levels of reported pain, NSSI frequency and SA are positively, significantly related, $b=0.47$, t (996)=2.74, $p=0.006$. As pain increased, the relationship between NSSI frequency and SA decreased, with the relationship becoming non-significant slightly above mean pain levels, $b=0.23$, t (996)=1.94, $p=0.053$.

Table 3
Moderation analysis predicting suicide attempt status.

	Coefficient	95% CI
Age	0.11 (0.03) ***	0.05–0.17
Gender	0.43 (0.24)	−0.05–0.90
NSSI frequency	0.64 (0.24) **	0.17–1.12
NSSI methods	0.81 (0.24)***	0.33–1.29
Subjective pain	1.33 (0.38)***	0.58–2.07
NSSI frequency × method	−0.08 (0.04)	−0.17–0.004
NSSI frequency × pain	−0.19 (0.09)*	−0.36–0.02

Note: unstandardized coefficients are presented.
NSSI methods=number of different NSSI methods used.

* $p<0.05$.
** $p<0.01$.
*** $p<0.001$.

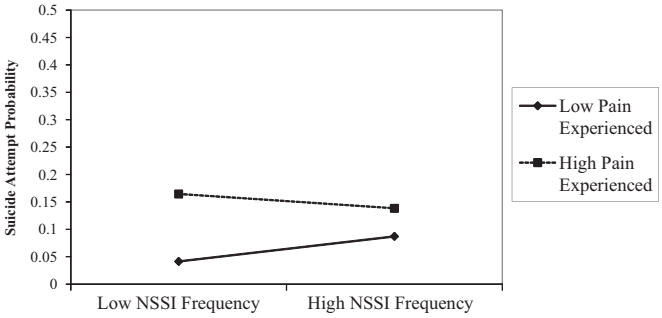

Fig. 1. Suicide attempt probability as a function of subjective pain × NSSI frequency.

4. Discussion

Consistently, the literature has evidenced NSSI as a primary risk factor for suicidal behavior (e.g., SAs) (Hamza et al., 2012). Theory has suggested that this risk relationship occurs because of the ability of NSSI acts to cultivate habituation to fear and pain to the degree necessary for undertaking lethal, suicidal acts (Joiner, 2005). The current study aimed to explore three main factors that likely play a role in developing this acquired capability for suicide: NSSI frequency, number of NSSI methods employed, and subjective pain experienced during NSSI. Supporting the study's hypotheses, each of these three factors was associated with the presence of SA. Further, results demonstrated that the subjective pain experienced during NSSI moderated the relationship between NSSI frequency and the presence of a SA.

When considering both number of NSSI methods and subjective pain as moderators of the relationship between NSSI frequency and SAs, only the subjective pain experienced during NSSI was a significant moderator. Specifically, we found that experiencing a lesser degree of pain during NSSI amplifies the relationship between NSSI frequency and SA. This suggests that the absence of pain during NSSI may serve as an indicator of having the necessary capability for suicide. This is consistent with previous research demonstrating that some individuals report experiencing little or no pain during NSSI, even when repetitive (Nock and Prinstein, 2005), and that this absence of pain is associated with SAs (Nock et al., 2006). One reason pain analgesia may be a prominent risk factor for SA is the presence of increased pain tolerance; those who retrospectively report an absence of pain during NSSI also endorse lower subjective pain reports and demonstrate increased pain tolerance while experiencing physical pain in the laboratory (Russ et al., 1992; Bohus et al., 2000). These findings have direct implications for the role of individual pain tolerance, but it is also possible, when considering the role of greater NSSI frequency, that the fear of pain, and potentially death, may erode more quickly among these individuals. For example, through repeated NSSI with minimal pain, an individual may become less fearful of initiating bodily harm and, further, death due to such bodily harm may appear more likely, thus increasing their overall acquired capability. Supporting this notion, those with a history of NSSI do not view pain as aversive, which may significantly impact the pain barrier of self-injurious behavior (Franklin et al., 2013). Overall, these findings are consistent with ample research indicating that greater NSSI frequency is a significant risk factor for SAs (e.g., Victor and Klonsky, 2014; Paul et al., 2015), as indicated by the IPTS (Joiner, 2005). Findings also add to this literature by suggesting that NSSI engagement may be particularly instrumental in acquiring capability for SA if a low degree of pain is experienced during these acts. Research supporting this has found that heightened frequency of NSSI predicted greater pain tolerance utilizing a pain paradigm and, further, that pain tolerance accounts for variance in the relationship between painful and provocative

events and acquired capability for suicide (Franklin et al., 2011).

It is important to note, however, that individuals who experienced higher pain during NSSI still demonstrated a heightened risk for SA. Although this finding initially seems to conflict with the IPTS's theorized relationship of pain tolerance in acquired capability (Joiner, 2005), our findings do not preclude the possibility that some individuals who report greater subjective pain during NSSI may be continually escalating their NSSI severity to ensure the experience of pain, particularly if they have become habituated to the pain induced by less severe acts of NSSI. It is also possible that those individuals who engage in NSSI frequently and report a high-degree of pain may be demonstrating an increasing willingness to *tolerate* pain rather than a decrease in the pain experienced itself. Future studies should explore whether willingness to tolerate pain is associated with the frequency of NSSI and other hypothesized painful and provocative events, and whether this, in turn, predicts likelihood of suicidal behavior. Future research also may consider exploring whether willingness to endure pain is contingent on pain sensitivity or whether it may be an independent construct.

Contrary to our hypotheses, number of NSSI methods did not serve as a significant moderator of the relationship between NSSI frequency and SAs, but was trending towards significance ($p=0.06$). This is in conflict with recent research demonstrating that a greater number of NSSI methods strengthened the relationship between NSSI frequency and suicidal behavior (Anestis et al., 2015). It is possible these discrepant findings have emerged as a consequence of the inclusion of subjective pain in the current model. The strength of the direct relationship between subjective pain and SAs is nearly twice that of NSSI frequency (and methods) with SAs (see Table 3). As such, subjective pain may account for more of the variation in the NSSI frequency – suicidal behavior relationship than NSSI methods; however, this will need to be further explored in future research. Although this interaction did not reach significance in the current sample, it is possible that individuals who engage in NSSI more frequently and with a wider variety of methods are at an increased risk for SAs. Number of NSSI methods was significantly associated with the presence of SAs, even after considering the role of NSSI frequency and the experience of subjective pain in the model. Results indicate that number of NSSI methods and NSSI frequency may operate as distinct mechanisms in acquiring the capability for suicide. It is possible that individuals with a high frequency of NSSI and low number of methods are still at an increased risk for SAs, and, in turn, those with a high number of methods, regardless of frequency, are similarly at a high risk for SA. Furthermore, the strength of the pathway from NSSI methods to SAs was greater than the strength of the pathway from NSSI frequency to SAs. These findings are consistent with those from a recent meta-analysis finding that the number of NSSI methods employed had a slightly larger effect size in predicting SAs than did NSSI frequency (Victor and Klonsky, 2014).

4.1. Limitations

The findings from the current study must be interpreted with an understanding of its limitations. The rate of SAs was lower than expected (12.8%) in the current sample given previous research finding higher rates among individuals with a history of NSSI (30%; Muehlenkamp and Gutierrez, 2007). Although the prevalence of NSSI from our overall sample (18.5%) is in line with previous research (Claes et al., 2014; Taliaferro and Muehlenkamp, 2015), it is possible that the current sample is less severe with regard to SA history. This may have influenced the relationships between NSSI characteristics and SA history; however, given the large number of those with SAs, this is unlikely. Moreover, previous research has found that individuals with a history of multiple SAs have greater levels of acquired capability than individuals with a history of a single SA (Van Orden et al., 2008). The current study measured only presence versus absence of SA history, limiting our ability to determine if the current relationships examined may vary based on SA frequency; future research should examine this possibility. There is some evidence that NSSI rates are influenced by providing incentives for completing research (Swannell et al., 2014). Given this finding, it is possible that the reported NSSI prevalence in the current sample is inflated; however, participants were not aware that the current study was designed to better understand NSSI and all participants from the larger study received equivalent amount of compensation regardless if NSSI was endorsed. Despite this, the current findings should be replicated in other non-incentivized samples in order to determine generalizability.

Also of note, the cross-sectional nature of the current data precludes us from determining the temporal relationship between NSSI and SAs. Consequently, any causal interpretations of the current findings, such that these NSSI characteristics fostered the development of acquired capability for a later SA, must be tested in a longitudinal design in order to be substantiated. Relatedly, the study relied solely on self-reported levels of all constructs measured. Whereas the subjective experience of pain during NSSI is inherently a self-reported perception, only one item was used to assess this construct. This item required individuals to report the pain they experience "in general" when engaging in NSSI, which requires some individuals to lump potentially hundreds of experiences together to derive an overall rating. Past research has suggested, however, that those who engage in NSSI, compared to non-injurers, reported lower levels of subjective pain during pain-inducing tasks (e.g., electric shock), even at higher shock levels (Weinberg and Klonsky, 2012). Given this, it is possible that pain tolerance as assessed by these behavioral paradigms may be a better predictor of the strength of the relationship between NSSI frequency and SAs, and should be included in future studies to compare with subjective pain reports. Moreover, our study did not assess baseline, or dispositional (Klonsky and May, 2015), factors that may contribute to one's capacity to carry out suicidal behavior. The assessment of such characteristics in the future may be particularly important given previous research suggesting capability to engage in suicidal behavior may be heritable (Smith et al., 2012). Although the current findings have shed light on the potential impact of subjective pain in suicide risk, future studies would benefit from observing pain levels over time, and gathering more nuanced information about the onset and duration of pain.

4.2. Clinical implications

The current study has implications for suicide risk assessment among individuals engaging in NSSI. Our finding that although both number of NSSI methods and NSSI frequency were independently predictive of SA presence but did not significantly interact, suggests that each of these NSSI characteristics should be considered independently when quantifying risk. For example, an individual who has engaged in many methods but only very few times for each, may still be at high-risk for suicidal behavior despite low overall frequency. Importantly, findings from the current study demonstrate that the level of subjective pain experienced during NSSI may be a highly clinically relevant NSSI characteristic to consider in suicide risk assessment. Our results strongly suggest that it may be important to assess pain experienced during NSSI, particularly among those with frequent NSSI engagement.

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