

ROBERTSON, CHRISTOPHER, Ph.D. *Why Nonsuicidal Self-Injury?: Examining the Validity of Steps of a Decision Model of Nonsuicidal Self-Injury Under Distress*. (2013). Directed by Dr. Rosemary Nelson-Gray. 107 pp.

The most common reason for Nonsuicidal Self-Injury (NSSI) is to reduce distress (Klonsky, 2007), yet it is unclear why people decide to use NSSI to reduce distress on a specific occasion. This study tested separate steps of a decision making model (adapted from Janis & Mann, 1977) about using NSSI to reduce distress. College students who have previously self-injured were administered 14-21 daily online questionnaires about coping behavior and decisions. Results supported each step of the model and indicated that NSSI was more likely when someone is more distressed, less hopeful to find another coping behavior, and can find solitude, amongst other findings. These results highlight potential areas of clinical intervention including specific cognitions to modify and improving social support. This study should be improved and replicated in future research.

WHY NONSUICIDAL SELF-INJURY?: EXAMINING THE VALIDITY
OF STEPS OF A DECISION MODEL OF NONSUICIDAL
SELF-INJURY UNDER DISTRESS

by

Christopher Robertson

A Dissertation Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirement for the Degree
Doctor of Philosophy

Greensboro
2013

Approved by

Committee Chair

APPROVAL PAGE

This dissertation written by Christopher Robertson has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair _____

Committee Members _____

Date of Acceptance by Committee

Date of Final Oral Examination

TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
LIST OF FIGURES	v
CHAPTER	
I. INTRODUCTION	1
II. METHOD	25
III. RESULTS	38
IV. DISCUSSION	46
REFERENCES.	62
APPENDIX A. FUNCTIONAL ASSESSMENT OF SELF-MUTILATION	72
APPENDIX B. COPE	75
APPENDIX C. DAILY QUESTIONNAIRE	79
APPENDIX D. TABLES AND FIGURES	82

LIST OF TABLES

	Page
Table 1. Means, Standard Deviations, Ranges, and Percentage Endorsed for Functional Assessment of Self-Mutilation Frequency of NSSI in the Past Year (n = 83) and Daily Questionnaire Variables Used in Analyses (n=1109).....	82
Table 2. Frequency and Percent of Coping Behaviors Endorsed on Daily Surveys for Entire Study Sample (n = 1109 surveys).....	84
Table 3. Coefficients, Standard Errors, Significance, and Effect Sizes for Hypothesis Tests.....	85
Table 4. Means, Standard Deviations, Ranges, and Percentage Endorsed for Functional Assessment of Self-Mutilation Function Items and Function Factors for Sample Used in Analyses (n = 83).....	86

LIST OF FIGURES

	Page
Figure 1. Model of decision making under stress.....	88
Figure 2. NSSI model of decision making under distress.....	89
Figure 3. Distribution of daily NSSI use for those endorsing NSSI on daily surveys.....	90
Figure 4. Number of NSSI occurrences for each day of the online survey portion of the study.....	91
Figure 5a. Q-Q plot of hypothesis 1 (first test) error variances.....	92
Figure 5b. Histogram of hypothesis 1 (first test) error variances.....	93
Figure 5c. Scatterplot of hypothesis 1 (first test) independent variable and corresponding error variances.....	94
Figure 6a. Q-Q plot of hypothesis one (second test) error variances.....	95
Figure 6b. Histogram of hypothesis one (second test) error variances.....	96
Figure 6c. Scatterplot of hypothesis one (second test) independent variable and corresponding error variances.....	97
Figure 7. Scatterplot of hypothesis two (first test) independent variable and corresponding error variances.....	98
Figure 8. Scatterplot of hypothesis two (second test) independent variable and corresponding error variances.....	99
Figure 9. Scatterplot of hypothesis three independent variable and corresponding error variances.....	100
Figure 10. Scatterplot of hypothesis four independent variable and corresponding error variances.....	101
Figure 11a. Q-Q plot of hypothesis five error variances.....	102

Figure 11b. Histogram of hypothesis five error variances.....	103
Figure 11c. Scatterplot of hypothesis five independent variable and corresponding error variances.....	104
Figure 12. Scatterplot of hypothesis six independent variable and corresponding error variances.....	105
Figure 13a. Q-Q plot of hypothesis seven error variances.....	106
Figure 13b. Histogram of hypothesis seven error variances.....	107
Figure 13c. Scatterplot of hypothesis seven independent variable and corresponding error variances.....	108
Figure 14. Scatterplot of hypothesis eight independent variable and corresponding error variances.....	109

CHAPTER I

INTRODUCTION

In the study of Nonsuicidal Self Injury (NSSI), there is an empirically based consensus that the primary reason for engaging in NSSI is to reduce or remove distress from affective or cognitive states (Klonsky, 2007). Although this primary function is generally agreed upon in the field, it is still unclear what the specific antecedents of NSSI are. Moreover, it is unclear what cognitive and behavioral processes are involved in the decision to use NSSI to alleviate distress. Nock, Prinstein, and Sterba (2009, p. 817) state that "Very little is known about ... what factors predict the transition from self-injurious thoughts to self-injurious behaviors..." The aim of this study is to identify what decisional processes are involved in an act of NSSI. This study focused on those individuals who already have used NSSI to reduce distress and will not seek to explain why people use NSSI initially or why some continue to use it and others do not.

Definition

NSSI is the direct and deliberate destruction of one's external body tissue occurring in the absence of certain or ambivalent intent to die, developmental disorders, psychosis, and socially accepted practices. NSSI includes, but is not limited to, cutting, carving, hitting, banging body parts on surfaces, striking oneself, severe scratching, interference with wound healing, pulling out hair, skin picking, sticking sharp objects (e.g., needles) into flesh, burning (e.g., with cigarettes or flames), and pinching (Nock &

Prinstein, 2004). Inherent in the definition of NSSI is that it is “deliberate,” thus leaving out any self-harming behavior that is done outside of conscious awareness such as singular hair pulling, skin picking, fingernail biting, or wound healing interference. NSSI does not involve repetitive and/or stereotyped behavior like that observed in developmental disorders such as Mental Retardation and Autistic Disorder (Jacobson & Gould, 2007). It also does not include severe bodily injury such as eye-enucleation, castration, and limb amputation that may occur in psychotic disorders or during psychotic episodes (Suyemoto, 1998). NSSI has also been distinguished from body modifications (e.g., piercings, tattoos) that are often times considered socially acceptable (Nock & Mendes, 2008; Suyemoto, 1998), and from indirect forms of self-harm (e.g., overdosing on medication, consuming poison) that are ambiguous and uncertain in their level of self-injury and are often times purposeful or ambivalent suicide attempts (Favazza & Rosenthal, 1993; Jacobson & Gould, 2007).

Incidence

Lifetime rates of NSSI are surprisingly high in adolescent and college populations. The rates of NSSI in college populations have been fairly well established. In a sample of 2,875 undergraduate and graduate students from two northeastern universities, Whitlock, Eckenrode, and Silverman (2006) found that 17% had engaged in NSSI at some time in their lives. Other smaller studies have found lifetime rates around 25% (Brown, 2009; Brown, Williams, & Collins, 2007; Glenn & Klonsky, 2009; Klonsky & Olino, 2008). Four other studies conducted at the same college (University of Massachusetts) found lifetime rates of NSSI in college students ranged from 35 to 44%

(Gratz, 2001; Gratz & Chapman, 2007; Gratz, Conrad, & Roemer, 2002; Gratz & Roemer, 2004). A similar rate has been found in a Southeast Asian sample - Treson, Ito, and Mearns (2012) collected data from 307 Indonesian college students and found 38% to engage in NSSI in their lifetimes. In the largest study to date, 15.3% of 11,529 randomly selected students across eight American universities in the Northeast and Midwest had engaged in NSSI at least once in their lives (Whitlock et al., 2012). All together, the lifetime incidence rates of NSSI in college students are surprisingly high with a broad range from 15-44%.

Adolescent samples usually show comparable rates to college samples. In a study of 440 community adolescents in two high schools, it was found that 13.9% of students between grades 7 and 11 had engaged in NSSI at least once in their lives (Ross & Heath, 2002). Another study of 1,393 students from a Midwestern United States high school found that 21.4% had performed NSSI sometime in their lives (Muehlenkamp, Williams, Gutierrez, & Claes, 2009). A study of 665 9th graders from the United States and Germany found that 16.1% of American students and 20.5% of German students engaged in NSSI in their lives (no significant difference; Plener, Libal, Keller, Fegert, & Muehlenkamp, 2009). Cerutti, Manca, Presaghi, and Gratz (2010) found 41.9% of their sample of 234 Italian adolescents to engage in lifetime NSSI. A sample of 1,663 Swedish high school students from 17 schools endorsed a lifetime rate of 17.1% (Lanstedt & Gadin, 2010). Studies with smaller samples of community adolescents have found NSSI lifetime rates to be generally high and in the 30% to 47% range (Claes, Houben, Vandereycken, Bijttebier, & Muehlenkamp, 2009; Lloyd-Richardson., Perrine, Dierker,

& Kelley, 2007). Taken together these studies demonstrate high variability across samples with prevalence rates from 14% to 47%. These rates are similar between America and Europe and are consistent with those found in college samples.

Studies of NSSI incidence in adult samples are scarce and usually methodologically flawed. For example, a study by Klonsky, Oltmanns, and Turkheimer (2003) found 4% of a large military population to have used NSSI in their lives. These authors only assessed NSSI with two items from a larger personality measure. Similarly, Briere and Gil (1998) assessed a stratified random sample of 927 adults (mean age 46) in the United States and found that 4% had engaged in NSSI in the past six months. These authors also used a measure of convenience which only included one item assessing NSSI. In the only high-quality study of the adult incidence of NSSI to date, Klonsky (2011) used a random-digit telephone dialing procedure with 439 American adults to assess the lifetime rate of NSSI. Klonsky found 5.9% of the anonymous responders to engage in NSSI in their lives. Overall, it appears that less than 10% of American adults have engaged in NSSI, but that number should be expected to rise as generations of self-injuring adolescents become adults.

Reasons for NSSI

Studies examining the reasons for using NSSI have determined that reducing negative emotional states is the most commonly reported reason for NSSI (Klonsky, 2007). Nock and Prinstein (2004, 2005) found two different samples of inpatient adolescents to endorse this reason at a higher rate than to increase a feeling state (to feel “real” or “alive”), escape or decrease a social situation (e.g., get out of an argument), or

to gain social rewards (e.g., care or attention). In these studies, Nock and Prinstein used a newly developed questionnaire that included questions directly asking participants about why they had used NSSI. In a large sample of college students, Whitlock et al. (2012) found 80.9% of participants to have used NSSI to regulate negative affect. Similarly, other authors using self-report of reasons have found that 53-100% of those using NSSI do so to relieve negative affect (Heath, Ross, Toste, Charlebois, & Nececheva, 2009; Kemperman, Russ, & Shearin, 1997; Kleindeinst et al., 2008; Klonsky, 2009; Klonsky, 2011; Nixon, Cloutie, & Aggarwai, 2002; Nock & Prinstein, 2004).

Other self-report studies have investigated participants' emotional states prior to and after NSSI. These studies are limited by their retrospective nature and rely on participants to recall how they were feeling before and after a specific episode of NSSI or multiple acts of NSSI; however, they provide further evidence that people commonly engage in NSSI to reduce negative affect. For example, Kamphuis, Ruyling, and Reijntnes (2007) mailed a questionnaire to Dutch women in a "self-harm support group" asking them to identify a recent act of NSSI and report whether or not they were experiencing certain positive or negative emotions (anger, depression, fatigue, tension and vigor) immediately before (i.e., baseline), immediately after, and one day after a specific NSSI act. These authors found that depression, anger, tension, and fatigue significantly decreased from before to after NSSI, while vigor significantly increased. All emotions returned to baseline one day later, except tension which remained significantly lower than it was at baseline. Significantly more participants showed a reduction in tension from right before to right after NSSI in comparison to the other emotions.

A study using similar methodology as Kampuis et al. (2007) and involving female inpatients with Borderline PD found significant effects with a decrease in negative affect (collapsed across different affects) and an increase in positive affect (collapsed) from immediately before to immediately after retrospectively recalled acts of NSSI. By calculating the slopes the authors found anger, anxiety, “upset”, and “overwhelmed” to decrease the most and peaceful to increase the most (Kemperman et al., 1997). In another study, Kleindeinst and colleagues (2008) found significant reductions in tension, pressure, emptiness, loneliness, depression, dejection, sadness, anger, disgust, numbness, unreal, and mortification from before to after retrospectively recalled acts of NSSI. Unexpectedly, there were significant increases in feeling ashamed, which may be a consequent emotion of NSSI in addition to the relief of other negative states. Similarly, Chapman and Dixon-Gordon (2007) asked female inmates to identify a past act of NSSI and report their emotions before and after the act. Combining several emotions (anger, anxiety, tension, guilt, relief, calmness, etc.) it was found that 55% of participants experienced a “positive shift” in emotions from immediately before to immediately after NSSI.

The best evidence to support reduction of negative emotions as a primary reason for NSSI is from experimental studies. In one such study, Brain, Haines, and Williams (1998) used participants with a history of NSSI and created personalized scripts for the participants based on interviews. These included scripts for an act of NSSI, an accidental act of self-injury, an angry social interaction, and a low arousing event (e.g., making coffee). Each script included four stages: 1) scene setting/description, 2) approach to the

action (e.g., self-injury), 3) the actual action, and 4) the immediate consequence of the action. As participants were read to, and visualized their scripts, they were monitored with physiological equipment measuring heart rate, respiration, and skin conductance. Additionally, they rated their emotional state on polarized dimensions (relaxed/tense, relaxed/anxious, calm/angry, unafraid/afraid, happy/sad, normal/unreal, and relieved/uptight) using visual analogue scales for each stage of the script after each script was finished (i.e., after an entire script was read, they recalled what they felt like during each stage of that script).

On the NSSI script, participants had an increase in all physiological measures between stage one (setting the scene) and stage two (approach). The physiological measures all decreased between stage two and stage three (action) and that level was maintained to stage four (consequence). This was in contrast to the other scripts where physiological indices either remained low throughout (neutral script) or increased from stage one to three and then decreased from stage three to four (accidental injury and angry social interaction scripts). In other words, imagining NSSI seemed to reduce physiological arousal, whereas imagining arguing and accidental injury increased arousal. With regard to self-reported emotions, during the NSSI script the majority of emotions (5 of 7: relaxed/tense, relaxed/anxious, calm/angry, happy/sad, normal/unreal) changed in the direction of more distress from stage one to stage two, stayed high from stage two to stage three, and then decreased from stage three to four. Once again, this pattern was unique to the NSSI imagery script. The authors highlight that there was a lag between the reduction in physiological measures and the reduction in self-reported affect with the

physiological measures decreasing during the NSSI stage (stage three) and the self-reported emotions decreasing during the consequence stage (stage four). They concluded from their results that the reduction in physiological arousal is the actual reinforcing mechanism of NSSI. The authors then divided the participants into recent (within last 12 months) and past (at least 12 months prior) self-injurers and found that the lag between physiological and subjective measures only existed for past self-injurers. The authors then concluded that people tend to cognitively reinterpret the effect of NSSI after they stop using it. Alternatively stated, when people are using NSSI they view it as an emotion regulation strategy that works immediately and so their self-report of affect reduction tends to coincide with their reduction in physiological arousal.

In a previous study using the same methodology as above, Haines, Williams, Brain, and Wilson (1995) examined personalized scripts with prisoners who have used NSSI. Script by stage interactions were significant for all subjective emotions and followed the same pattern as the Brain and colleagues (1998) study where physiological arousal stayed at a low level for the neutral script, increased from stage one to three and then decreased at stage four for the accident and angry interaction scripts, and increased from stage one to two and then decreased at stage three for the NSSI script. Once again, there was a lag between physiological and subjective measures on the NSSI scripts with the subjective ratings of emotions reducing after imagining the NSSI (stage 3), although the authors did not divide the participants by recency of NSSI to see if this explained the lag.

In one of the only two ecological momentary sampling studies of NSSI to date, Nock et al. (2009) followed 30 community adolescents who had recently used NSSI. These participants kept personal digital assistants (PDAs) that randomly prompted them twice a day to complete questions about self-injurious thoughts and behaviors. Additionally, participants were asked to self-initiate an entry if they had a “self-destructive thought or behavior.” Reducing negative experiences (including negative emotions as well as cues to negative emotions such as thoughts and memories) was provided as a reason for 64.7% of the NSSI episodes. Of these instances, the specific reasons cited were to escape anxiety on 34.8% of occasions, sadness on 24.2% of occasions, anger on 19.7% of occasions, a bad thought on 28.8% of occasions, and a bad memory on 13.6% of occasions.

Arney, Crowther, and Miller (2011) used similar methodology over a period of one week with a sample of 36 college students. Participants completed assessments regarding affect (PANAS-X; Watson & Clark, 1994) and NSSI behavior on palm pilots six times a day and after any use of NSSI. Latent growth curve analyses of affect before, during, and after NSSI events indicated a significant quadratic slope for the PANAS-X Negative Affect scale and Guilt scale. An item level analysis also showed a significant slope for the Anger item. Each slope indicated that the emotion increased prior to NSSI, peaked during NSSI, and decreased after NSSI. This study provided further evidence that NSSI successfully reduces negative emotions.

Feeling generation has been endorsed with moderate frequency in samples as a reason for NSSI, but at a lower rate than to reduce negative emotions. Nock and Prinstein

(2004) found feeling generation reasons including “to punish yourself,” “to feel relaxed,” and “to feel something, even if it was pain” to be endorsed at a significantly lower rate than negative emotion reduction reasons, but at a higher rate than social reasons. Several of the studies above that examined changes in negative affect also found changes in positive affect (increasing vigor, calm, relaxed, relieved, and peaceful). This includes both retrospective report (Chapman & Dixon-Gordon, 2007; Kamphuis et al., 2007; Kemperman et al., 1997; Kleindeinst et al., 2008; Klonsky, 2009) and experimental studies (Brain et al., 1998; Haines et al., 1995). In addition, an ecological momentary sampling study of NSSI found that approximately 25% of NSSI instances were done for feeling generation reasons (Nock et al., 2009).

Some studies have examined specific reasons that fall under the category of feeling generation including self-punishment and increasing a sense of reality (alternatively stated as reducing dissociation). For example, a study involving a large sample of college students found that 47.6% engage in NSSI to punish themselves (Heath et al., 2009). In a study of women with BPD, Kleindeinst et al. (2008) found 12% to endorse self-punishment as their reason for NSSI during a six-month interval. Whitlock et al. (2012) found their large college sample to report self-punishment (24.7%) and physiological stimulation (24.1%) as reasons for using NSSI. Klonsky (2009) found 54% of a sample of college students to endorse “expressing anger at self” as their secondary reason for engaging in NSSI, although only 15% rated it as a primary reason for NSSI. Another study by Klonsky (2011) found in a large adult American sample that 36% used NSSI “to feel something because you were feeling numb or empty” and 32% doing so to

“punish yourself.” Support for the dissociation reduction reason comes from an ecological momentary sampling study, where Nock et al. (2009) found moments of feeling numb/nothing were predictive of instances of NSSI.

Regardless of whether the reported reason for NSSI is to reduce negative affect, reduce dissociation, or self-punish, the majority of people engage in NSSI to reduce distress. This distress may be in the form of anxiety, sadness, anger, or other negatively valenced emotions. This reduction in negative affect may also result in increases in other feelings such as calmness, relaxation, or relief. The distress may also be due to a dissociative experience from which a person wants relief. Finally, the distress may be due to a sense of guilt or frustration that would be alleviated with self-punishment (Chapman, Gratz, & Brown 2006). Collectively, reasons for increasing a feeling state or reducing a negative emotion have the shared capacity to reduce distress. The distinction between feeling generation and reducing negative emotions is somewhat arbitrary as both work via reductions in distress. It is helpful to consider them together as a way to regulate distress. The remainder of this paper refers to both reasons collectively with the term “distress regulation.”

NSSI and Coping

Although there is ample evidence that most instances of NSSI occur in order to relieve distress, it seems that this is typically not the preferred method of distress reduction. In support of this notion, Klonsky and Glenn (2008) conducted a study examining what adaptive strategies people have used to prevent an occurrence of NSSI after having an urge to engage in NSSI. They found that 89.7% of their college sample

had tried to resist NSSI urges in the past and endorsed an average of 16 different methods of avoiding using NSSI. The most common methods were “keeping busy” endorsed by 82.4% of the sample, “being around friends” by 80%, “talking to someone about how you feel” by 74.3%, and “writing about how you feel” by 74.3%. Four of the next five most common reasons (each endorsed by 59% or more of the sample) involved interacting with or thinking about others. Participants also rated how helpful the methods were in ending the urge for NSSI on a scale including “very helpful,” “somewhat helpful,” and “not at all helpful.” The most common “very helpful” methods were sports or exercise endorsed by 65.2%, removing means/instrument by 63.6%, finding someone who is understanding by 60.9%, and turning to religion/spirituality by 50%. On average, participants reported successfully resisting 85% of the time when using a “very helpful” method and 52% of the time when using a “somewhat helpful” method. These results provide evidence that most of the time when people have the urge to self-harm, they are able to successfully select a strategy to overcome the temptation.

It is still unclear in the literature what circumstances result in failing to use a distress regulation strategy other than NSSI. Bennum and Phil (1983) examined what circumstances lead to NSSI, but relied on unstructured interviews conducted by the first author. They surmised that for 70% of the sample, NSSI was the result of a chain of events. A study by Nock et al. (2009) did not find any activity such as socializing, resting, recreational activities, and eating to be significant predictors of a NSSI thought in daily life. Furthermore, these authors only found that being alone was a significant predictor of NSSI.

Another study by Nock, Holmberg, Photos, and Michel (2007) used a new structured interview to ask adolescents about the nature of their NSSI. In this study, participants rated on an average of 0-4 how much certain stressors (family, friends, relationships, peers, work/school, mental state) were antecedents to their NSSI. The average for all items was fairly low and between 1 and 2, with the exception of “mental state” which had a high average of 3.4. These results suggest that no specific stressor is important to NSSI, but rather it is the end state of distress that is the main precipitant of NSSI.

Taken together, there appears to be no specific stressor that results in the urge to use NSSI or the actual use of NSSI. Aside from specific reasons in the environment, one explanation for why people fail to regulate their distress and resort to NSSI is that of ego depletion. Ego depletion is the concept that all volitional abilities including self-regulation are drawn from the same limited bank of inner resources (Baumeister, Bratslavsky, Muraven, & Tice, 1998). In the case of NSSI, someone may become distressed and consequently put forth effort in regulating their emotions and behavior. This effortful self-regulation of distress may cause ego depletion that limits the ability to search for or use an alternative method to NSSI, which ultimately leads to NSSI because it is familiar and hence an easy idea to generate. Furthermore, other methods of distress reduction may require more work (e.g., locating another person and initiating a conversation) or be less effective. In other words, people may just be too distressed to fight off the powerful urge to use NSSI.

The above research also highlights the fact that most people using NSSI would prefer not to use it. In further support of this idea, a study of adolescents who have used NSSI found 78.8% to report a reason to stop engaging in NSSI (Deliberto & Nock, 2008). Of these participants, 56.1% said it was an unhealthy behavior, 17.1% said NSSI attracts attention, 14.6% said it results in scarring, 7.3% said it causes shame, and 4.9% stated that NSSI upsets family and friends. This research suggests that when people use NSSI they have made a decision to relieve their unwanted distress at the expense of potential long-term costs (e.g., scarring, negative self-image, deteriorating relationships). It appears that despite good reasons to not engage in NSSI many still do so, likely because of NSSI's ability to quickly and effectively reduce distress.

Some studies have examined the differences in coping strategy preferences between those who use NSSI and those who have never used it. Findings are generally inconsistent for whether or not those using NSSI use less adaptive coping strategies than controls; however, one finding that has been consistent is that those using NSSI report more avoidance strategies than those not using NSSI. Brown et al. (2007) divided college students into three groups: 1) never used NSSI, 2) used NSSI before the previous 12 months, but not in the previous 12 months (past NSSI), and 3) used NSSI in the past 12 months (current NSSI). These participants were administered a self-report of coping mechanisms (COPE; Carver, Scheier, & Weintraub, 1989). Of the fifteen different coping strategies, only two were significant, with behavioral disengagement being higher in both NSSI groups and substance use being higher in the past NSSI group compared to the control group. One of the strategies (behavioral disengagement) that was higher in the

NSSI groups is by definition an avoidance strategy and the other (substance use) is often considered to be an avoidance strategy (Hayes, Wilson, Strosahl, Gifford, & Follette, 1996).

Andover, Pepper, and Gibb (2007) compared college students with and without a lifetime history of NSSI on a self-report of coping strategies (Coping Strategy Inventory; Amir Khan, 1990) that had three factors including problem solving, seeking social support, and avoidance. Consistent with the above study by Brown et al. (2007), those who had used NSSI reported using more avoidance, and also less social support. Williams and Hasking (2010) examined young adults who have used NSSI on self-reports of coping strategies including the COPE and the Emotion Regulation Scale (Gross & John, 2003). They used a continuous measure of NSSI based on frequency, recency, and severity and weighted by number of methods. Increased NSSI was positively and significantly correlated with emotional suppression from the Emotion Regulation Scale and avoidant coping from the COPE. NSSI was also negatively correlated with more adaptive types of coping such as emotional reappraisal from the Emotion Regulation Scale and the problem focused coping and emotion focused coping scales from the COPE.

A study by Hasking, Momeni, Swannell, & Chia (2008) also found differences in avoidance, but unlike the aforementioned studies, also found several differences in other types of coping. In this study, the authors examined self-report of coping mechanisms (COPE) between young adults who had never used NSSI, used “mild” NSSI, or used “moderate/severe” NSSI. The mild and moderate/severe groups were based on frequency, recency, severity, and weighted by the number of different methods where mild NSSI

was characterized by consistently low severity and infrequent NSSI. By using the higher-order scales from the COPE (emotion-focused, problem-focused, avoidant), the moderate/severe group had lower emotion focused, and higher avoidant coping than controls. The mild NSSI group also had greater avoidant coping than controls. For the lower order factors, the moderate/severe NSSI group had lower positive reinterpretations, seeking social support for instrumental reasons, active coping, seeking social support for emotional reasons, and higher mental disengagement, denial, behavioral disengagement, and substance use than controls. The mild NSSI group had lower active coping and higher behavioral disengagement and substance use than controls. Although this study replicated the other studies in that the NSSI groups used more avoidant coping techniques (mental disengagement, denial, behavioral disengagement, substance use, avoidant coping), they also used less adaptive coping techniques (e.g., seeking social support).

Finally, a study by Haines and Williams (2003) essentially found null results with regard to differences in coping. These authors compared prisoners with a lifetime history of NSSI, prisoner controls, and college student controls and found only one group difference among 14 scales from two self-report measures of coping strategies. The prison NSSI group was lower than the other two on cognitive reinterpretation.

Taken together, these studies on coping and NSSI demonstrate that those who use NSSI usually do not want to use NSSI and are typically successful in finding a way to prevent themselves from engaging in NSSI after they have to the urge to do so. Additionally, those using NSSI are more prone to using avoidance techniques (e.g., suppressing emotions, physically avoiding problem situations) in reaction to stressors.

This is not surprising as NSSI has been argued to be a type of experiential avoidance (Chapman et al., 2006). Experiential avoidance occurs when “a person is unwilling to remain in contact with particular private experiences (e.g., bodily sensations, emotions, thoughts, memories, behavioral predispositions) and takes steps to alter the form or frequency of these events and the contexts that occasion them (Hayes et al., 1996). Given that NSSI is usually engaged in to escape distressing feelings (or an absence of feelings), it appears to be a type of experiential avoidance technique.

Solitude

The literature so far has demonstrated that those who use NSSI typically do so to reduce distress and that when trying to reduce distress, alternative methods that may be more adaptive and socially acceptable are usually attempted first. Moreover, it has been shown that those who report a history of NSSI have a greater predilection towards avoidant coping strategies than those who have never used NSSI, which is not surprising as NSSI fits the definition of an experiential avoidance technique. Another factor that has been consistently demonstrated to be important for engaging in NSSI is solitude. Nock et al. (2009) used ecological momentary sampling with adolescents using NSSI and found that being alone was a significant predictor of future NSSI acts. A study of adolescents from either an inpatient psychiatric unit or acute partial hospitalization program found that 95.2% of the sample engaged in NSSI when alone (Nixon et al., 2002). In a small study of undergraduates using NSSI at least once in their lives, 17.4% reported using NSSI in front of friends or with them and 4.3% reported doing it as part of a group (Heath et al., 2009). Although the percentage of those using NSSI in solitude was not

reported, these first two rates suggest that the majority of participants have only engaged in NSSI when alone. Furthermore, Glenn and Klonsky (2009) found 54.5% of their sample to report always engaging in NSSI alone and 33.8% to report sometimes doing it alone with the limitation being that the response options were limited to always alone, sometimes alone, and never alone during NSSI. Lastly, Whitlock et al. (2012) found in their large college student sample that 63.7% “always injure[s] in private” and 8.8% “sometimes injure[s] in the presence of others.” Overall, it appears that people most often find solitude when engaging in NSSI.

Janis and Mann’s Model of Decision Making under Stress

The above review has demonstrated that those who use NSSI typically do so to reduce distress, after attempting an alternative coping strategy for their distress, and when alone. The review also highlighted that individuals with a history of using NSSI are more likely to use avoidant coping strategies in comparison to those who have never used NSSI. Janis and Mann (1977) created a model to explain decision making under distress, which Janis (1982) then further refined (*Figure 1*). This model may help to explain how one moves from an urge to engage in NSSI to actually using NSSI.

The model delineated by Janis and Mann (1977) and Janis (1982) presumes that decision making is compromised under distress and that this decision making process involves discrete steps that are assumed to occur rapidly (in seconds or minutes) and in a specified sequence: 1) the person appraises whether or not there is an imminent danger, 2) they determine if there is an effective coping strategy readily available, 3) if no obvious strategy is available, then they determine if there may be an effective coping

strategy that they have not identified yet, and 4) they determine if they have enough time to search for an effective coping strategy.

In Janis and Mann's (1977) model, someone first appraises whether or not there is danger before moving on to subsequent steps. It should be mentioned here that when applied to the behavior of NSSI, the "danger" consists of further enduring emotional distress (*Figure 2*). When faced with the decision to use NSSI to regulate distress, people are not concerned about imminent physical danger, but rather the possibility of having to endure their distress any longer. People who use NSSI may come to the conclusion that they can no longer tolerate their emotional distress and this constitutes determining the presence of "danger."

In stage two of the model, a person assesses whether or not there is an effective coping strategy for the danger that is readily available. This process involves searching one's memory to determine if there is something that has worked in the past. Given the evidence on alternative coping strategies and NSSI, it is presumed that although a person remembers NSSI working in the past, they will most likely attempt to think of another strategy. If a person identifies an effective coping strategy (other than NSSI) and is able to use it, then they will; otherwise, they will move onto a third stage. In this third stage of decision making where no effective coping strategy (other than NSSI) was immediately identified, the person must decide if there is "hope" for finding an effective strategy. Janis and Mann (1977) postulate that at this point a person will ask themselves "Is it realistic to hope to find a better means of escape?" (p. 57). This subjective assessment of hope depends on one's appraisal of external social resources (i.e., others who can advise

them) and internal resources (i.e., intellectual abilities). In some situations, people may not immediately identify an effective coping strategy and then decide that there is no hope of finding an effective strategy through external or internal resources.

If someone decides there is no hope, then Janis and Mann (1977) theorize that the person will engage in an experiential avoidance technique. Given that the person is already aware of the potential of NSSI as an experiential avoidance technique, it is assumed that the person would resort to this specific technique after deciding that there is no hope of finding an alternative. This is the first of two possible pathways to deciding to use NSSI; the second occurs later as a potential result of the decision made in step four of the model. Alternatively, if the person still has hope of finding an effective strategy other than NSSI, then the person will move on to step four and determine if there is sufficient time to find an effective coping strategy. The decision made in step four results in the person engaging in either good or bad search strategies. These good and bad search strategies are known as vigilance and hypervigilance, respectively.

If a person determines at step four that there is “insufficient time” to search for a strategy, then a state of hypervigilance occurs. More specifically, a person at step four is expected to quickly evaluate “Is there sufficient time to make a careful search for and evaluation of information and advice?” (Janis & Mann, 1977, p. 59). “Insufficient time” is therefore a subjective “belief” about whether or not there is time available, given the impending danger (in this case, ongoing distress), to appropriately and fully search for an effective coping strategy. This feeling of insufficient time is expected to be intensified when the danger is more salient. In this case, a feeling of “insufficient time” is likely a

function of level of distress (i.e., as distress increases, so does the likelihood of feeling there is insufficient time).

Hypervigilance, which is the result of deciding there is “insufficient time” to search for an effective strategy, is characterized by a frantic and disorganized search for and appraisal of coping options and a phenomenon known as “premature closure.” Premature closure involves coming to a decision without considering or appropriately appraising all relevant information and appropriately considering the outcomes and long-term consequences. Janis (1982) explains that during the decision process, stress impairs attention and perception and results in cognitive rigidity. This cognitive rigidity is characterized by a narrowing of alternatives and the tendency to overlook long-term consequences of choices. This cognitive rigidity often results in premature closure, which for the person familiar with NSSI, is likely to result in using NSSI. In other words, a person in distress who has used NSSI before to reduce distress may decide to search for another strategy, engage in a poor quality and frantic search, and end up resorting to NSSI despite their initial wishes not to. This is the second pathway to NSSI.

If, on the other hand, the person feels that they have sufficient time to find a good coping strategy, then they will enter a state of vigilance. In a state of vigilance, a person feels that they have the necessary time to carry out a thorough search strategy. A person in a state of vigilance will engage in a thorough and appropriate search for coping strategies followed by a careful evaluation of options and a selection of the (presumably) best coping strategy available. It should be reiterated that when this model is applied to NSSI there are two pathways that may lead to NSSI. One pathway involves the decision

that there is no hope for a good coping strategy and the other involves a state of low quality hypervigilant searching as the result of a decision that there is not enough time to search for an effective coping strategy other than NSSI.

The Janis and Mann (1977) model is applicable to the behavior of NSSI. Given that most instances of NSSI are in the service of reducing distress, the Janis and Mann model is helpful because it applies to situations made under the condition of distress. Furthermore, it appears that people who have used NSSI in the past attempt to identify another effective coping strategy to end their distress rather than use NSSI (Deliberto & Nock, 2008; Klonsky & Glenn, 2008). Most often, they are successful, but sometimes they are unable to effectively find or use another strategy and they resort to NSSI to reduce their distress. A new model specifically applying the Janis and Mann theory of decision making to the behavior of NSSI is depicted in *Figure 2*.

NSSI Model of Decision Making Under Distress

The updated model in *Figure 2* is similar to the original Janis and Mann (1977) model depicted in *Figure 1* with some notable differences. The first step of the updated model involves experiencing heightened emotional distress, and thus an urge to engage in NSSI. According to previous research on the reasons for using NSSI, most instances of NSSI are done in order to reduce distress. Therefore, when someone is in a state of distress they will most likely consider using NSSI as way to reduce that distress. Rather than making an assessment that “danger is imminent” as Janis and Mann’s original model begins, this model involves a decision that distress is too high to endure. The second, third and fourth steps are nearly identical to those of the Janis and Mann model. In the

updated model shown in *Figure 2*, notice that there are two paths that lead to the decision to use NSSI. One is through subjectively determining that there is no “hope” of finding an alternative effective strategy based on an assessment of internal and external resources. Janis and Mann said that at this point people engage in an avoidance technique, which in this case is NSSI. The other pathway to the decision to use NSSI is through a subjective belief that there is “insufficient time” to appropriately search for an effective alternative to NSSI. Finally, an extra and fifth step was added to the model for NSSI where after a person decides that they will engage in NSSI, they must find solitude to do so. If they are successful in finding solitude, then they will engage in NSSI. However, if they are unsuccessful at finding solitude, then they will endure the distress and not use NSSI.

Goal

The goal of this study was to determine the validity of the NSSI model of decision making under distress provided above. This goal was accomplished by separate analyses for each of the steps in the model (*Figure 2*). Thus, the entire model was not analyzed, but rather its component parts were analyzed.

Hypotheses

1. Consistent with step one of the model, increased daily emotional distress will predict looking for an effective coping strategy. For this study, the variable of “effort” in looking for a strategy is used.

2. Since heightened emotional distress should eventually result in a greater likelihood of engaging in NSSI, higher daily emotional distress will be associated with a greater likelihood of NSSI.
3. Consistent with step two of the model, less time looking for a coping strategy (i.e., having one readily available) will be associated with using a strategy other than NSSI. Research on NSSI shows that people who use NSSI prefer not to; therefore, it is hypothesized that if people choose a coping strategy immediately and use it, then it will be something other than NSSI.
4. Consistent with step three of the model, lower perceived “hope of finding an effective technique” will significantly predict increased occurrences of decision to engage in NSSI.
5. In support of step four of the model, a higher subjective rating of “sufficient time to search for an effective search strategy” will be associated with higher vigilance.
6. Also consistent with step four of the model, a lower subjective rating of vigilance will significantly predict increased occurrences of decision to engage in NSSI.
7. The decision to engage in NSSI will predict increased effort in trying to isolate oneself.
8. Given the literature on solitude and NSSI as well as step five of the model, actually isolating oneself will predict use of NSSI.

CHAPTER II

METHOD

Participants

In order to recruit participants with a recent history of NSSI, the Functional Assessment of Self-Mutilation (described below; FASM; Lloyd, Kelley, & Hope, 1997) was administered during the Fall and Spring Mass Screening in the Psychology Department at the University of North Carolina at Greensboro (UNCG) in the 2010-2011 and 2011-2012 school years. Participants endorsing any type of NSSI in the past year were contacted by e-mail and offered to take part in a study on daily experiences of mood regulation in exchange for credit towards their General Psychology research requirement. In addition, two participants were recruited from the UNCG Psychology Clinic based on therapist endorsement of past NSSI. These “clinic participants” were given money in exchange for participation.

One hundred thirty-nine participants were enrolled in the study. Of these, 53 indicated on the FASM completed in the lab that they did not self-injure during the past year (one was a clinic participant), contrary to what they had reported on the FASM in mass screening or what their therapist had reported. This left 86 participants who were eligible to continue the study after the lab session. Ineligible participants continued the study and completed online surveys per UNCG Internal Review Board agreement, but their data were not used in analyses. Additionally, the daily data from these 53

individuals were examined and they did not endorse daily use of NSSI for any of the accumulated 700 surveys completed. There were no differences between those confirming NSSI past year on the laboratory FASM and those who did not on gender, $t(137) = -.99$ (*ns*); age, $t(137) = 1.45$ (*ns*); family income, $t(137) = -1.08$ (*ns*); or ethnicity $F(132, 5) = 2.16$, *ns*.

Of the remaining 86 eligible participants, 83 completed at least one daily questionnaire and were used in analyses. 78.3% ($n = 65$) were female. Ages ranged from 17 to 31 ($M = 19.02$, $SD = 2.31$). Most participants were Caucasian (71%, $n = 59$), followed by African American (18.1%, $n = 15$), Latino (3.6%, $n = 3$), and Interracial (7.2%, $n = 6$). The family incomes ranged broadly from the lowest (\$0-\$10,000) to highest (\$100,000+) intervals. The median income range reported was \$50,001 - \$60,000 and the mean was approximately \$50,001 - \$60,000 as well. The standard deviation was approximately 3 intervals of \$10,000. The one clinic participant included in analyses was not markedly different from other participants as she was a Caucasian female college student. See Table 1 for descriptive statistics of the FASM and the daily questionnaire (described below) variables. Table 2 displays the frequency of endorsement for each coping behavior on the daily survey for the whole analysis sample ($n = 1109$ surveys).

Nineteen participants indicated using NSSI for any reason on at least one of their daily surveys with a mean of 2.05 days of NSSI use ($SD = 1.13$; see *Figure 3* for distribution). There appeared to be a trend toward less NSSI occurring over the course of the online portion of the study for participants, although this was not tested for significance (see *Figure 4*). Twelve participants reported using NSSI specifically for

coping on at least one daily survey. There were no differences between the 19 that used NSSI during the study and the 64 that did not on age, $t(81) = -.17$ (*ns*); gender, $t(81) = -.08$ (*ns*); income, $t(81) = .78$ (*ns*); or ethnicity, $F(77, 5) = 2.03$, (*ns*). In addition to examining demographic differences, HLM was used to see if those using NSSI during the study were different than others on any of the daily survey variables (discussed below). The same multi-level modeling structure used in the hypothesis tests was applied to these preliminary analyses. Results indicated that those using NSSI during the study had more overall distress, $\gamma(85) = 0.69$ ($SE = .20$, $p < .001$), higher peak distress, $\gamma(85) = .11$ ($SE = .04$, $p < .01$), used more effort in searching for a coping strategy, $\gamma(85) = .76$ ($SE = .24$, $p < .01$), tried harder to isolate themselves to use a coping strategy, $\gamma(85) = 1.05$ ($SE = .25$, $p < .001$), and were more likely to be alone when coping, $\gamma(85) = .89$ ($SE = .29$, $p < .01$). Thus, it appears that those using NSSI in the study had more daily distress, tried harder to reduce this distress, and successfully tried harder to isolate themselves to cope with their distress.

Materials

Demographic form. Basic demographic information was gathered including ethnicity, age, sex, and family income.

Functional Assessment of Self-Mutilation. The Functional Assessment of Self-Mutilation (FASM; Lloyd, Kelley, & Hope, 1997) is a self-report of specific NSSI behaviors used during the past year (Appendix A). For each of the twelve NSSI behaviors (e.g., burning oneself, cutting oneself) the respondent indicates whether or not they did it, how many times they did it, and whether or not they received medical treatment for the

injury. The Functional Assessment of Self-Mutilation also has 23 items assessing the functions of NSSI (i.e., the reasons for NSSI). Good validity (content and convergent) and reliability (internal) have been demonstrated for this measure (Nock & Prinstein, 2004, 2005). All items on this measure were generated from an extensive review of the literature on NSSI and from focus groups involving inpatient adolescents who had engaged in NSSI (Lloyd, Kelley, & Hope, 1997). The 23 items assessing functions have been found to have a four factor structure according to a confirmatory factor analysis: Automatic Positive Reinforcement, Automatic Negative Reinforcement, Social Positive Reinforcement, Social Negative Reinforcement (Nock & Prinstein, 1994). The Functional Assessment of Self-Mutilation has shown excellent convergent validity with the Self-Injurious Thoughts and Behavior Interview (Nock et al., 2007) with perfect agreement between presence of NSSI in the past year, and near-perfect agreement for frequency of NSSI in the past year ($r = .99$; Nock et al., 2007).

In order to make participants report of NSSI more consistent with the definition used in this study, some items were modified to clarify that the behavior was done with the intent of causing harm to oneself. All modifications are in parentheses in Appendix A. Additionally, the words “without the intent to kill yourself” were added to the instructions line and question fourteen. The item, “While doing any of the above acts, were you trying to kill yourself?” was removed.

COPE. The COPE (Carver, Scheier, & Wintrauv, 1989) is a 60-item self-report of coping strategies. The measure contains fifteen scales with four items, each rated on a Likert-style scale from “I usually don’t do this at all” to “I usually do this a lot.” The

purpose of the COPE was to facilitate the deceptive cover story that the study is concerning several different types of coping strategies (i.e., not just NSSI).

Daily questionnaire. In order to test the NSSI model of decision making under distress, an experience sampling methodology approach was used. Participants were sent an e-mail each day with a link to a survey for them to complete at the end of the day (Appendix C). Participants were also provided with a link at the beginning of the study in case there were technical difficulties with e-mail at any point. On this daily questionnaire, participants were first given a definition of distress and asked to “rank the overall degree to which you were distressed today” and “what was your highest level of distress today” on a seven-point Likert scale from “minimally” to “extremely.”

The second item on the daily measure asked how hard they looked for a coping strategy to reduce their distress. This item assessed the effort that they put into looking for a strategy and was on a seven-point Likert scale from “not hard at all” to “very hard.” The third item assessed how hopeful they felt about finding a strategy to reduce their distress on a seven-point scale from “no hope at all” to “certain of finding a way.” The fourth question assessed the extent to which they felt they had sufficient time to search for a coping strategy. This question was also on a seven-point scale with anchors of “no time at all” and “as much time as I needed.” Questions three and four are modeled after Janis and Mann’s (1977) examples of what a person may ask themselves when deciding if there is hope and if there is sufficient time (“Is it realistic to hope to find a better means of escape?” and “Is there sufficient time to make a careful search for and evaluation of

information and advice?”). These items have been reworded to fit the daily questionnaire better and to not assume that the person wants to “escape” a particular situation.

In order to assess whether the person engaged in vigilance or hypervigilance, question five asked to what degree their search for a coping strategy was characterized by frantic and disorganized searching versus through and organized searching. This question is on a seven-point scale. The sixth and seventh questions both have the same response options, but ask the participant what methods of distress reduction they decided to use and actually used, respectively. The responses include adaptive and maladaptive methods such as NSSI, using alcohol or drugs, avoidance, social support, and problem solving. The eighth question assessed how successful the method was at reducing distress on a seven-point scale from “not at all” to “very successful.” The ninth question assessed the time it took to identify the strategy actually used in minutes and hours while the tenth question asked about the person’s effort in trying to isolate themselves on a seven-point scale from “not at all” to “very hard.” The eleventh question assessed who the person was with when they used the coping strategy and included the response options of alone, friend(s) or peer(s), family member(s), stranger(s), or other. Although not directly related to the hypotheses, question twelve assesses how close the respondent was to whom they were with on a seven-point scale from “not close at all” to “very close.” The thirteenth question assessed how much time passed between deciding to use a coping strategy and actually using it in hours and minutes. The fourteenth question assessed whether or not the person actually engaged in NSSI that day. If they responded yes, then they were asked what method was used (14a), based on a list taken from the modified Functional

Assessment of Self-Mutilation. They were also asked how successful NSSI was (if endorsed) in reducing their distress on a seven point scale from “not at all” to “very successful” and how much they regretted it on a seven-point scale from “not at all” to “very much.”

Procedure

The FASM was given to students enrolled in Introduction to Psychology at the beginning of the Fall and Spring semesters during the school years of 2010-2011 and 2011-2012. Students endorsing any NSSI over the past year were sent an e-mail inviting them to the study. In the e-mail they were provided with a numerical code to sign up electronically for the experiment via the UNCG Psychology Department’s experiment website (Experimetrix). Participants from the UNCG Psychology Clinic were nominated by their therapists based on a history of NSSI. These clinic participants were then called by the student investigator and offered to participate in exchange for financial compensation.

All participants then attended an initial session in the lab where a research assistant provided informed consent, a demographic questionnaire, the COPE, and the FASM. In order to increase the specificity of identifying nonsuicidal self-injurers, any person not endorsing NSSI again in the lab was retained in the study, but their data was removed from all analyses. As part of the consent, participants were deceived and provided a cover story indicating that the study was about how people cope in different ways (i.e., not just NSSI) on a daily basis. Participants were then instructed to complete online questionnaires at the end of each day for the next 14 days. Finally, the participants

were provided with a web address to complete the questionnaire should they have any difficulty with their e-mail.

In order to improve response rates on the daily questionnaires, incentives were provided for completing these. Students were given two research credits for attending the initial session. They were given another credit for completing five days of online questionnaires and a fourth credit for completing another five days of online questionnaires (total of 10 days). Clinic participants were given \$10 in cash for the laboratory visit and an additional \$5 in cash for every five days of online questionnaires completed. All participants were entered into a drawing for one of 5 \$25 gift cards to Target at the end of the semester if they completed all 14 days of questionnaires.

There was low recruitment during the first semester of the first year, which prompted some changes in methodology. One change was the inclusion of study participants from the UNCG Psychology Clinic, although only two participants were recruited in the study. Additionally, the length of the online portion of the study was extended to 21 days to increase the likelihood that the sample obtained would engage in NSSI during the study. This resulted in other changes in procedure including the possibility of obtaining a fifth credit for completing 15 days (total) of questionnaires and the requirement of completing all 21 days of questionnaires to be entered into the gift card drawing. Of the 83 participants included in the study, 32 completed the 14-day protocol and 51 completed the 21-day protocol. As expected, there was a difference between participants in mean number of surveys completed with those in the 21-day protocol completing more ($M = 15.57, SD = 5.24$) than those in the 14-day protocol ($M =$

9.75, $SD = 3.30$), $t(81) = -5.62$, $p < .05$. This difference indicates that the procedural change was helpful in collecting more data. All participants, regardless of involvement in the 14-day or-21 day procedure, were combined for all analyses. A difference in number of surveys completed was anticipated and was accounted for by using multilevel modeling with Level 1 data group centered (i.e., centered within individuals).

In order to protect participants from imminent harm, their responses to online questionnaires were monitored by the principle investigator (Christopher Robertson). In particular, the “other” option for the daily items assessing what methods they decided to use and actually used to reduce their distress (items 6 and 7, respectively) was monitored for suicidal content. There were no indications of suicide or other safety concerns during the study.

Analyses

All of the hypotheses were assessed using multilevel modeling where daily question responses (Level 1) were nested within individual participants (Level 2 data). This multilevel analysis is considered standard for experience sampling methodology. Hypotheses two, three, four, six, and eight, had binary outcomes and could not be appropriately analyzed with a multilevel linear model. Therefore, a link function was used with HLM software (Raudenbush, Bryk, & Congdon, 2004) to transform the binary outcome variables into ratios so that these models could be analyzed using a linear model. The link function is: $\text{Prob}(\text{Dependent Variable} = 1 | \text{Participant}_j) = \Phi_{ij} \rightarrow \log[\Phi_{ij}/(1 - \Phi_{ij})] = \text{Transformed Dependent variable}$.

The first eight hypotheses involved the relationship between two Level 1 variables. For the first hypothesis, multilevel modeling was used to examine the direct relationship between overall daily level of distress (item 1a on the daily questionnaire) and effort in looking for a coping strategy (item 2 on the daily questionnaire), and highest level of daily distress (item 1b) and effort in looking for a coping strategy (two separate analyses).

$$\text{Level 1: } Y_{ij} = \pi_{0j} + \pi_{1j} * (\mathbf{\text{Peak Distress or Overall Distress}}) + E_{ij}$$

$$\text{Level 2: } \pi_{0j} = \beta_{00} + R_{0j}$$

Where: Y_{ij} = effort; **Bold predictors are centered within participants**

Hypothesis two was tested with multilevel modeling to examine the relationship between overall and highest daily levels of distress (item 1a and 1b on the daily questionnaire, respectively; two separate analyses) and whether or not they engaged in NSSI (item 14; 1 = NSSI, 0 = any other response and not using NSSI).

$$\text{Level-1: } \eta_{ij} = \pi_{0j} + \pi_{1j} * (\mathbf{\text{Peak Distress or Overall Distress}}) + E_{ij}$$

$$\text{Level-2: } \pi_{0j} = \beta_{00} + R_{0j}$$

$$\pi_{1j} = \beta_{10} + R_{1j}$$

Where: $\text{Prob}(\text{NSSI Use}_{ij} = 1 | \pi_j) = \Phi_{ij}$

$$\log[\Phi_{ij}/(1 - \Phi_{ij})] = \eta_{ij}$$

In order to test the third hypothesis, the relationship between amount of time spent looking for a coping strategy (item 9 on the daily questionnaire) and using a coping

strategy other than NSSI (item 7; 0 = NSSI, 1 = any other response and not NSSI) was assessed using multilevel modeling.

$$\text{Level-1: } \eta_{ij} = \pi_{0j} + \pi_{1j} * (\mathbf{Time\ Looking\ for\ Strategy}) + E_{ij}$$

$$\text{Level-2: } \pi_{0j} = \beta_{00} + R_{0j}$$

$$\pi_{1j} = \beta_{10} + R_{1j}$$

$$\text{Where: } \text{Prob}(\text{NSSI to Cope}_{ij}=1 | \pi_j) = \Phi_{ij}$$

$$\log[\Phi_{ij}/(1 - \Phi_{ij})] = \eta_{ij}$$

Hypothesis four was tested with multilevel modeling to examine the relationship between perceived hope over finding a coping strategy (item 3 on the daily questionnaire) and the dichotomous daily variable of decision to use NSSI (item 6 on the daily questionnaire; 1 = NSSI, 0 = any other response and not NSSI).

$$\text{Level-1: } \eta_{ij} = \pi_{0j} + \pi_{1j} * (\mathbf{Hope}) + E_{ij}$$

$$\text{Level-2: } \pi_{0j} = \beta_{00} + R_{0j}$$

$$\pi_{1j} = \beta_{10} + R_{1j}$$

$$\text{Where: } \text{Prob}(\text{NSSI Decision}_{ij}=1 | \pi_j) = \Phi_{ij}$$

$$\log[\Phi_{ij}/(1 - \Phi_{ij})] = \eta_{ij}$$

The relationship between perception of sufficient time to find a coping strategy (item 4 on the daily questionnaire) and increased hypervigilance (item 5 on the daily questionnaire) was assessed using multilevel modeling to test hypothesis five.

$$\text{Level 1: } Y_{ij} = \pi_{0j} + \pi_{1j} * (\mathbf{\text{Sufficient Time}}) + E_{ij}$$

$$\text{Level 2: } \pi_{0j} = \beta_{00} + R_{0j}$$

Where: Y_{ij} = Hypervigilance

Multilevel modeling was used to test hypothesis six by examining the relationship between hypervigilance (item 5 on the daily questionnaire) and the dichotomous decision for NSSI variable (item 6 on the daily questionnaire).

$$\text{Level-1: } \eta_{ij} = \pi_{0j} + \pi_{1j} * (\mathbf{\text{Hypervigilance}}) + E_{ij}$$

$$\text{Level-2: } \pi_{0j} = \beta_{00} + R_{0j}$$

$$\pi_{1j} = \beta_{10} + R_{1j}$$

Where: $\text{Prob}(\text{NSSI Decision}_{ij}=1 | \pi_j) = \Phi_{ij}$

$$\log[\Phi_{ij}/(1 - \Phi_{ij})] = \eta_{ij}$$

In order to test hypothesis seven, multilevel modeling was used to assess the relationship between decision to engage in NSSI (dichotomized item 6 on the daily questionnaire) and effort in isolating oneself (item 10 on the daily questionnaire).

$$\text{Level 1: } Y_{ij} = \pi_{0j} + \pi_{1j} * (\mathbf{\text{NSSI Decision}}) + E_{ij}$$

$$\text{Level 2: } \pi_{0j} = \beta_{00} + R_{0j}$$

Where: Y_{ij} = isolation effort

Hypothesis eight was tested with multilevel modeling by examining the relationship between being alone (item 11 on the daily questionnaire; 1 = alone, 0 = any other response and not alone) and use of NSSI (dichotomized item 14).

Level-1: $\eta_{ij} = \pi_{0j} + \pi_{1j}*(\mathbf{Alone}) + E_{ij}$

Level-2: $\pi_{0j} = \beta_{00} + R_{0j}$

$$\pi_{1j} = \beta_{10} + R_{1j}$$

Where: $\text{Prob}(\text{NSSI Use}_{ij}=1 | \pi_j) = \Phi_{ij}$

$$\log[\Phi_{ij}/(1 - \Phi_{ij})] = \eta_{ij}$$

CHAPTER III

RESULTS

Assumption Tests

This first results section does not concern the actual hypothesis tests discussed above. Rather, this section reports the tests of the statistical assumptions of the multilevel model for each hypothesis test. This was done to determine if the model assumptions for the hypothesis tests were upheld or not. Models that met statistical assumptions were then analyzed and the results of these analyses are reported in the next section.

All hypotheses involved only Level 1 data and therefore only required tests for Level 1 assumptions. The Level 1 assumptions are normality of error variances and independence of error terms with the predictors (independent variables). Hypotheses two, three, four, six and eight models have binary outcomes and the assumption of normality does not apply (Raudenbush & Bryk, 2002), and therefore was not assessed. Normality of error variances for the hypothesis one, five, and seven models was assessed by examining Q-Q plots and histograms of the error variances plotted against the normal curve. Independence of error terms with the predictors was tested for hypotheses one through eight. The independence assumption was assessed by examining scatter plots of the independent variables plotted against the corresponding Level 1 error variances for each model. Pearson correlations between the error variance and the independent variable were then conducted for each model as an additional test of independence.

For the first test of the first hypothesis (daily overall distress predicting daily search effort) examination of the Q-Q plot and histogram indicated normally distributed error variances (*Figures 5a and 5b*). A scatter plot of the independent variable with the error variances indicated a positive relationship (*Figure 5c*) that was confirmed with a Pearson correlation, $r = .72, p < .001$. Several data transformations of the independent variable (square root, inverse, natural log, log linear) were attempted to correct this violation with no success. As a result of this violation assumption, hypothesis one will not be assessed using overall distress as an independent variable.

For the second test of the first hypothesis (daily peak distress predicting search effort) the Q-Q plot appeared normal (*Figure 6a*). The histogram appeared normal (*Figure 6b*), but was kurtotic (kurtosis = 2.63, $SE = .15$). An inverse transformation of the dependent variable resulted in a normal distribution of error variances (kurtosis = .66, $SE = .15$). The scatter plot of the independent variable plotted against the corresponding model level 1 error variances indicated a null relationship (*Figure 6c*) that was also evidenced with a non-significant Pearson correlation, $r = -.030, ns$, demonstrating that the independent variable and the error were not related. The results of these tests indicate that the statistical assumptions were upheld after transforming the independent variable.

For the first test (daily overall distress predicting daily use of NSSI) of hypothesis two, an examination of the scatter plot of Level 1 error variances plotted against the independent variable (overall distress) demonstrated independence (*Figure 7*). This was confirmed with a point-biserial correlation, $r_{pb} = .03, ns$. The second test of hypothesis two (daily peak distress predicting daily use of NSSI) also showed a null relationship

with a scatterplot and point-biserial correlation, $r_{pb} = .02$, *ns* (*Figure 8*). The independent variables were not related to their respective errors; therefore, statistical assumptions were upheld for both of the models testing hypothesis two.

The models for hypotheses three and four met statistical assumptions. The scatter plot of hypothesis three (time searching for coping strategy predicting daily use of NSSI) Level 1 error variances plotted against the independent variable showed independence (*Figure 9*). This was supported with a point-biserial correlation, $r_{pb} = -.002$, *ns*. Similar results were found for hypothesis four, $r_{pb} = -.02$, *ns* (*Figure 10*). These results indicate that statistical assumptions were upheld for the models for both hypotheses three and four.

The Q-Q plot for the Level 1 model error variances of the fifth hypothesis (perception of insufficient time to find a coping strategy predicting frantic/hypervigilant searching) indicates a normal distribution of error variance (*Figure 11a*). The histogram also appears to be normally distributed (*Figure 11b*), although it is somewhat leptokurtic (kurtosis = 2.13). Several transformations of the dependent variable were conducted (square root, inverse, natural log, log 10) with none being successful in reducing kurtosis. The scatterplot of the independent variable plotted against the corresponding error variances showed a null relationship (*Figure 11c*) which was supported with a Pearson correlation, $r = .05$, *ns*. The assumption of independence was upheld, but the assumption of normality of error variances showed a minor violation. This means that hypothesis five should be interpreted with some (minimal) caution.

The hypothesis six (hypervigilance predicting daily decision for NSSI) scatterplot of error variances plotted against the independent variable did not clearly demonstrate a relationship between the error and the independent variable, but the two were correlated, $r_{pb} = -.11, p < .05$ (*Figure 12*). Several transformations of the independent variable (hypervigilance) were tried (natural log, inverse, square root, Log10) with none resulting in independence with the error. This relationship constitutes a small violation of the independence assumption, but the result of the hypothesis six test should still be interpreted with caution.

Statistical assumptions were met for hypotheses seven and eight. The Q-Q plot of the error variances of the hypothesis seven (daily decision to use NSSI predicting daily effort in isolating oneself) Level 1 model appeared normal (*Figure 13a*). The histogram of the error variances plotted against the normal curve was also normally distributed (*Figure 13b*). The scatterplot of the Level 1 error variances plotted against the independent variable (decision to engage in NSSI) showed a null relationship (*Figure 13c*), which was confirmed with a point-biserial correlation, $r_{pb} = .02, ns$. Similar results supporting independence were demonstrated for hypothesis 8 (daily being alone to cope and daily use of NSSI), $r_{pb} = .04, ns$ (*Figure 14*). These results indicate that statistical assumptions were upheld for both the hypothesis seven and eight models.

Analyses

All hypotheses involve the relationship between two Level 1 variables. For these hypotheses, multilevel modeling was used to examine the direct relationship between daily variables nested within individuals. For the first hypothesis (daily peak distress

predicting search effort), peak distress significantly and negatively predicted search effort, $\gamma(85) = -.10$ ($SE = .006$, $p < .001$) (see Table 3). This analysis was conducted with the inversely transformed search effort variable; therefore, the coefficient should be interpreted as a positive relationship, $\gamma(85) = .10$. This indicates that a higher peak level of distress during the day was related to increased effort in searching for a coping strategy.

For hypothesis two (daily distress predicting daily use of NSSI), a link function was used to transform the binary outcome into a ratio so that it could be analyzed using a linear model. The first test of this hypothesis used overall daily level of distress as the independent variable and was supported, $\gamma(85) = .95$ ($SE = .14$, $p < .001$). The second test of hypothesis two was also supported, $\gamma(85) = .88$ ($SE = .15$, $p < .001$). These results indicate that higher daily distress resulted in a greater likelihood of using NSSI on a given day. As these hypothesis tests had binary outcomes, their effect size should be assessed with odds ratios. The first test of hypothesis two resulted in an odds ratio of 2.58, meaning that with every unit increase in the independent variable (i.e., one digit increase on the distress scale of 1-7) the odds of using NSSI increased another 2.58:1. This odds ratio is considered a medium effect size by conventional standards (small = 1.50, medium = 2.50, large = 4.30). The odds ratio for the second test of hypothesis two was 2.41 and falls just short of a medium effect size.

In order to test the third hypothesis (daily amount of time searching for coping strategy predicting daily use of NSSI to cope), a link function changing the dependent variable into a ratio was used as this model involved a binary outcome (1 = NSSI, 0 = any

other coping method). The third hypothesis was supported, $\gamma(85) = .003$ ($SE = .001$, $p < .01$), indicating that more time spent searching for a coping strategy on a day resulted in a higher likelihood of using NSSI to cope. The odds ratio for this test was 1.003, which is a very small odds ratio. Thus, it seems that amount of time searching for a coping strategy was significantly associated with using NSSI to cope, but this association is quite small in a practical sense.

Hypothesis four (lower perceived hope of finding a coping strategy predicting daily decision to use NSSI) used a link function transforming the dependent variable into a ratio as this variable was binary (1 = decided to use NSSI, = 0 didn't decide to use NSSI). Hypothesis four was supported, $\gamma(85) = -.29$ ($SE = .13$, $p < .05$), that is, that lower perceived hope of finding an effective coping strategy predicted a higher likelihood of deciding to use NSSI. Although this finding was significant, it appears that lower hope actually has a small impact on deciding to use NSSI ($OR = .74$).

The relationship between perception of insufficient time to find a coping strategy and increased hypervigilant searching (phrased as frantic/disorganized in daily questionnaire) was analyzed to test hypothesis five. For this test, one statistical assumption was upheld (normality) while the other was violated (independence), indicating that the result must be interpreted with caution. There was a significant relationship between perception of insufficient time to find a coping strategy and increased hypervigilance, $\gamma(85) = .49$, $SE = .04$, $p < .001$. This indicates that as participants were searching for a coping strategy, perception of sufficient time to find a coping strategy was associated with less frantic, disorganized, and hypervigilant

searching. Conversely, perceiving insufficient time resulted in more hypervigilant search strategies.

Multilevel modeling was used to test hypothesis six by examining the relationship between hypervigilance and daily decision to use NSSI. This model used a link function transforming the dependent variable into a ratio as it was a binary variable. Hypothesis six was supported, $\gamma(85) = -.72$ ($SE = .15$, $p < .001$). That is, more hypervigilant or frantic searching predicted a greater likelihood of using of NSSI. The effect size for this relationship was quite small, however, $OR = .49$.

In order to test hypothesis seven, multilevel modeling was used to assess the relationship between decision to engage in NSSI and effort in isolating oneself. The analysis resulted in a significant positive relationship between decision to engage in NSSI and effort in isolating oneself, $\gamma(85) = 1.70$ ($SE = .42$, $p < .001$). In other words, deciding to use NSSI resulted in a greater effort to try and isolate oneself.

Hypothesis eight was tested with multilevel modeling by examining the relationship between being alone to cope on a given day and use of NSSI. This model involved a link function transforming the dependent variable into a ratio as the dependent variable was binary. This hypothesis was supported, $\gamma(85) = 1.65$ ($SE = .54$, $p < .01$), that is, actually isolating oneself predicted a greater use of NSSI. Moreover, this effect was very large, $OR = 5.18$.

Regarding the last two hypothesis tests, it could be argued that the variables of NSSI decision and NSSI use on the daily surveys are redundant and capture the same variance. That is, when one decides to use NSSI, they will always end up using it. If this

were true, then the relationship between decision to use NSSI and isolation effort (hypothesis seven), and the relationship between being alone to cope and NSSI use (hypothesis 8), would be unimportant as they would not have an impact beyond the relationship between decision to use NSSI and actual NSSI use. The data was examined for each of the 40 instances in which someone decided to use NSSI. Of this subsample, 30 followed through on using NSSI, while 10 (i.e., 25%) used another coping behavior. Of the remaining 25% most chose to suppress their thoughts or emotions ($n = 6$), while others used alcohol or drugs ($n = 1$), distraction ($n = 2$), or physical avoidance ($n = 1$). Thus, it is evident that a decision to engage in NSSI does not always result in actually using it. Moreover, it appears that the majority who decide to use NSSI, but fail to use it, end up using emotional and/or thought suppression.

CHAPTER IV

DISCUSSION

Review of Hypotheses

This study examined the different steps of a theoretical model used to explain the decisional pathway from becoming distressed and using NSSI to cope with that distress. This model is applicable only to those who have previously used NSSI as a coping method for distress. A large body of empirical literature supports the theory that most people who use NSSI do so to cope with distress, and most instances of NSSI behavior are done to cope with distress. The goal of this study was to assess the steps of a theoretical model explaining the steps between becoming distressed and using NSSI to cope with that distress.

The results supported each independent part of the theoretical model (*Figure 2*). The model first delineated by Janis and Mann (1977, 1982; *Figure 1*) was devised for physical disasters and a desire to avoid bodily harm or death. It was adapted for this study to explain NSSI as a means to avoid further emotional harm (i.e., distress). Despite this theoretical “leap,” the different steps of the model were supported by the current study’s data.

The first step of the model indicates that heightened distress and an assumed urge for NSSI (based on past research demonstrating that NSSI is most commonly used and effective for reducing distress) will lead to a search for coping methods. Due to the

deceptive nature of the study as a “coping study,” participants were not asked if they experienced an NSSI urge. Hypothesis one was created to test this first step by examining if increased daily distress was related to an increase in effort to find a coping strategy. This hypothesis was supported for peak distress only, as overall distress was not examined due to violation of a statistical assumption for the hypothesis one statistical model.

Hypothesis two was a test of the overall premise of the model, rather than any particular step. The crux of this study and this theoretical model is that the reason for using NSSI is typically to reduce distress. Therefore, it was important to examine if that was true in this sample. The hypothesis was supported, that heightened emotional distress predicted a greater likelihood of NSSI for both overall distress and peak distress. Furthermore, 72.2% of the sample endorsed using NSSI over the past year for distress regulation reasons (automatic positive or negative reinforcement) on the FASM (Table 4). It should be noted that some of the data for this analysis involved times when people used NSSI, but didn’t specifically say it was to reduce distress. Data were not collected on the reason for daily use of NSSI other than when it was specifically decided to use NSSI for coping. Therefore, some of the daily instances of NSSI may have been due to other reasons (e.g., to gain attention).

The third hypothesis was an examination of one of the three possible outcomes of step two of the model. The theoretical model posits that somebody will use an alternative method of coping (to NSSI) if there is one readily identifiable and available. If not, one is much more likely to reluctantly fall back on a method of experiential avoidance, NSSI in

this model. The results supported this hypothesis, that less time searching for a coping strategy predicts a decision to use NSSI as a coping strategy. Consistent with this hypothesis, Arney et al. (2011) found results demonstrating an increase in negative affect several hours prior to NSSI with negative affect then decreasing after NSSI. These authors used the PANAS-X in an experience sampling methodology study of 36 college students and found detectable increases in general negative affect, guilt, and anger an average of 7.82 hours prior to using NSSI. They interpret these findings as evidence that several hours may pass between an urge to use NSSI to reduce negative affect and using NSSI for this purpose. The current study expands on this by theorizing that these hours between urge and use of NSSI are used trying to find an alternative way to cope with negative affect.

Hypothesis four maps directly onto step three of the model stating that no hope for using an alternative coping strategy (to NSSI) will result in deciding to use NSSI as an experiential avoidance method of coping. Although the theoretical model conceptualizes this step as dichotomous (hope or no hope), this study assessed constructs dimensionally whenever possible. This allowed a more appropriate fit to the statistical model. The hypothesis was supported, that lack of hope predicted use of NSSI.

The fifth hypothesis mapped onto step four of the model. This step indicates that if one perceives there to be sufficient time to find a coping strategy for their distress, then they will search in an adaptive and vigilant fashion. Alternatively, if one feels there is not sufficient time, they will search in a maladaptive and hypervigilant fashion that is characterized by frantic and disorganized searching. Similar to the variable of hope, the

variables of sufficient time and hypervigilance were measured in a continuous fashion. When examined in this dimensional way, hypothesis five and thus step four, were supported.

Hypothesis six maps onto the second assumption of the model's fourth step. The model assumes that when one searches in a vigilant fashion they will select an "adaptive" coping strategy (rather than NSSI). On the other hand, if they search in a hypervigilant fashion they will likely fall back on using NSSI as experiential avoidance to cope. The results were consistent with this hypothesis, providing evidence in support of step four of the model. At first read, this hypothesis may seem contradictory to hypothesis three. As discussed in the introduction, hypervigilance leads to "premature closure" and the selection of an avoidance technique (NSSI in this case). This could imply that more hypervigilance results in spending LESS time looking for a strategy and using NSSI. This is in direct contrast to hypothesis three stating that MORE time searching will lead to using NSSI. In order to further explore the implied relationship between hypervigilance and time spent searching, a multilevel model using the same structure as the hypothesis test models was analyzed to see if these two variables were related. The results demonstrated a null relationship between the two variables, $\gamma = -3.18$ ($SE = 2.91$, *ns*), indicating that hypervigilance is not associated with less time searching for a coping strategy, and thus hypothesis three and six are not in contrast.

An important assumption of steps two, three, and four of the model is that NSSI is used as a form of experiential avoidance when used to cope with emotions. Studies have demonstrated that those using NSSI tend to use more methods of experiential avoidance

to cope in comparison to those not using NSSI (e.g., Andover et al., 2007; Brown et al., 2007). Additionally, frequency of NSSI has been found to positively correlate with greater use of avoidant coping (Hasking et al., 2008). More recently, studies have examined how NSSI is related to experiential avoidance. Howe-Martin, Murrell, & Guarnaccia (2012) administered questionnaires to 211 American high school students. Participants reporting using NSSI in their lifetime evidenced greater thought suppression as measured by the White Bear Suppression Inventory (Wegner & Zanakos, 1994). In a study of 214 college students, Anderson and Crowther (2012) found those using NSSI in the past year to report higher levels of experiential avoidance on the White Bear Suppression Inventory and Acceptance and Action Questionnaire (Hayes et al., 2004) in comparison to those not using NSSI in their lifetime.

Hypothesis seven reflects the third assumption of the fourth step of the model which theorizes that once a person decides to use NSSI, they will try isolating themselves. For this hypothesis test, effort in isolating oneself was assessed dimensionally. The hypothesis was confirmed in this study.

The final step of the model is dichotomous in nature and suggests that someone's use of NSSI to cope with distress is contingent upon their ability to isolate themselves. Specifically, if they do isolate themselves they will use NSSI and if they are unable to isolate themselves they will endure the distress and not cope with it. This hypothesis was supported.

Post-hoc analyses were conducted to determine if solitude was related to other coping behaviors. Specifically, using alcohol or drugs was examined as this behavior is

similar to NSSI in multiple respects – both are active behaviors and neither are socially accepted as good coping behavior. Two HLM models following the same structure as the hypothesis tests were used to examine if using alcohol/drugs on a particular day was related to 1) isolation effort, and 2) being alone to cope. The results demonstrated a significant and negative relationship between alcohol/drug use and isolation effort, $\gamma(85) = -.43$ ($OR = .65$, $SE = .16$, $p < .01$), and between alcohol/drug use and being alone to cope, $\gamma(85) = -1.90$ ($OR = .15$, $SE = .59$, $p < .01$). Thus, the opposite relationship was found in that using drugs/alcohol to cope was related to decreased effort in isolation and a higher likelihood to be around others. This provides evidence that the findings of hypotheses seven and eight, and therefore the last two steps of the model, are specific to using NSSI to cope. Moreover, of the 19 participants who used NSSI during the study, only 6 also used alcohol/drugs during the study (of 13 total participants who used alcohol/drugs).

Research Implications

The results of this study have implications for additional areas of research. One endeavor, given the results of this study, would be to examine the model in its entirety. This study tested the steps of the model individually; however, this does not necessarily support the model as a whole. That is, even though individual parts of the model (e.g., isolation results in higher likelihood of NSSI) have support from this study, these parts may not flow together as indicated (see *Figure 2*). A less intensive methodology and statistical analysis could be used to assess the model as a whole. Data on NSSI antecedents and decisions could be collected from individual self-injurers via

questionnaires and/or interviews. This methodology has been used to assess why people engage in NSSI and their affective experiences prior to NSSI (e.g., Kampuis et al., 2007; Nock & Prinstein, 2004, 2005). Self-injurers could be queried about specific NSSI occurrences (e.g., last time) or about their NSSI in general to determine, to the best of their memory and understanding, if they had the desire to reduce their distress, if they considered NSSI, if they searched for other options, and so on. Using this data, a simpler statistic such as path analysis could be used as the data would not be nested (i.e., multileveled).

In addition to the variables included in this model (see *Figure 2*), there may be other factors related to specific instances of using NSSI for distress regulation that should be studied. In addition to the degree of distress one feels, the degree of urgency may also be important. Recent studies have demonstrated that NSSI is associated with urgency, a “tendency to act ‘impulsively’ when experiencing negative affect” (Lynam, Miller, Miller, Bornovalova, & Lejuez, 2010, p. 152). For example, Black and Mildred (2013) examined 106 internet recruited adult females from eight different countries (primarily Australia, USA, and UK) who had self-injured in the past year. They administered the UPPS Impulsive Behavior Scale (UPPS; Whiteside & Lynam, 2001) and used logistic regression to see if the urgency and lack of perseverance predicted “impulsive” NSSI (cutting, burning, carving, punching, or skin-picking). In this study urgency predicted impulsive NSSI while lack of perseverance did not. In another study, Lynam et al. (2010) examined how the number of different methods of NSSI (lifetime) correlated with different facets of impulsivity including urgency. They also used the UPPS questionnaire

in their sample of 76 substance abuse inpatients. Their results indicated that the number of NSSI methods was significantly associated with greater urgency in addition to lack of premeditation and lack of perseverance.

Another important factor may be the amount (or rather lack of) of social support one has available. Klonsky and Glenn (2008) found in their study of college students that 90% of their NSSI using sample had tried to resist NSSI urges. Six of the nine most endorsed methods of resisting NSSI urges were social in nature, including “being around friends” (endorsed by 80%) and “talking to someone about how you feel” (endorsed by 74%). A more comprehensive model may help us better understand the process beginning with an urge to use NSSI for distress and ending with the use of NSSI. Statistically speaking, this consideration of comprehensiveness would best be tested by analyzing the model as a whole, as discussed above. This approach would allow researchers to determine the relative contribution of factors (e.g., decisions) and not simply whether or not they are statistically related to each other and/or using NSSI.

Another area for future research is in social reasons for NSSI. This study was designed to specifically examine instances of NSSI used for distress regulation. Research has shown that distress regulation is by far the most common reason for using NSSI (e.g., Kleindeinst et al., 2008; Klonsky, 2011). Social reasons for NSSI such as gaining attention or avoiding an interpersonal obligation are endorsed far less commonly (10-31%; Lloyd-Richardson et al., 2007; Nixon et al., 2002; Nock et al., 2009), but still warrant attention. Perhaps it is the same factors, but conceptualized in a different way. For example, “hope of finding a healthy method of reducing distress” could be restated as

“hope of finding a healthy way of gaining attention.” Alternatively, other social variables not included in this study may be important, such as characteristics of particular relationships and perception of others. For example, Bureau et al. (2010) examined self-report questionnaires of current parent-child relationships (mother and father combined) in 1,238 undergraduate students from one Canadian university with 105 of this undergraduate sample endorsing NSSI in the past six months. They found the NSSI group to report more failed protection, less trust of parents, worse communication with parents, and more alienation from parents in comparison to those not using NSSI. Another study compared 23 undergraduates using NSSI to cope with their stress in their lifetime to 23 controls on a retrospective self-report measure of social support (Heath et al., 2009). The results found a significant difference in perceived support of friends (lower for NSSI group), but not for parents. These findings warrant the consideration of peer and parent relationships when considering single instances of NSSI used for social reasons.

Clinical Implications

The results of this study have implications for therapy approaches, and cognitive-behavioral therapy (CBT) in particular. For example, particular cognitions found to be related to daily use of NSSI, use of NSSI to cope with distress, or decision to use NSSI to cope with distress could be addressed in CBT. For example, the perception of less hope to find an effective coping strategy was associated with a greater likelihood of deciding to use NSSI to cope. The cognition of being able to find a coping strategy for distress other than NSSI could be challenged and restructured in CBT. Similarly, a perception of less “sufficient time” to find an effective coping strategy was associated with increased

hypervigilance, which was then associated with a higher likelihood of deciding to use NSSI. Although this relationship isn't direct, the results indicate that "less time" may be associated with deciding to use NSSI to cope. This would be another cognition to assess in CBT and treat accordingly. No study to date has examined specific beliefs/cognitions about NSSI, with the one exception being that it is helpful for reducing distress (e.g., Lewis & Santor, 2010).

In addition to addressing cognitions, specific behavioral interventions could be used to facilitate reducing NSSI behavior. This study demonstrated the importance of solitude in using NSSI, which is consistent with prior studies showing that solitude is a strong correlate and predictor of NSSI behavior (Klonsky, 2009; Nixon et al., 2002; Nock et al., 2009; Whitlock et al., 2012). In this case, social support and social presence seem to be important protective factors for NSSI. This is consistent with research conducted by Klonsky and Glenn (2008). These authors assessed self-report of behaviors used to resist urges to engage in NSSI. There were twelve behaviors endorsed by more than 50% of the sample. Of these 12 behaviors, half involved social interactions: "being around friends," "talking to someone about how you feel," "talking to friends," "interacting with someone who is nice to you," "finding someone who is understanding," and "being around people." Moreover, "finding someone who is understanding" was rated as the third most successful behavior behind "doing sports or exercise recreationally," and "removing the means/instrument typically used to self-harm from home."

The current study and prior literature highlight the need to address social behavior in the treatment of NSSI. Given the results of this study, it seems important for those

using NSSI to simply be in the presence of others when distressed. Klonsky and Glenn (2008) also found that being around others is helpful in resisting the urge to use NSSI. These authors found that in addition to social presence, interacting with others is important. When selecting behavioral interventions for reducing NSSI, it is important to include social interventions and resources in daily life.

Limitations

There are some important limitations to note in this study. Firstly, a small sample of participants actually used NSSI in the study (3.5%, Table 1). There was an even lower rate of using NSSI to cope (1.9%) which is likely the reason for the small effect size found for hypothesis 3 (less time spent searching for a coping strategy predicting NSSI to cope). Similarly, the low rate of deciding to use NSSI to cope (4%) may be the reason for small effect sizes found for the hypothesis four and six tests, which both included decision to use NSSI to cope as the dependent variable.

Another noteworthy limitation is that some steps of the theoretical model (*Figure 2*) were not assessed directly due to the deception used in this study. For example, participants were told this was a study about coping behavior in general; therefore, certain tenants of the model such as heightened emotional distress leading to an urge for NSSI (step one) could not be directly asked without revealing the true nature of the study. Similarly, steps two, three, and four assumed that lack of time, hope, and vigilance (respectively) would result in giving in to urges for NSSI when trying to use another coping method. The assumption that individuals were trying to abstain from NSSI during their coping decisions could not be directly tested in the study.

Arguably, the most noteworthy limitation of the study is the tenuous applicability of the theoretical model for explaining the use of NSSI under distress. The theory created by Janis and Mann (1977) was specifically designed for life-threatening events, and emotional distress is certainly not one of those events. This theoretical limitation has possibly resulted in methodological and interpretive limitations in this study. For example, participants were asked about “hope” and perception of “sufficient time” with regard to deciding on a way to cope with distress. These variables, while applicable to life-threatening situations, may not be consciously considered when people are coping with their distress. Given literature showing a positive relationship between NSSI and urgency (Black & Mildred, 2013; Lynam et al., 2010) it seems likely that “hope” and “sufficient time” are not carefully and consciously considered when deciding to use or not use NSSI for coping with distress. Rather they are redundant and part of the same rapid determination that is made out of awareness. Although the current dataset does not allow for examination of awareness/consciousness, speed of these processes and limited examination of redundancy can be analyzed.

Speed of these decisional processes was indirectly assessed by examining how much time people spent each day on “searching” for a strategy to cope with their distress. The mean for all 1109 daily surveys was 26.72 minutes ($SD = 83.64$). The time taken to search for a strategy was even longer when NSSI was ultimately used ($n = 39$, $M = 68.90$, $SD = 232.72$). Thus, it appears that ample time was used in searching for a coping strategy which would likely accommodate for such determinations as hope for a strategy and sufficient time for a strategy.

In order to test the argument that hope and sufficient time in this model are redundant, the relationship between these two variables and NSSI outcome variables (NSSI use, NSSI decision) using HLM was assessed. Results indicated that hope and sufficient time had a significant positive relationship, $\gamma(85) = .58$ ($SE = .04$, $p < .001$) with each other. Additionally, hope, $\gamma(85) = -.29$ ($OR = .75$, $SE = .13$, $p < .05$), and sufficient time $\gamma(85) = -.44$ ($OR = .64$, $SE = .14$, $p < .01$) were each significantly and negatively related to the decision for NSSI. Hope, $\gamma(85) = -.33$ ($OR = .72$, $SE = .14$, $p < .05$), and sufficient time, $\gamma(85) = -.42$ ($OR = .66$, $SE = .14$, $p < .01$), were also negatively related to the actual daily use of NSSI. Interestingly, when both sufficient time and hope were entered in the same model, only sufficient time remained significant. This was true for both NSSI decision and NSSI use. These findings give some evidence that hope may be redundant to and subsumed under sufficient time. In other words, it appears that the relationship between hope and NSSI decision/use is mediated by sufficient time. It does appear that steps 2 and 3 of this decision making process may indeed be collapsible into one step.

A similar question could be raised about redundancy of “sufficient time” and the actual time spent searching for a way to cope with distress. A post-hoc HLM analysis indicated a significant, yet negative relationship between actual time used and rating of sufficient time, $\gamma(85) = -.006$ ($SE = .002$, $p < .001$). In other words, the more time one feels they have to search for a coping behavior, the less time they actually need. One interpretation is that a higher perception of sufficient time results in faster searching. Another interpretation is that a coping behavior is immediately identified (low time)

resulting a subjective rating of ample time to search. The former interpretation suggests independent steps; however, the second interpretation suggests redundancy. At this time it remains unclear if these are actually separate steps or the same step. Moreover, the use of actual time to find a coping behavior is suspect as time per se was not part of the original Janis and Mann (1977) model. Rather, time, as discussed in the introduction is a proxy for the step of having a coping behavior “immediately available” and thus using it. In future research, other ways of assessing this step should be used such as directly asking if a coping behavior was immediately available and implemented.

Lastly, hope and actual time used to find a coping strategy were assessed for redundancy. An HLM model using the same structure as the hypothesis tests revealed that these variables were not significantly related, $\gamma(85) = 3.92$ ($SE = 4.66$, $p = .40$). Thus, it appears that these variables are not redundant.

Another limitation involves the use of retrospective reporting at the end of each day of the study. Specifically, participants may have rated such variables as hope, sufficient time, and actual time based on whether or not they were successful with coping that day. In order to examine this HLM models were used to examine the relationship between each of these variables and subjective coping effectiveness. Results showed that each of these variables were significantly related to effectiveness: hope $\gamma(85) = .39$ ($SE = .04$, $p < .001$); sufficient time $\gamma(85) = .33$ ($SE = .04$, $p < .001$); actual time $\gamma(85) = -.004$ ($SE = .001$, $p < .001$). Additionally, each of these variables remained significant when combined in the same model at Level 1. These results suggest that these three variables may have been influenced by ratings of effectiveness. One counter to this argument is

that the rating for effectiveness was provided later in the online questionnaire and couldn't itself have influenced ratings of the above variables. Rather, participants would have to have thought about how well they coped during the day before completing the questionnaire, which seems unlikely. It is ostensibly more likely, given the order of questions, that participants rated hope, sufficient time, and actual time, and then came to the conclusion that they coped effectively.

One last limitation is simply a terminological one. The use of vigilance and hypervigilance could understandably be confusing. These terms were borrowed from Janis and Mann (1977) in order to retain similarities between models where possible. The term hypervigilance suggests more vigilance that is not necessarily bad, which is in contrast to how Janis and Mann describe it as "maladaptive." Future research involving applications of the Janis and Mann model would benefit from alternate wording such as "effective" instead of vigilant and "ineffective" instead of hypervigilant. Alternatively, vigilance/hypervigilance could be divided into further constructs as the components of "organized and complete" on one pole and "disorganized and frantic" on the other pole should not necessarily be grouped together. That is, organization does not equate to completeness and vice versa. It may be useful to separate these constructs in future research.

Strengths

The current study is an important contribution to the literature for multiple reasons. Foremost, it is novel in scope. Few studies to date have examined individual acts of NSSI. Moreover, no study to date has examined the decisions, cognitions, and

behaviors leading up to a particular act of NSSI. Another strength of the study was its use of experiential sampling methodology. By assessing participants with a recent history of NSSI for 14-21 days using a convenient format (e-mail), the factors associated with coping and NSSI could be recorded on a daily basis, thus minimizing errors due to memory construction, forgetting, and memory biases. Finally, this study used multilevel modeling to maximize relationships between variables by addressing daily variance nested within individual variance.

Conclusion

This study was designed to address a gap in the literature pertaining to what causes specific instances of NSSI to reduce distress. In order to address this question, a theoretical foundation was created by adapting a model of decision making under distress created by Janis and Mann (1977). With this model as a guide, experience sampling methodology was used to provide support for each step of the model. These findings provide important information for what leads up to using NSSI after becoming emotionally distressed. In turn, these findings provide ideas for treating NSSI using cognitive, behavioral, and social strategies. Future studies should seek to further this research by assessing the model as a whole, asking questions about NSSI directly, and by including other important variables related to the use of NSSI

REFERENCES

- Amirkhan, J. H. (1990). A factor analytically derived measure of coping: The Coping Strategy Indicator. *Journal of Personality and Social Psychology*, *59*, 1066-1074.
- Anderson, N. L., & Crowther, J. H. (2012). Using the experiential avoidance model of non-suicidal self-injury: Understanding who stops and who continues. *Archives of Suicide Research*, *16*(2), 124-134.
- Andover, M. S., Pepper, C. M., Gibb, B. E. (2007). Self-mutilation and coping strategies in a college sample. *Suicide and Life-Threatening Behavior*, *37*(2), 238-243.
- Armey, M. F., Crowther, J. H., & Miller, I. W. (2011). Changes in ecological momentary assessment reported affect associated with episodes of nonsuicidal self-injury. *Behavior Therapy*, *41*, 579-588.
- Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego-depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, *74*, 1252-1265.
- Bennum, I., & Phil, M. (1983). Depression and hostility in self-mutilation. *Suicide and Life-Threatening Behavior*, *13*, 71-83.
- Brain, K. L., Haines, J., Williams, C. L. (1998). The psychophysiology of self-mutilation: Evidence of tension reduction. *Archives of Suicide Research*, *4*, 227-242.

- Briere, J. & Gil, E. (1998). Self-mutilation in clinical and general population samples: Prevalence, correlates, and functions. *American Journal of Orthopsychiatry*, 68(4), 609-620.
- Brown, S. A. (2009). Personality and non-suicidal deliberate self-harm: Trait differences among a non-clinical population. *Psychiatry Research*, 169, 28-32.
- Brown, S. A., Williams, K., & Collins, A. (2007). Past and recent deliberate self-harm: Emotion and coping strategy differences. *Journal of Clinical Psychology*, 63(9), 791-803.
- Bureau, J., Martin, J., Freynet, N., Poirier, A. A., Lafontaine, M., & Cloutier, P. (2010). Perceived dimensions of parenting and non-suicidal self-injury in young adults. *Journal of Youth and Adolescence*, 39, 484-494.
- Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, 56, 267-283.
- Cerutti, R., Manca, M., Presaghi, F., & Gratz, K. L. (2010). Prevalence and clinical correlates of deliberate self-harm among a community sample of Italian adolescents. *Journal of Adolescence*, 34(2), 337-347.
- Chapman, A. L., & Dixon-Gordon, K. L., (2007). Emotional antecedents and consequences of deliberate self-harm and suicide attempts. *Suicide and Life-Threatening Behavior*, 37(5), 543-552.

- Chapman, A. L., Gratz, K. L., & Brown, M. Z. (2006). Solving the puzzle of deliberate self-harm: The experiential avoidance model. *Behaviour Research and Therapy*, *44*, 371-394.
- Claes, L., Houben, A., Vandereycken, W., Bijttebier, P., & Muehlenkamp, J. (2010). Brief report: The association between non-suicidal self-injury, self-concept and acquaintance with self-injurious peers in a sample of adolescents. *Journal of Adolescence*.
- Claes, L., Klonsky, E. D., Muehlenkamp, J., Kuppens, P., & Vandereycken, W. (2010). The affect-regulation function of nonsuicidal self-injury in eating-disordered patients: Which affect states are regulated? *Comprehensive Psychiatry*, *51*, 386-392.
- Cook, S. W., Heppner, P. P. (1997). A psychometric study of three coping measures. *Educational and Psychological Measurement*, *57*, 906-923.
- Deliberto, T. L., & Nock, M. K. (2008). An exploratory study of correlates, onset, and offset of non-suicidal self-injury. *Archives of Suicide Research*, *12*, 219-231.
- Favazza, A. R., & Rosenthal, R. J. (1993). Diagnostic issues in self-mutilation. *Hospital and Community Psychiatry*, *44*, 134-141.
- Glenn, C. R., & Klonsky, E. D. (2009). Social context during non-suicidal self-injury indicates suicide risk. *Personality and Individual Differences*, *46*, 25-29.
- Gratz, K. L. (2001). Measurement of deliberate self-harm: Preliminary data on the deliberate self-harm inventory. *Journal of Psychopathology and Behavioral Assessment*, *23*(4), 253-263.

- Gratz, K. L., & Chapman, A. L. (2007). The role of emotional responding and childhood maltreatment in the development and maintenance of deliberate self-harm among male undergraduates. *Psychology of Men and Masculinity*, 8(1), 1-14.
- Gratz, K. L., Conrad, S. D., & Roemer, L. (2002). Risk factors for deliberate self-harm among college students. *American Journal of Orthopsychiatry*, 72(1), 128-140.
- Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment*, 26(1), 41-54.
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships and well-being. *Journal of Personality and Social Psychology*, 85, 348–362.
- Haines, J., & Williams, C. L. (2003). Coping and problem solving of self-mutilators. *Journal of Clinical Psychology*, 59(10), 1097-1106.
- Haines, J., Williams, C. L., Brain, K. L., & Wilson, G. V. (1995). The psychophysiology of self-mutilation. *Journal of Abnormal Psychology*, 104(3), 471-489.
- Hasking, P., Momeni, R., Swannell, S., & Chia, S. (2008). The nature and extent of non-suicidal self-injury in a non-clinical sample of young adults. *Archives of Suicide Research*, 12, 208-218.
- Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., ...McCurry, S. M. (2004). Measuring experiential avoidance: A preliminary test of a working model. *The Psychological Record*, 54, 553-578.

- Hayes, S. C., Wilson, K. G., Strosahl, K., Gifford, E. V., & Follette, V. M. (1996). Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and treatment. *Journal of Consulting and Clinical Psychology, 64*(6), 1152-1168.
- Raudenbush, S.W., Bryk, A.S., & Congdon, R. (2004). HLM 6 for Windows [Computer software]. Skokie, IL: Scientific Software International, Inc.
- Heath, N. L., Ross, S., Toste, J. R., Charlebois, A., & Nececheva, T. (2009). Retrospective analysis of social factors and nonsuicidal self-injury among young adults. *Canadian Journal of Behavioral Science, 41*(3), 181-186.
- Howe-Martin, L. S., Murrell, A. R., & Guarnaccia, C. A. (2012). Repetitive nonsuicidal self-injury as experiential avoidance among a community sample of adolescents. *Journal of Clinical Psychology, 68*, 809-828.
- Hulbert, C., & Thomas, R. (2010). Predicting self-injury in BPD: An investigation of the experiential avoidance model. *Journal of Personality Disorders, 24*(5), 651-663.
- Jacobson, C.M., & Gould, M. (2007). The epidemiology and phenomenology of non-suicidal self-injurious behavior among adolescents: A critical review of the literature. *Archives of Suicide Research, 11*, 129-147.
- Janis, I. L. (1982). Decision-making under stress. In L. Goldberger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects* (pp. 69-80). New York: Free Press.
- Janis, I. L., & Mann. L. (1977). *Decisionmaking: A psychological analysis of conflict, choice, and commitment*. New York: Free Press.

- Kamphuis, J. H., Ruyling, S. B., & Reijntnes. (2007). Testing the emotion regulation hypothesis among self-injuring females: Evidence for differences across mood states. *The Journal of Nervous and Mental Disease, 195*(11), 912-918.
- Kaufman, J., Birmaher, B., Brent, D. A., Rao, U., & Ryan, N. D. (1997). Schedule for Affective Disorders and Schizophrenia for School Age Children, Present and Lifetime Version (K-SADS-PL): Initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 980-988.
- Kemperman, I., Russ, M. J., & Shearin, E. (1997). Self-injurious behavior and mood regulation in borderline patients. *Journal of Personality Disorders, 11*(2), 046-157.
- Kleindeinst, N., Bohus, M., Ludascher, P., Limberger, M. F., Kuenkele, K., Ebner-Priemer, U. W., . . . Schmahl, C. (2008). Motives for nonsuicidal self-injury among women with borderline personality disorder. *Journal of Nervous and Mental Disease, 196*, 230-236.
- Klonsky, E.D. (2007). The functions of deliberate self-injury: A review of the evidence. *Clinical Psychology Review, 27*, 226-239.
- Klonsky, E. D., (2009). The functions of self-injury in young adults who cut themselves: Clarifying the evidence for affect-regulation. *Psychiatry Research, 166*, 260-268.
- Klonsky, E. D. (2011). Non-suicidal self-injury in United States adults: Prevalence, sociodemographics, topography, and functions. *Psychological Medicine, 41*(9), 1981-1986.

- Klonsky, E. D., & Glenn, C. R. (2008). Resisting urges to self-injure. *Behavioural and Cognitive Psychotherapy*, *36*, 211-220.
- Klonsky, E. D., & Olino, T. M. (2008). Identifying clinically distinct subgroups of self-injurers among young adults: A latent class analysis. *Journal of Consulting and Clinical Psychology*, *76*(1), 22-27.
- Klonsky, E. D., Oltmanns, T. F., & Turkheimer, E. (2003). Deliberate self-harm in a nonclinical population: Prevalence and psychological correlates. *American Journal of Psychiatry*, *160*, 1501-1508.
- Lanstedt, E., & Gadin, K. G. (2010). Deliberate self-harm and associated factors in 17-year-old Swedish students. *Scandinavian Journal of Public Health*, *0*, 1-9.
- Lewis, S. P., & Santor, D. A. (2010). Self-harm reasons, goal achievement, and prediction of future self-harm intent. *The Journal of Nervous and Mental Disease*, *198*(5), 362-369.
- Liu, X., Spybrook, J., Congdon, R., Martinez, A., & Raudenbush, S. (2009). Optimal Design for Multi-level and Longitudinal Research 2.0 [Computer Software]. Ann Arbor, MI: Survey Research Center of the Institute of Social Research at the University of Michigan.
- Lloyd, E. E., Kelley, M. L., & Hope, T. (1997, April). *Self-mutilation in a community sample of adolescents: Descriptive characteristics and provisional prevalence rates*. Poster session presented at the annual meeting of the Society for Behavioral Medicine, New Orleans, LA.

- Lloyd-Richardson, E. E., Perrine, N., Dierker, L., & Kelley, M. L. (2007). Characteristics and functions of non-suicidal self-injury in a community sample of adolescents. *Psychological Medicine, 37*, 1183-1192.
- Lynam, D., Miller, J. D., Miller, D. J., Bornovalova, M. A., & Lejuez, C. W. (2010). Testing the relations between impulsivity-related traits, suicidality, and nonsuicidal self-injury: A test of the incremental validity of the UPPS model. *Personality Disorders: Theory Research, and Treatment, 2*(2), 151-160.
- Muehlenkamp, J. J., Williams, K. L., Gutierrez, P. M., Claes, L. (2009). Rates of non-suicidal self-injury in high school students across five years. *Archives of Suicide Research, 13*, 317-329.
- Nixon, M. K., Cloutier, P. F., & Aggarwai, S. (2002). Affect regulation and addictive aspects of repetitive self-injury in hospitalized adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*(11), 1333-1341.
- Nock, M. K., Holmberg, E. B., Photos, V. I., & Michel, B. D. (2007). Self-Injurious Thoughts and Behaviors Interview: Development, reliability, and validity in an adolescent sample. *Psychological Assessment, 19*(3), 309-317.
- Nock, M. K., & Mendes, W. B. (2008). Physiological arousal, distress tolerance, and social problem-solving deficits among adolescent self-injurers. *Journal of Consulting and Clinical Psychology, 76*(1), 28-38.
- Nock, M. K., & Prinstein, M. J. (2004). A functional approach to the assessment of self-mutilative behavior. *Journal of Consulting and Clinical Psychology, 72*(5), 885-890.

- Nock, M. K., & Prinstein, M. J. (2005). Contextual features and behavioral functions of self-mutilation. *Journal of Abnormal Psychology, 114*(1), 140-146.
- Nock, M. K., Prinstein, M. J., & Sterba, S. K. (2009). Revealing the form and function of self-injurious thoughts and behaviors: A real-time ecological assessment study among adolescents and young adults. *Journal of Abnormal Psychology, 118*(4), 816-827.
- Perez, J., Venta, A., Garnaat, S., & Sharp, C. (2012). The difficulties in emotion regulation scale: Factor structure and association with nonsuicidal self-injury in adolescent inpatients. *Journal of Psychopathology and Behavioral Assessment, 34*, 393-404.
- Plener, P. L., Libal, G., Keller, F., Fegert, J. M., & Muehlenkamp, J. J. (2009). An international comparison of adolescent non-suicidal self-injury (NSSI) and suicide attempts: Germany and the USA. *Psychological Medicine, 39*, 1549-1558.
- Raudenbush, S. W., & Bryk, A. S., (2002). *Hierarchical linear models: Applications and data analysis methods (2nd Ed.)*. Sage Publications: Thousand Oaks, CA.
- Ross, S., & Heath, N. (2002). A study of the frequency of self-mutilation in a community sample of adolescents. *Journal of Youth and Adolescence, 31*(1), 67-77.
- Suyemoto, K. L. (1998). The functions of self-mutilation. *Clinical Psychology Review, 18*(5), 531-554.
- Tresno, F., Ito, Y., & Mearns, J. (2012). Self-injurious behavior and suicide attempts among Indonesian college students. *Death Studies, 36*, 627-639.

- Watson, D., & Clark, L. (1994). *The PANAS-X: Manual for the Positive and Negative Affect Schedule-Expanded Form*. Unpublished manuscript.
- Wegner, D. M., & Zanakos, S. (1994). Chronic thought suppression. *Journal of Personality, 62*, 616-640.
- Whiteside, S. P., & Lynam, D. R. (2001). The five-factor model of impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*, 669-689.
- Whitlock, J., Eckenrode, J., & Silverman, D. (2006). Self-injurious behaviors in a college population. *Pediatrics, 117*(6), 1939-1948.
- Whitlock, J., Muehlenkamp, J., Purington, A., Eckenrode, J., Barreira, P., Baral, G., . . . Knox, K. (2012). Nonsuicidal self-injury in a college population: General trends and sex differences. *Journal of American College Health, 59*(8), 691-698.
- Williams, F., & Hasking, P. (2010). Emotion regulation, coping, and alcohol use as moderators in the relationship between non-suicidal self-injury and psychological distress. *Prevention Science, 11*(1), 33-41.

APPENDIX A

FUNCTIONAL ASSESSMENT OF SELF-MUTILATION

Within the past year, have you ever intentionally engaged in the following behaviors
(without the intent to kill yourself)? (check all that apply):

	No	Yes	Approx. how many times?	Have you gotten medical treatment?
1. Cut or carved your skin				
2. Hit yourself on purpose				
3. Pulled your hair out (with the intent of hurting yourself)				
4. Gave yourself a tattoo				
5. Picked at a wound (with the intent of hurting yourself)				
6. Burned your skin (i.e., with a cigarette, match or other hot object)				
7. Inserted objects under your nails or skin				
8. Bit yourself (e.g., your mouth or lip) (with the intent of hurting yourself)				
9. Picked areas of your body to the point of drawing blood (with the intent of hurting yourself)				
10. Scraped your skin				
11. "Erased" your skin to the point of drawing blood				
12. Other (specify):				

14. How long did you think about doing the above act(s) before actually doing it? _____

15. Did you perform any of the above behaviors while you were taking drugs or alcohol?
Yes No

16. Did you experience pain during this self-harm?

- _____ Severe pain
- _____ Moderate pain
- _____ Little pain
- _____ No pain

17. How old were you when you first harmed yourself in this way?

18. If not in the past year, have you ever done any of the above acts?

Yes No

Did you harm yourself for any of the reasons below? (check all that apply):

0 Never	1 Rarely	2 Sometimes	3 Often
------------	-------------	----------------	------------

Reasons:	Rating
1a. To avoid school, work, or other activities	
2a. To relieve feeling “numb” or empty	
3a. To get attention	
4a. To feel something, even if it was pain	
5a. To avoid having to do something unpleasant you don’t want to do	
6a. To get control of a situation	
7a. To try to get a reaction from someone, even if it’s a negative reaction	
8a. To receive more attention from your parents and friends	
9a. To avoid being with people	
10a. To punish yourself	
11a. To get other people to act differently or change	
12a. To be like someone you respect	
13a. To avoid punishment or paying the consequences	
14a. To stop bad feelings	
15a. To let others know how desperate you were	
16a. To feel more a part of a group	
17a. To get your parents to understand or notice you	

18a. To give yourself something to do when alone	
19a. To give yourself something to do when with others	
20a. To get help	
21a. To make others angry	
22a. To feel relaxed	
23a. Other (specify):	

APPENDIX B

COPE

We are interested in how people respond when they confront difficult or stressful events in their lives. There are lots of ways to try to deal with stress. This questionnaire asks you to indicate what you generally do and feel, when you experience stressful events.

Obviously, different events bring out somewhat different responses, but think about what you usually do when you are under a lot of stress.

Then respond to each of the following items by filling in the correct circle using the response choices listed below. Please try to respond to each item separately in your mind from each other item. Choose your answers thoughtfully, and make your answers as true FOR YOU as you can. Please answer every item. There are no “right” or “wrong” answers, so choose the most accurate answer for YOU—not what you think “most people” would say or do. Indicate what YOU usually do when YOU experience a stressful event.

Then, for each item, fill in how much each thing helps you cope with the stress and feel better from “Not at all” to “A lot.”

1 = Not at all 2 = A little bit 3 = A medium amount 4 = A lot

1. I try to grow as a person as a result of the experience. How much does this help?	1 2 3 4 1 2 3 4
2. I turn to work or other substitute activities to take my mind off things. How much does this help?	1 2 3 4 1 2 3 4
3. I get upset and let my emotions out. How much does this help?	1 2 3 4 1 2 3 4
4. I try to get advice from someone about what to do. How much does this help?	1 2 3 4 1 2 3 4
5. I concentrate my efforts on doing something about it. How much does this help?	1 2 3 4 1 2 3 4
6. I say to myself “this isn’t real.” How much does this help?	1 2 3 4 1 2 3 4
7. I put my trust in God. How much does this help?	1 2 3 4 1 2 3 4
8. I laugh about the situation. How much does this help?	1 2 3 4 1 2 3 4
9. I admit to myself that I can’t deal with it, and quit trying. How much does this help?	1 2 3 4 1 2 3 4
10. I restrain myself from doing anything too quickly.	1 2 3 4

How much does this help?	1 2 3 4
11. I discuss my feelings with someone. How much does this help?	1 2 3 4 1 2 3 4
12. I use alcohol or drugs to make myself feel better. How much does this help?	1 2 3 4 1 2 3 4
13. I get used to the idea that it happened. How much does this help?	1 2 3 4 1 2 3 4
14. I talk to someone to find out more about the situation. How much does this help?	1 2 3 4 1 2 3 4
15. I keep myself from getting distracted by other thoughts or activities. How much does this help?	1 2 3 4 1 2 3 4
16. I daydream about things other than this. How much does this help?	1 2 3 4 1 2 3 4
17. I get upset, and am really aware of it. How much does this help?	1 2 3 4 1 2 3 4
18. I seek God's help. How much does this help?	1 2 3 4 1 2 3 4
19. I make a plan of action. How much does this help?	1 2 3 4 1 2 3 4
20. I make jokes about it. How much does this help?	1 2 3 4 1 2 3 4
21. I accept that this has happened and that it can't be changed. How much does this help?	1 2 3 4 1 2 3 4
22. I hold off doing anything about it until the situation permits. How much does this help?	1 2 3 4 1 2 3 4
23. I try to get emotional support from friends or relatives. How much does this help?	1 2 3 4 1 2 3 4
24. I just give up trying to reach my goal. How much does this help?	1 2 3 4 1 2 3 4
25. I take additional action to try to get rid of the problem. How much does this help?	1 2 3 4 1 2 3 4
26. I try to lose myself for a while by drinking alcohol or taking drugs. How much does this help?	1 2 3 4 1 2 3 4
27. I refuse to believe that it has happened. How much does this help?	1 2 3 4 1 2 3 4
28. I let my feelings out. How much does this help?	1 2 3 4 1 2 3 4
29. I try to see it in a different light, to make it seem more positive. How much does this help?	1 2 3 4 1 2 3 4
30. I talk to someone who could do something concrete about the problem. How much does this help?	1 2 3 4 1 2 3 4
31. I sleep more than usual.	1 2 3 4

How much does this help?	1 2 3 4
32. I try to come up with a strategy about what to do. How much does this help?	1 2 3 4 1 2 3 4
33. I focus on dealing with this problem, and if necessary let other things slide a little. How much does this help?	1 2 3 4 1 2 3 4
34. I get sympathy and understanding from someone. How much does this help?	1 2 3 4 1 2 3 4
35. I drink alcohol or take drugs, in order to think about it less. How much does this help?	1 2 3 4 1 2 3 4
36. I kid around about it. How much does this help?	1 2 3 4 1 2 3 4
37. I give up the attempt to get what I want. How much does this help?	1 2 3 4 1 2 3 4
38. I look for something good in what is happening. How much does this help?	1 2 3 4 1 2 3 4
39. I think about how I might best handle the problem. How much does this help?	1 2 3 4 1 2 3 4
40. I pretend that it hasn't really happened. How much does this help?	1 2 3 4 1 2 3 4
41. I make sure not to make matters worse by acting too soon. How much does this help?	1 2 3 4 1 2 3 4
42. I try hard to prevent other things from interfering with my efforts at dealing with this. How much does this help?	1 2 3 4 1 2 3 4
43. I go to movies or watch tv, to think about it less. How much does this help?	1 2 3 4 1 2 3 4
44. I accept the reality of the fact that it happened. How much does this help?	1 2 3 4 1 2 3 4
45. I ask people who have had similar experiences what they did. How much does this help?	1 2 3 4 1 2 3 4
46. I feel a lot of emotional distress and I find myself expressing those feelings a lot. How much does this help?	1 2 3 4 1 2 3 4
47. I take direct action to get around the problem. How much does this help?	1 2 3 4 1 2 3 4
48. I try to find comfort in my religion. How much does this help?	1 2 3 4 1 2 3 4
49. I force myself to wait for the right time to do something. How much does this help?	1 2 3 4 1 2 3 4
50. I make fun of the situation. How much does this help?	1 2 3 4 1 2 3 4
51. I reduce the amount of effort I'm putting into solving the problem.	1 2 3 4

How much does this help?	1 2 3 4
52. I talk to someone about how I feel. How much does this help?	1 2 3 4 1 2 3 4
53. I use alcohol or drugs to help me get through it. How much does this help?	1 2 3 4 1 2 3 4
54. I learn to live with it. How much does this help?	1 2 3 4 1 2 3 4
55. I put aside other activities in order to concentrate on this. How much does this help?	1 2 3 4 1 2 3 4
56. I think hard about what steps to take. How much does this help?	1 2 3 4 1 2 3 4
57. I act as though it hasn't even happened. How much does this help?	1 2 3 4 1 2 3 4
58. I do what has to be done, one step at a time. How much does this help?	1 2 3 4 1 2 3 4
59. I learn something from the experience. How much does this help?	1 2 3 4 1 2 3 4
60. I pray more than usual. How much does this help?	1 2 3 4 1 2 3 4

APPENDIX C

DAILY QUESTIONNAIRE

1. For the purposes of this study, distress is defined as any unwanted emotional state (e.g., angry, sad, scared, anxious, numb). Please rank the overall degree to which you were distressed today.:
 - a. minimally 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 extremely
 - b. What was your highest level of distress today?
minimally 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 extremely
2. How hard did you look for a coping strategy to reduce your distress?
not hard at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 very hard
3. To what degree did you feel hopeful of finding something to do to reduce your distress?
no hope at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 certain of finding a way
4. To what extent did you feel there was sufficient time to search for and consider information and advice to help you find something to reduce your distress?
no time at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 as much time as I needed
5. When searching for a strategy to reduce distress, to what degree do you think your search was frantic and disorganized versus thorough and organized?
frantic/disorganized 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 organized and complete
6. Sometimes people make the decision to engage in a behavior and they may or may not follow through on their decision. What methods did you decide to use to reduce your distress today? Choose all that apply.
 - a. Used alcohol or nonprescribed drugs
 - b. Tried to distract yourself (e.g., music, television)
 - c. Avoided or left the distressing situation
 - d. Tried to suppress thoughts or emotions
 - e. Self-injured without intent to die (e.g., cutting, burning, scratching, striking, biting, pulling hair, or any other injury to external body tissue)
 - f. Talked to somebody for support or help
 - g. Dealt with the distressing situation directly by trying to solve the problem
 - h. Other (please specify): _____

7. Primarily, what did you actually do today to try and reduce your distress? In other words, what was your main method of reducing your distress. Exception: If you used self-injury without intent to die at any time, choose this one.
- Used alcohol or non-prescribed drugs
 - Tried to distract yourself (e.g., music, television)
 - Avoided or left the distressing situation
 - Tried to suppress thoughts or emotions
 - Self-injured without intent to die (e.g., cutting, burning, scratching, striking, biting, pulling hair, or any other injury to external body tissue)
 - Talked to somebody for support or help
 - Dealt with the distressing situation directly by trying to solve the problem
 - Other (please specify): _____
8. How successful was this method at reducing your distress?
not at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 very successful
9. Once you started searching for a way to reduce distress, how long did it take you to identify the strategy that you actually used?
- hours _____
 - minutes _____
10. How hard did you try to isolate yourself (i.e., be alone) to use your coping method?
not at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 very hard
11. Who were you with when you used your coping strategy?
- Alone
 - Friend(s) or peer(s)
 - Family member(s)
 - Stranger(s)
 - Other (please specify): _____
12. If you were with other people when you used your coping strategy, how close did you feel to them?
not close at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 very close
13. How much time passed between when you decided to use the coping method and when you actually did it?
- hours _____
 - minutes _____
14. Did you purposefully hurt yourself (exterior body tissue) today without the intent to die?
Yes No

- a. If yes, what did you do:
- i. Cut or carved your skin
 - ii. Hit yourself on purpose
 - iii. Pulled your hair out (with intent to hurt yourself)
 - iv. Picked at a wound (with intent to hurt yourself)
 - v. Gave yourself a tattoo
 - vi. Burned your skin (i.e., with a cigarette, match or other hot object)
 - vii. Inserted objects under your nails or skin
 - viii. Bit yourself (e.g., your mouth or lip) (with the intent to hurt yourself)
 - ix. Picked areas of your body to the point of drawing blood (with the intent to hurt yourself)
 - x. Scraped your skin
 - xi. "Erased" your skin to the point of drawing blood
 - xii. Other (please specify): _____
- b. If yes, how successful was this strategy in reducing your distress?
not at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 very successful
- c. If yes, how much did you regret it?
not at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 very much

APPENDIX D

TABLES AND FIGURES

Table 1

Means, Standard Deviations, Ranges, and Percentage Endorsed for Functional Assessment of Self-Mutilation Frequency of NSSI in the Past Year (n = 83) and Daily Questionnaire Variables Used in Analyses (n = 1109)

Variable	Mean	Standard Deviation	Range	Percent of daily questionnaires behavior was endorsed
Frequency of NSSI past year	32.57	59.61	0-302	-
Overall Distress	2.95	1.69	0-7	-
Peak Distress	3.42	1.84	0-7	-
Effort in Distress Reduction Search	2.65	1.69	0-7	-
Hope of Finding Distress Reduction	4.21	2.00	0-7	-
Sufficient time to find Distress Reduction	4.22	2.09	0-7	-
Frantic/Disorganized Searching*	4.40	2.00	0-7	-
Decision to Use NSSI to Reduce Distress	.04	.20	0-1	4%
Used NSSI to Reduce Distress	.02	.14	0-1	1.9%
Time Used to Search for Distress Reduction (minutes)	26.72	83.64	0-1440	-
Effort in Isolation to Cope	2.75	1.89	0-7	-
Being Alone to Cope	.47	.50	0-1	-
Time Between Coping Decision and	25.28	85.55	0-1500	-

Implementation
(minutes)

Used NSSI	.04	.18	0-1	3.5%
-----------	-----	-----	-----	------

* Higher scores indicate more organized searching.

Table 2

Frequency and Percent of Coping Behaviors Endorsed on Daily Surveys for Entire Study Sample (n = 1109 surveys)

Coping Behavior	Frequency	Percent
Alcohol or Drugs	22	2
Distraction	255	23
Avoidance (Physical)	135	12.2
Thought or Emotion Suppression	124	11.2
NSSI	21	1.9
Talked to Somebody	195	17.6
Dealt with Situation Directly	223	20.1
Other	131	11.8

Table 3

Coefficients, Standard Errors, Significance, and Effect Sizes for Hypothesis Tests

Hypothesis	Independent Variable	Dependent Variable	γ	<i>SE</i>	<i>p</i>	Effect size*
One	Peak Distress	Search Effort	.10	.006	<.001	
Two	Overall Distress	NSSI Use	.95	.14	<.001	<i>OR</i> = 2.58
Two	Peak Distress	NSSI Use	.88	.15	<.001	<i>OR</i> = 2.41
Three	Time Searching	NSSI Use to Cope	.003	.001	<.01	<i>OR</i> = 1.003
Four	Hope	NSSI Decision	-.29	.13	<.05	<i>OR</i> = .74
Five	Sufficient Time	Vigilance	.49	.04	<.001	
Six	Hypervigilance	NSSI Decision	.72	.15	<.001	<i>OR</i> = .49
Seven	NSSI Decision	Isolation Effort	1.70	.42	<.001	
Eight	Isolation	NSSI Use	1.65	.54	<.01	<i>OR</i> = 5.18

Note. *OR* = Odds Ratio. γ = coefficient. *SE* = standard error. *p* = significance. All hypothesis tests had 85 degrees of freedom.

* Odds ratios of 1.50 are considered small, while 2.50 are considered medium and 4.30 are large.

Table 4

Means, Standard Deviations, Ranges, and Percentage Endorsed for Functional Assessment of Self-Mutilation Function Items and Function Factors for Sample Used in Analyses (n = 83)

Functional Assessment of Self-Mutilation Function Item	Mean	Standard Deviation	Range	Percent of Sample Endorsing Item/Scale
Avoid school, work, or other activities	.35	.70	0-3	25%
Relieve feeling “numb” or empty	.93	1.08	0-3	50%
Get attention	.36	.72	0-3	25%
Feel something, even if it is pain	.92	1.12	0-3	45.8%
Avoid having to do something unpleasant you don’t want to do	.28	.61	0-3	20.8%
Get control of a situation	.88	1.17	0-3	41.7%
Try to get a reaction from someone, even if it’s a negative reaction	.50	.84	0-3	30.6%
Receive more attention from your parents and friends	.32	.78	0-3	18.1%
Avoid being with people	.19	.57	0-3	12.5%
Punish yourself	.94	1.02	0-3	54.2%
Get other people to act differently or change	.35	.82	0-3	18.1%
Be like someone you respect	.13	.41	0-2	9.7%
Avoid punishment of paying the consequences	.08	.33	0-2	6.9%
Stop bad feelings	.86	.98	0-3	52.8%
Let others know how desperate you were	.29	.66	0-3	19.4%
Feel more a part of a group	.13	.44	0-2	8.3%
Get your parents to understand or notice you	.21	.60	0-3	12.5%
Give yourself something to do when alone	.25	.58	0-2	18.1%
Give yourself something to do when with others	.07	.35	0-2	4.2%
Get help	.25	.62	0-3	16.7%
Make others angry	.19	.58	0-3	12.5%
Feel relaxed	.72	1.02	0-3	38.9%

Functional Assessment of Self-Mutilation Function Scale				
Automatic Negative Reinforcement (2 items)	1.79	1.86	0-6	59.7%
Automatic Positive Reinforcement (3 items)	2.58	2.54	0-9	68.1%
Social Negative Reinforcement (4 items)	.90	1.75	0-9	33.3%
Social Positive Reinforcement (12 items)	3.85	5.32	0-24	63.9%
Automatic Negative or Positive Reinforcement	4.38	4.15	0-15	72.2%
Social Negative or Positive Reinforcement	4.75	3.00	0-32	68.1%

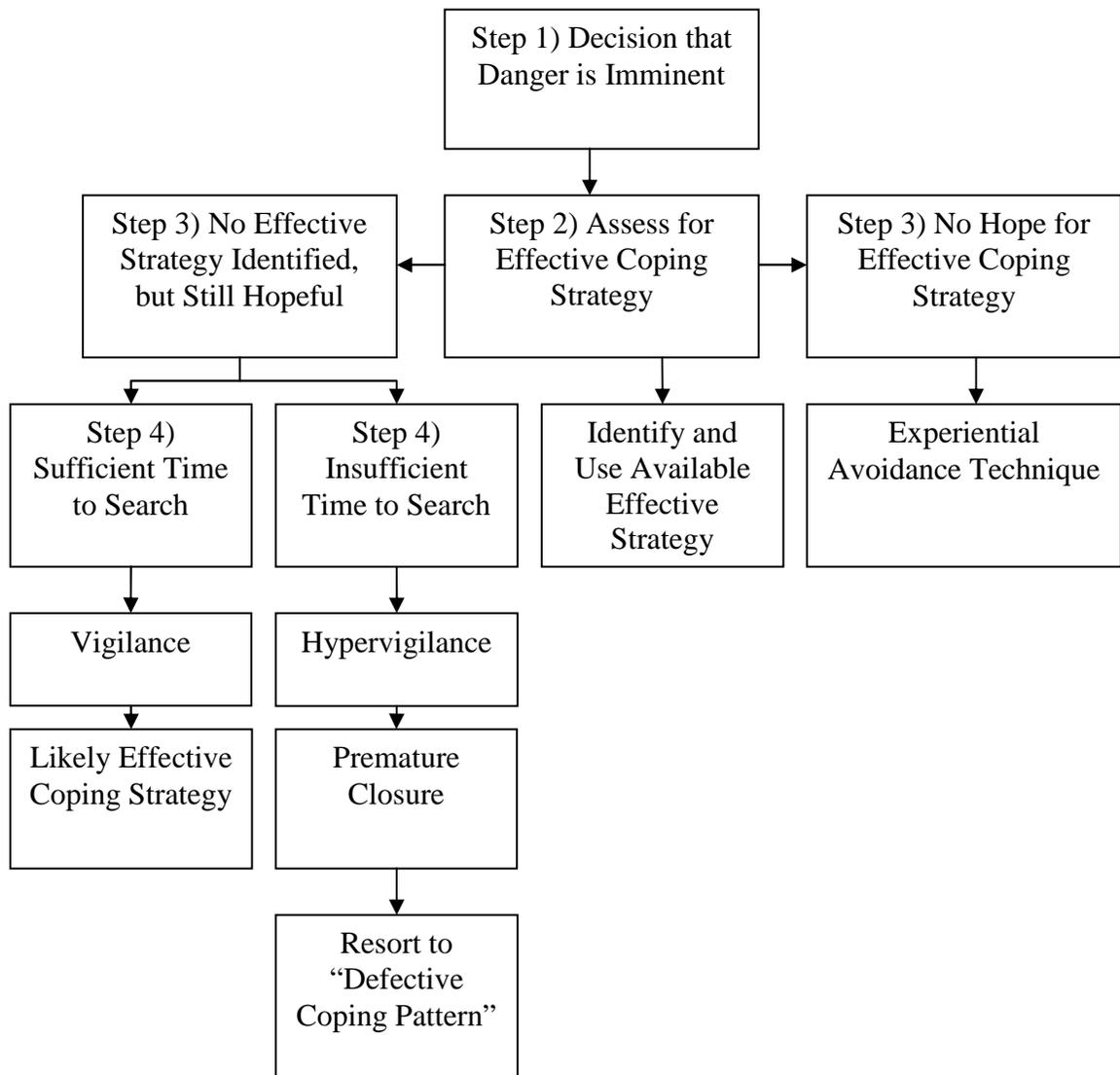


Figure 1. Model of decision making under stress. Adapted from “Decisionmaking: A psychological analysis of conflict, choice, and commitment,” by I. L. Janis, and L. Mann, New York: Free Press.

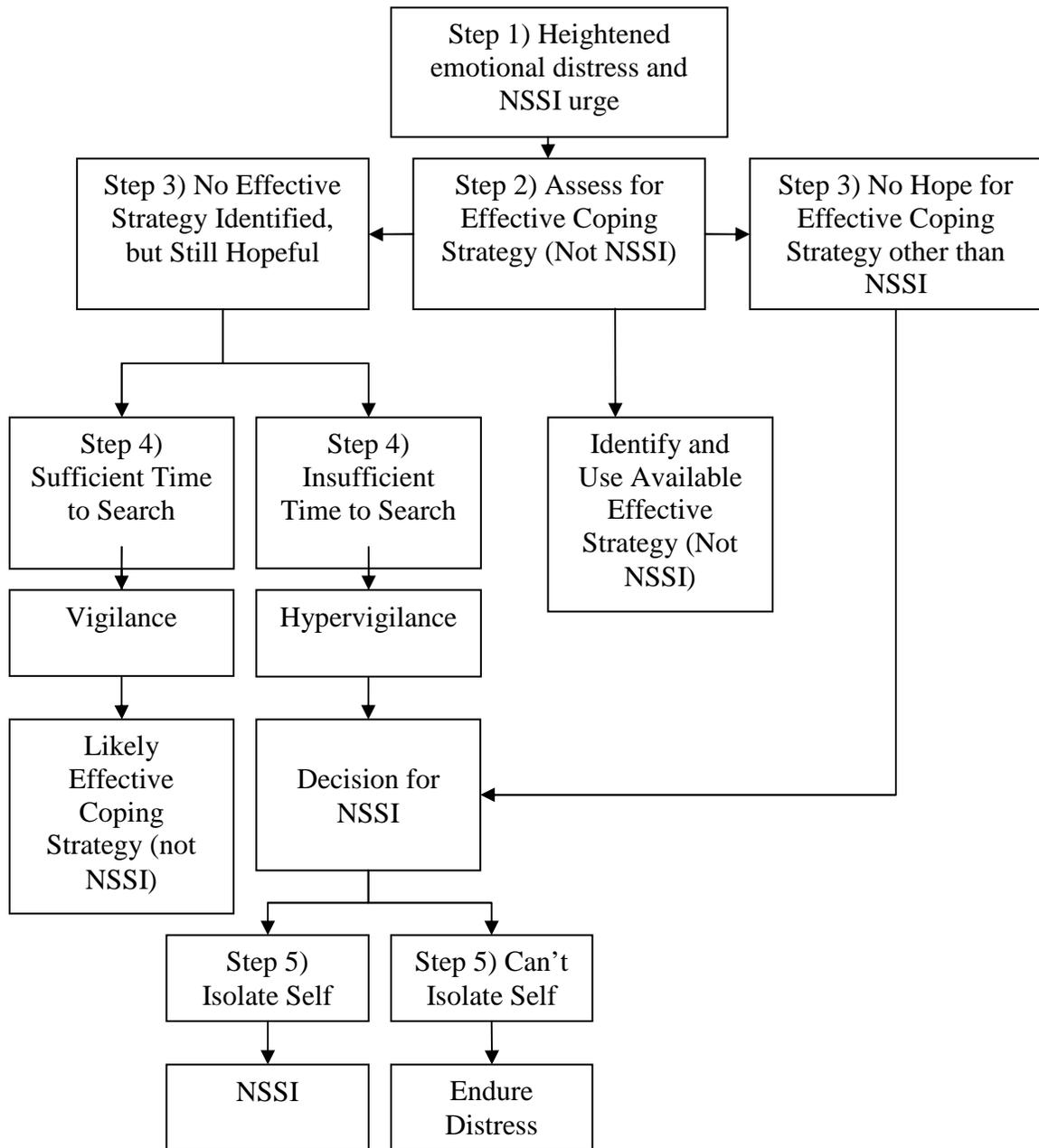


Figure 2. NSSI model of decision making under distress.

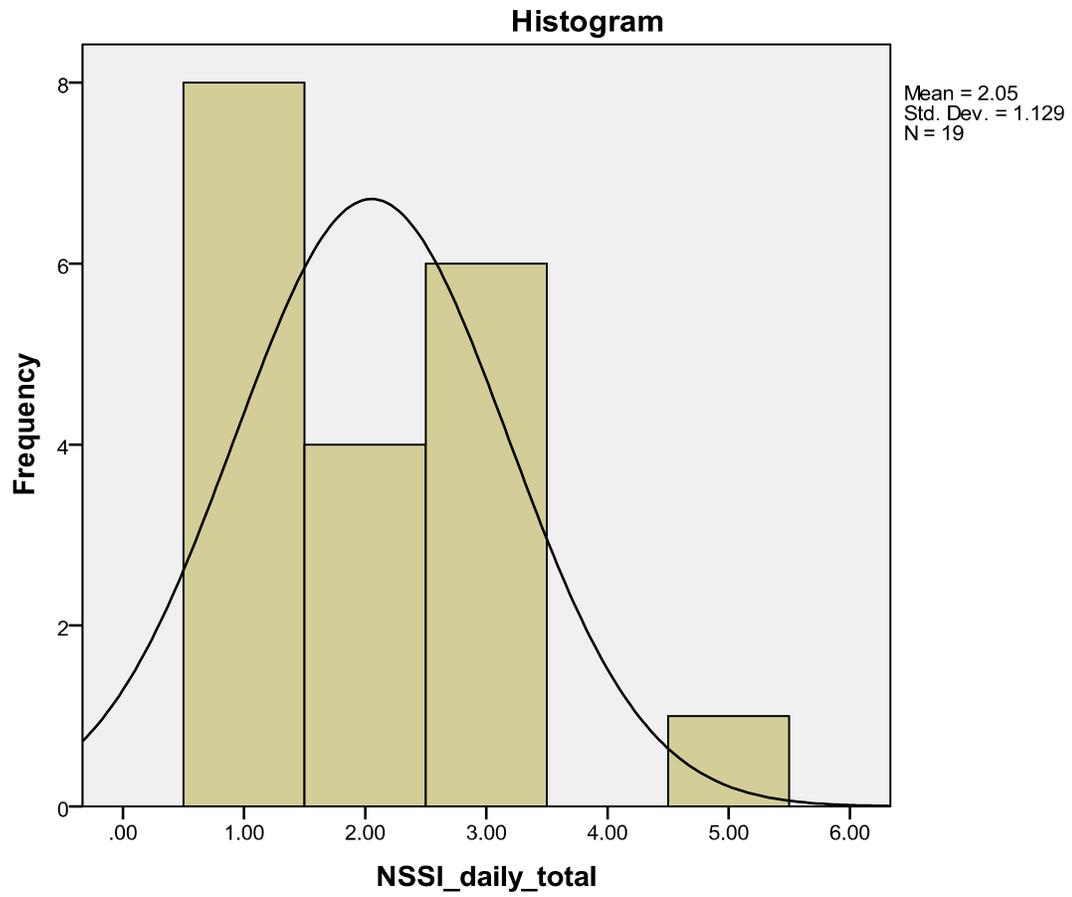


Figure 3. Distribution of daily NSSI use for those endorsing NSSI on daily surveys.

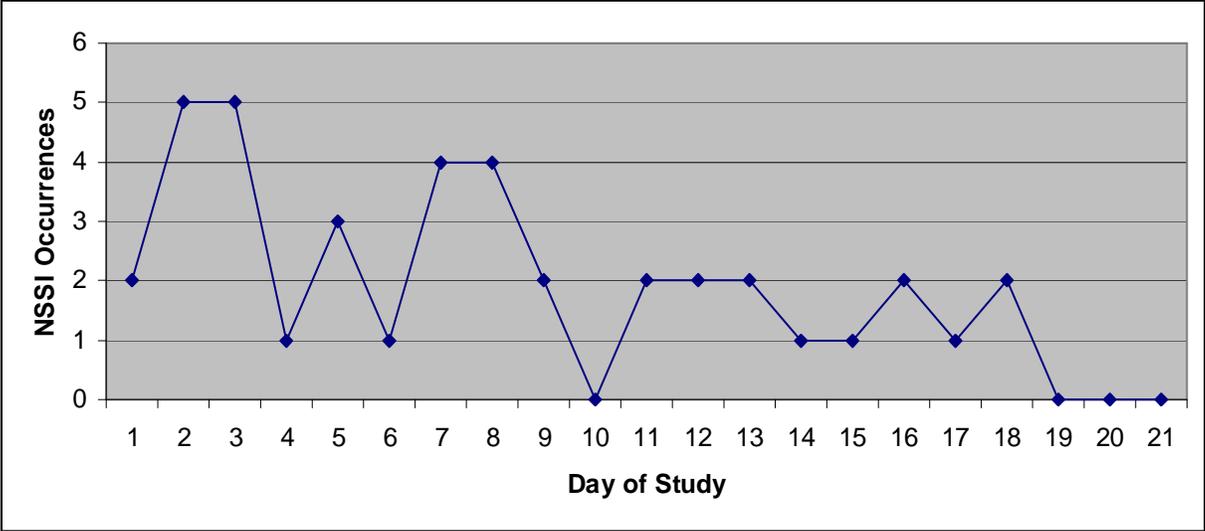


Figure 4. Number of NSSI occurrences for each day of the online survey portion of the study.

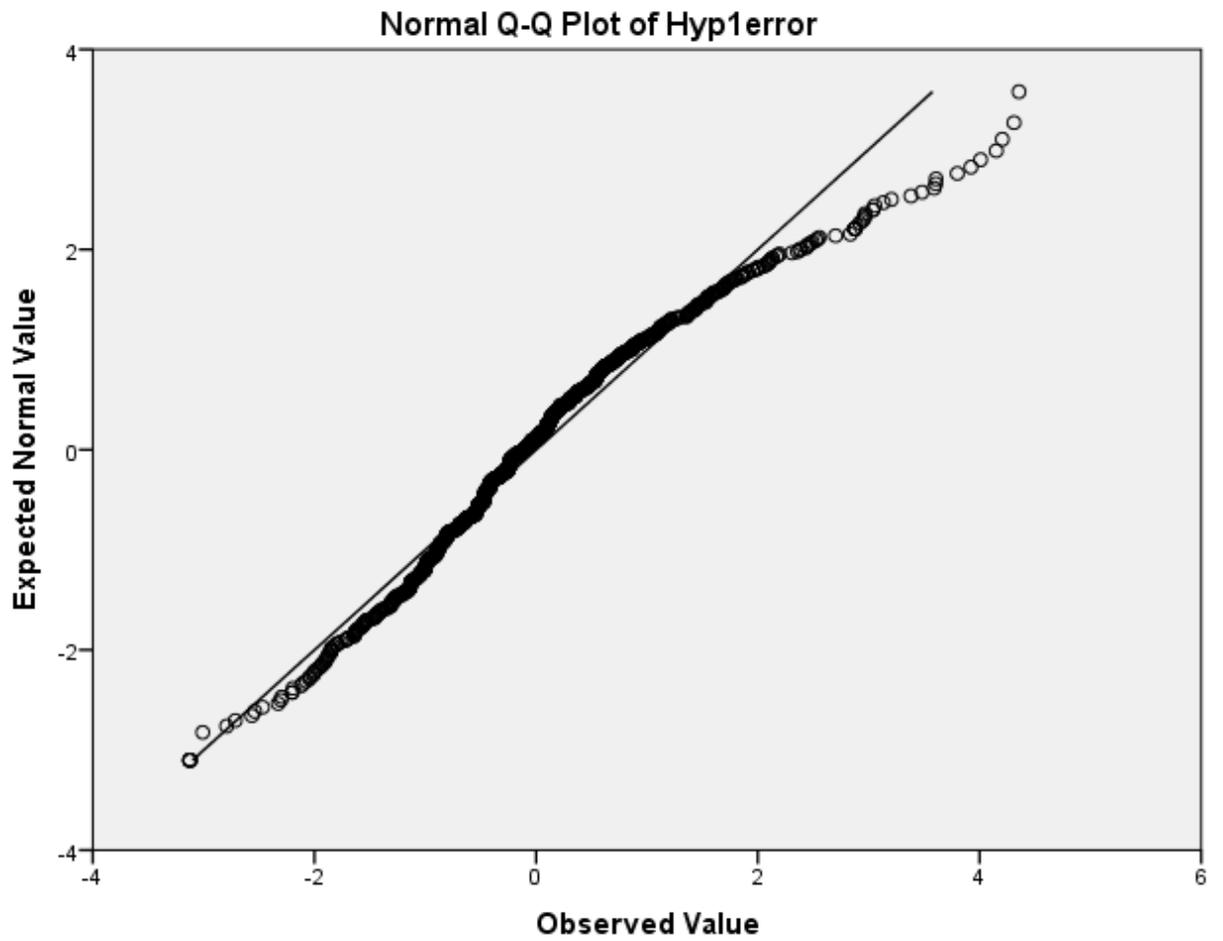


Figure 5a. Q-Q plot of hypothesis 1 (first test) error variances.

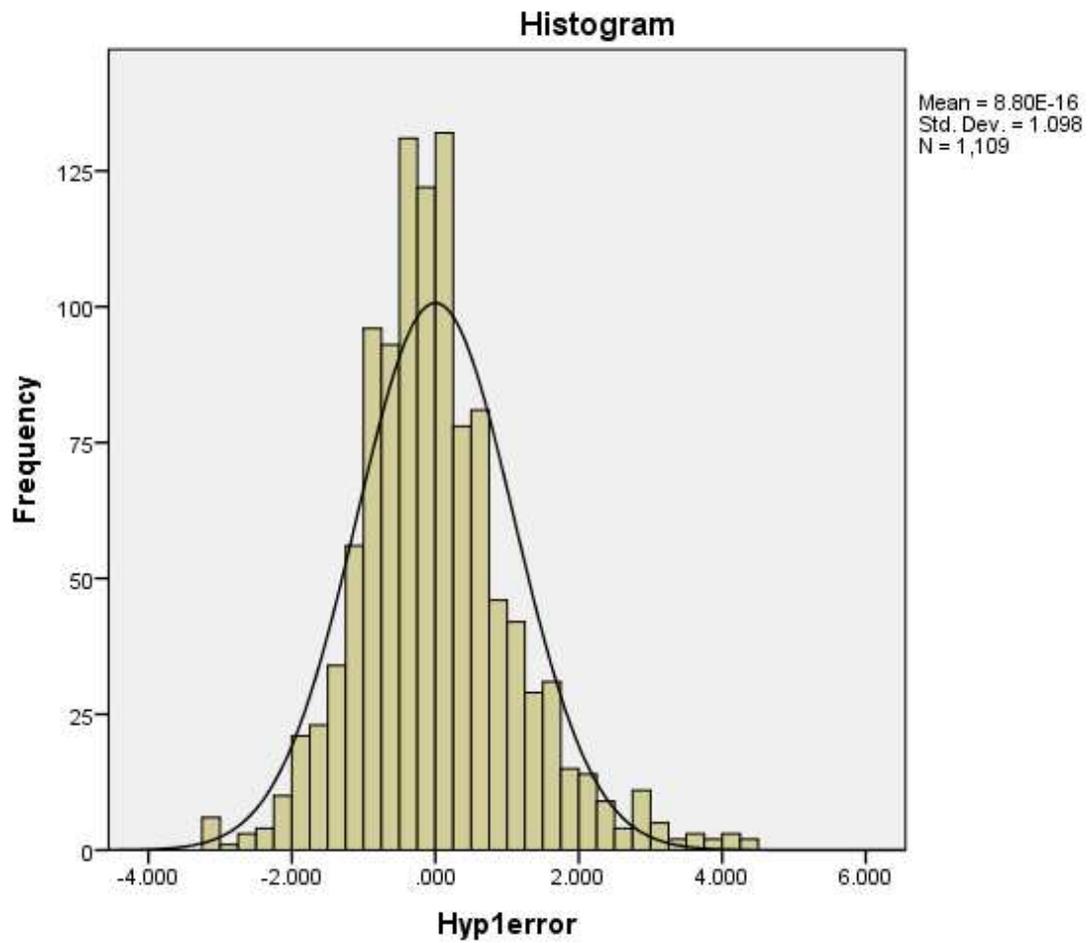


Figure 5b. Histogram of hypothesis 1 (first test) error variances.

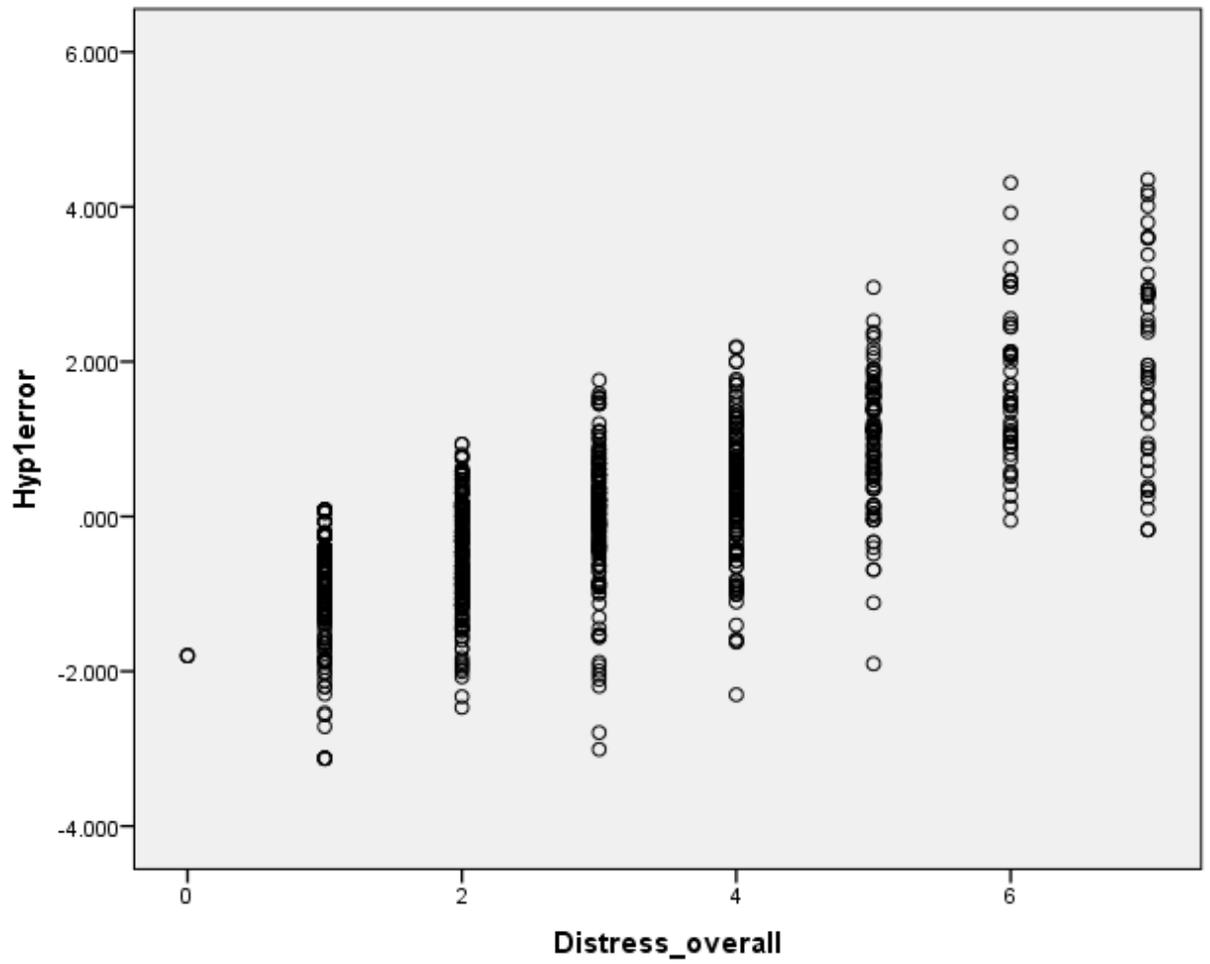


Figure 5c. Scatterplot of hypothesis 1 (first test) independent variable and corresponding error variances.

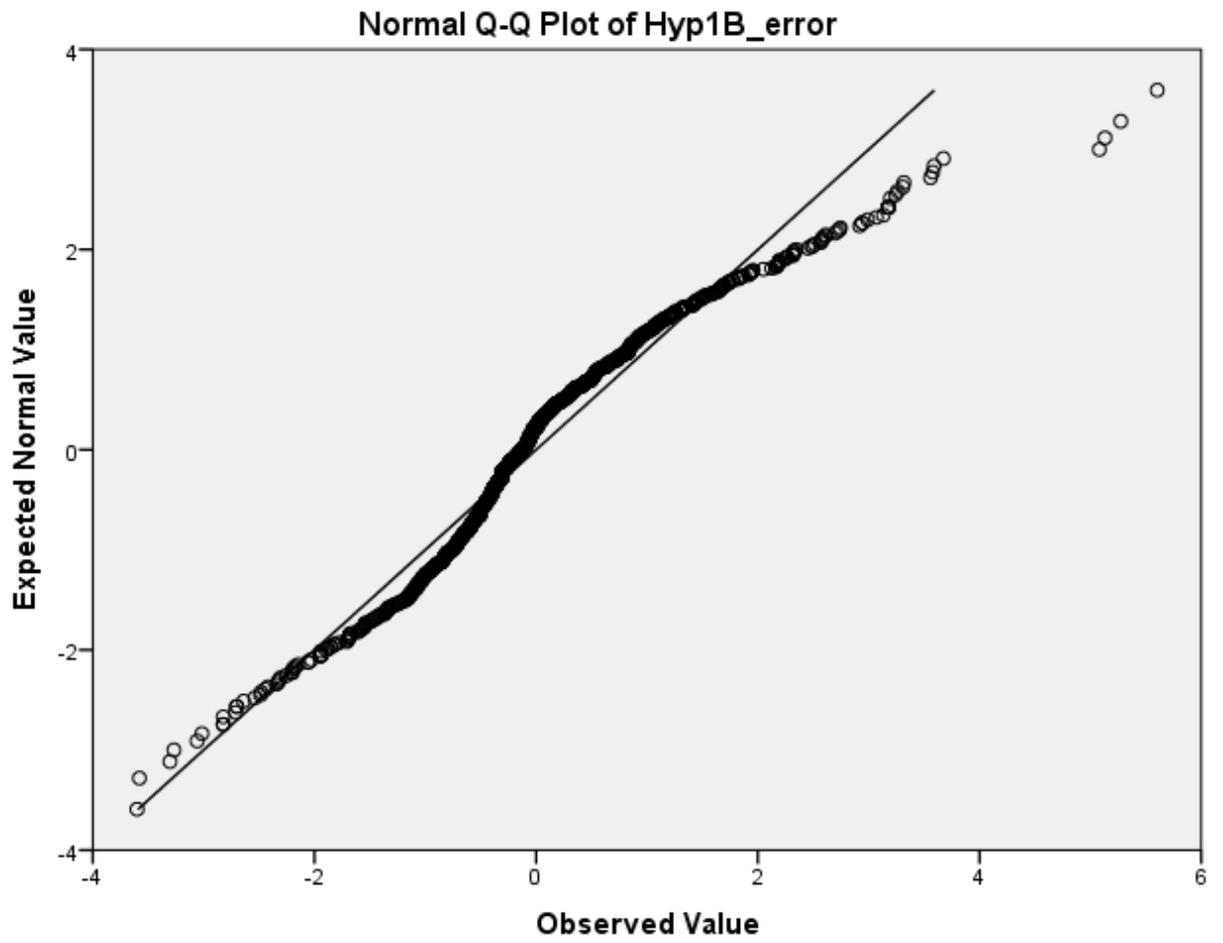


Figure 6a. Q-Q plot of hypothesis one (second test) error variances.

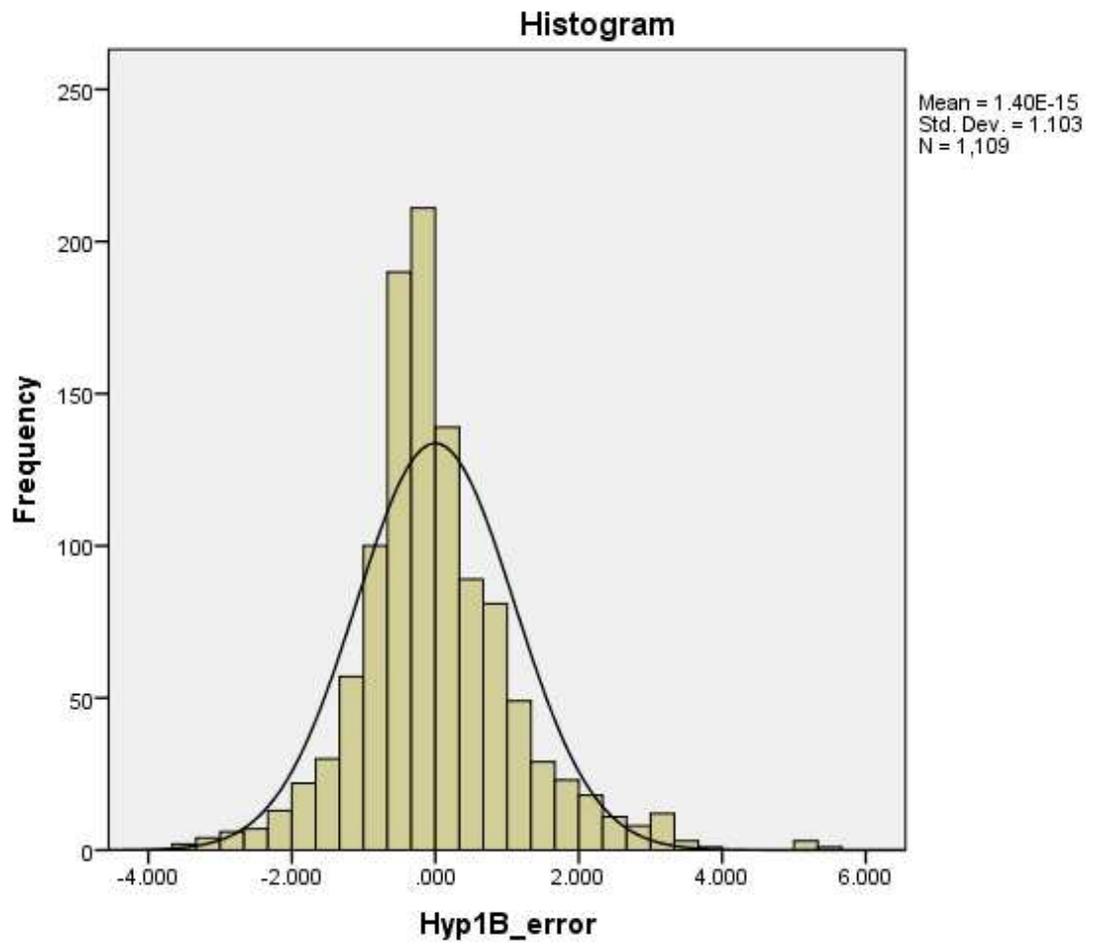


Figure 6b. Histogram of hypothesis one (second test) error variances.

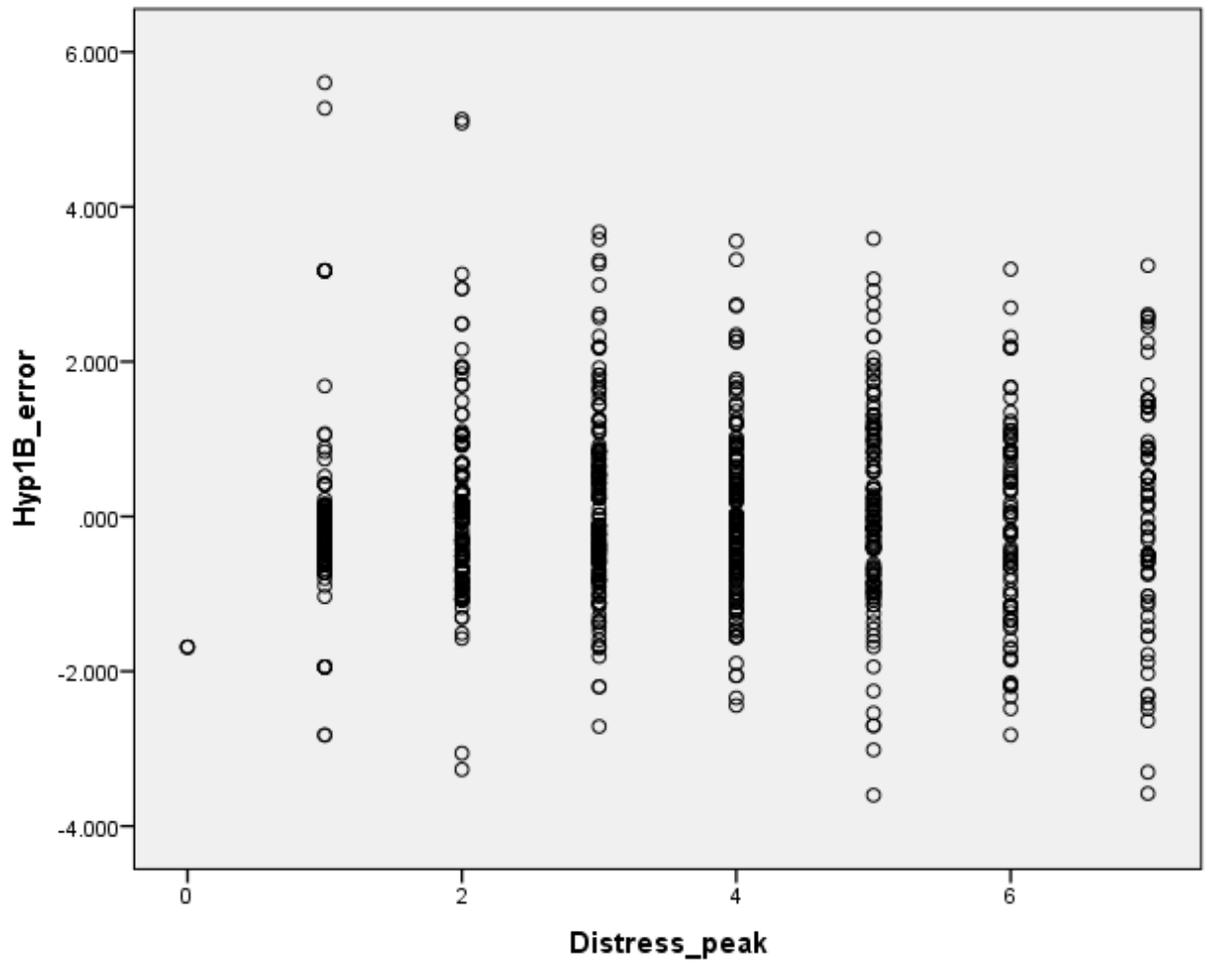


Figure 6c. Scatterplot of hypothesis one (second test) independent variable and corresponding error variances.

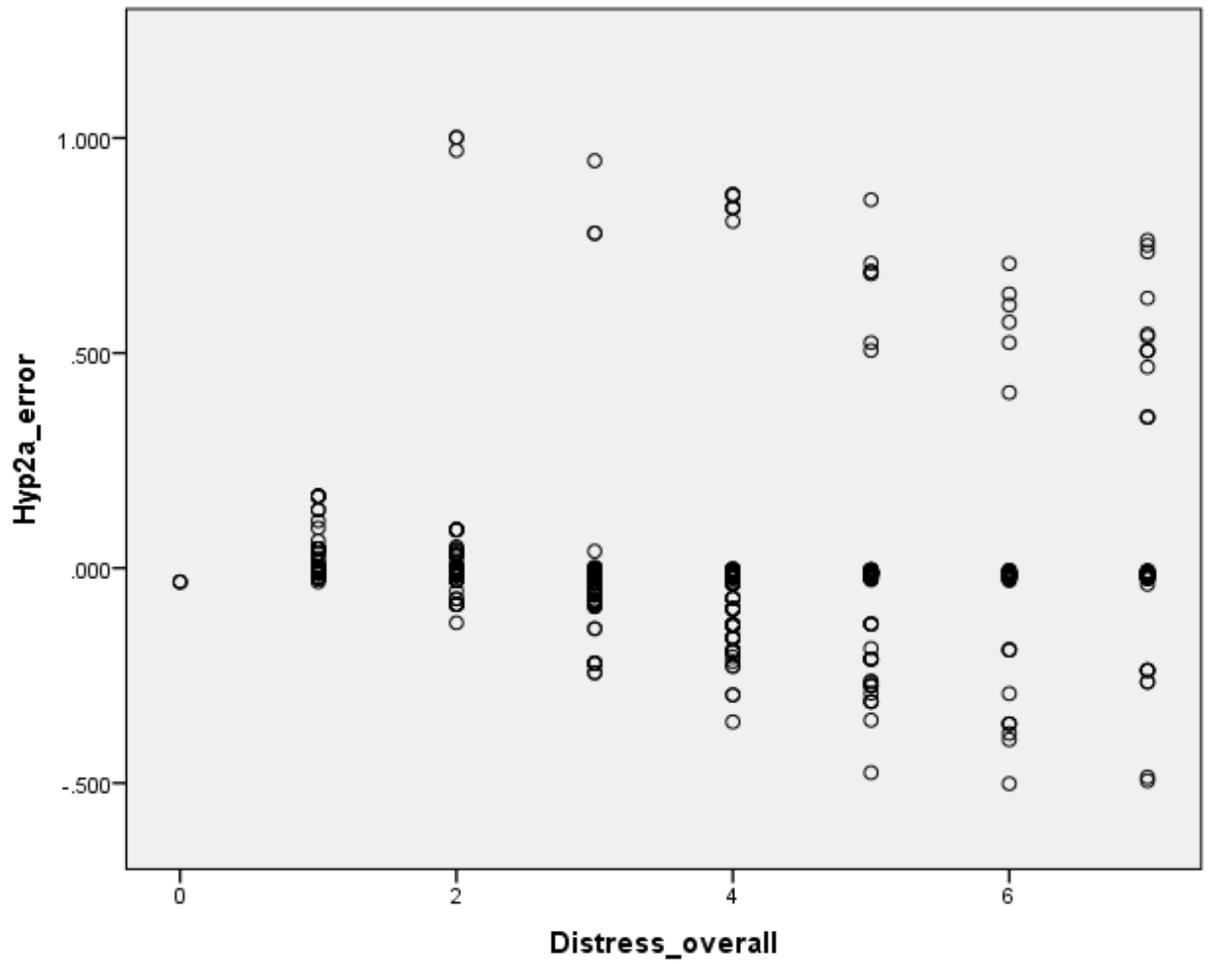


Figure 7. Scatterplot of hypothesis two (first test) independent variable and corresponding error variances.

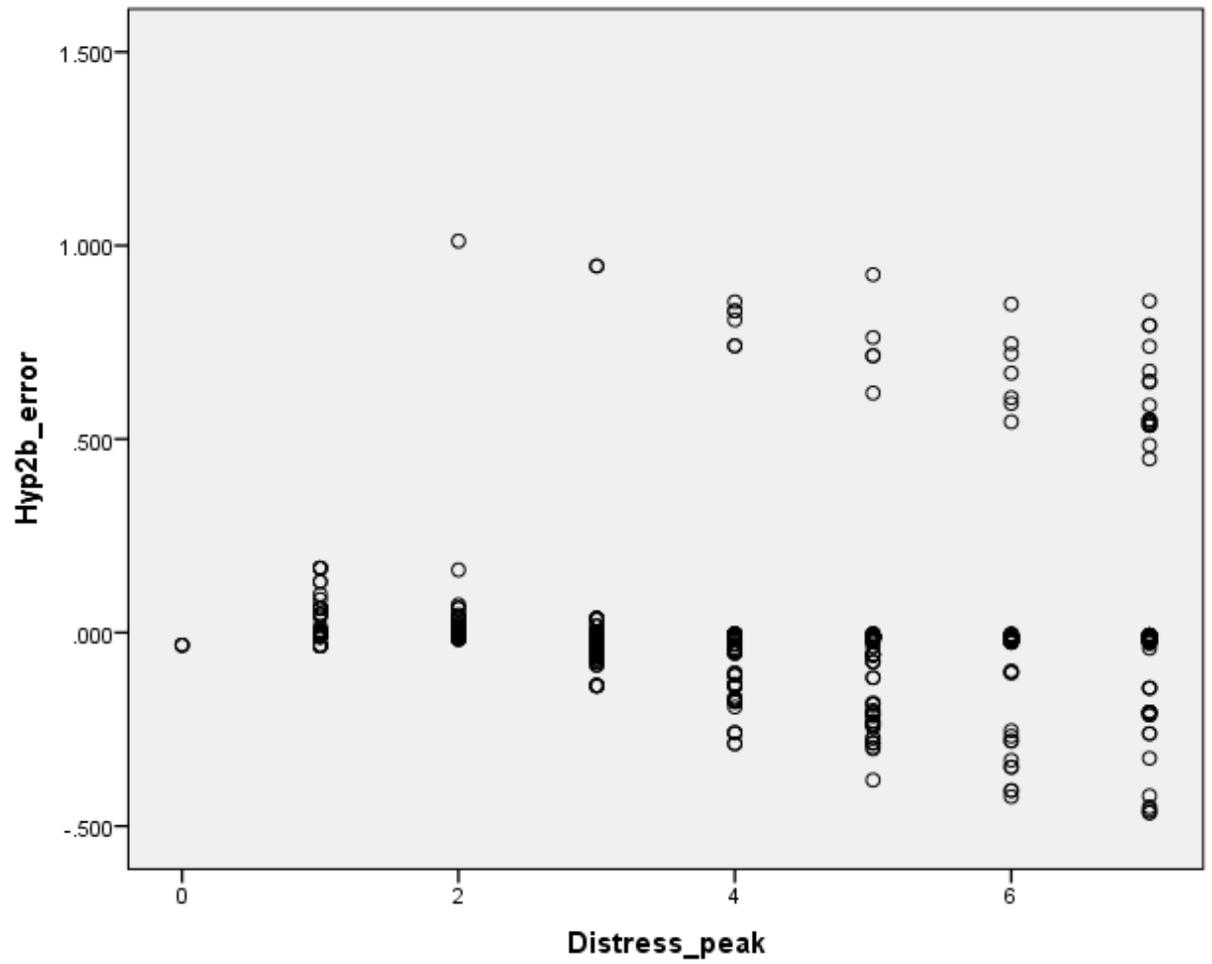


Figure 8. Scatterplot of hypothesis two (second test) independent variable and corresponding error variances.

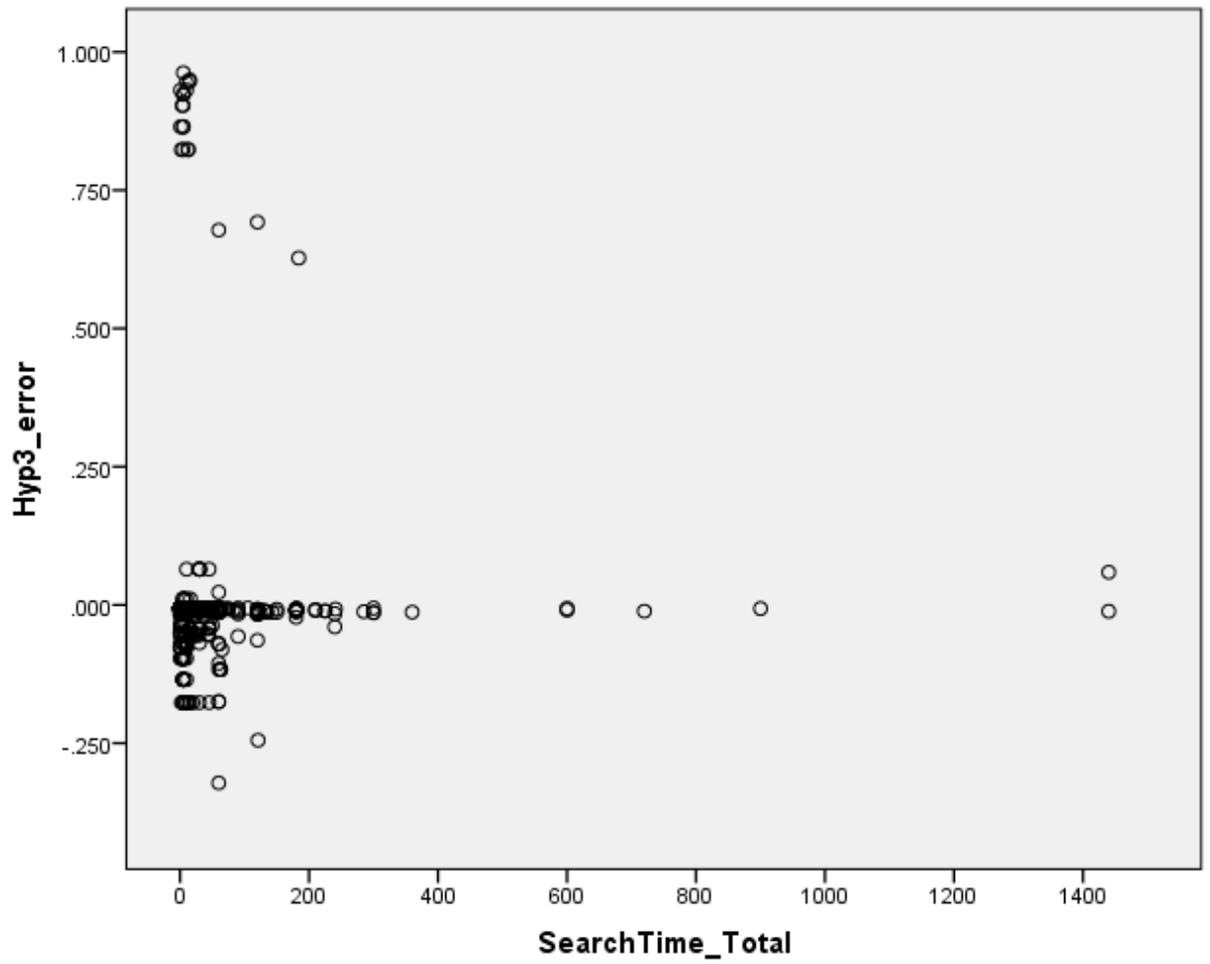


Figure 9. Scatterplot of hypothesis three independent variable and corresponding error variances.

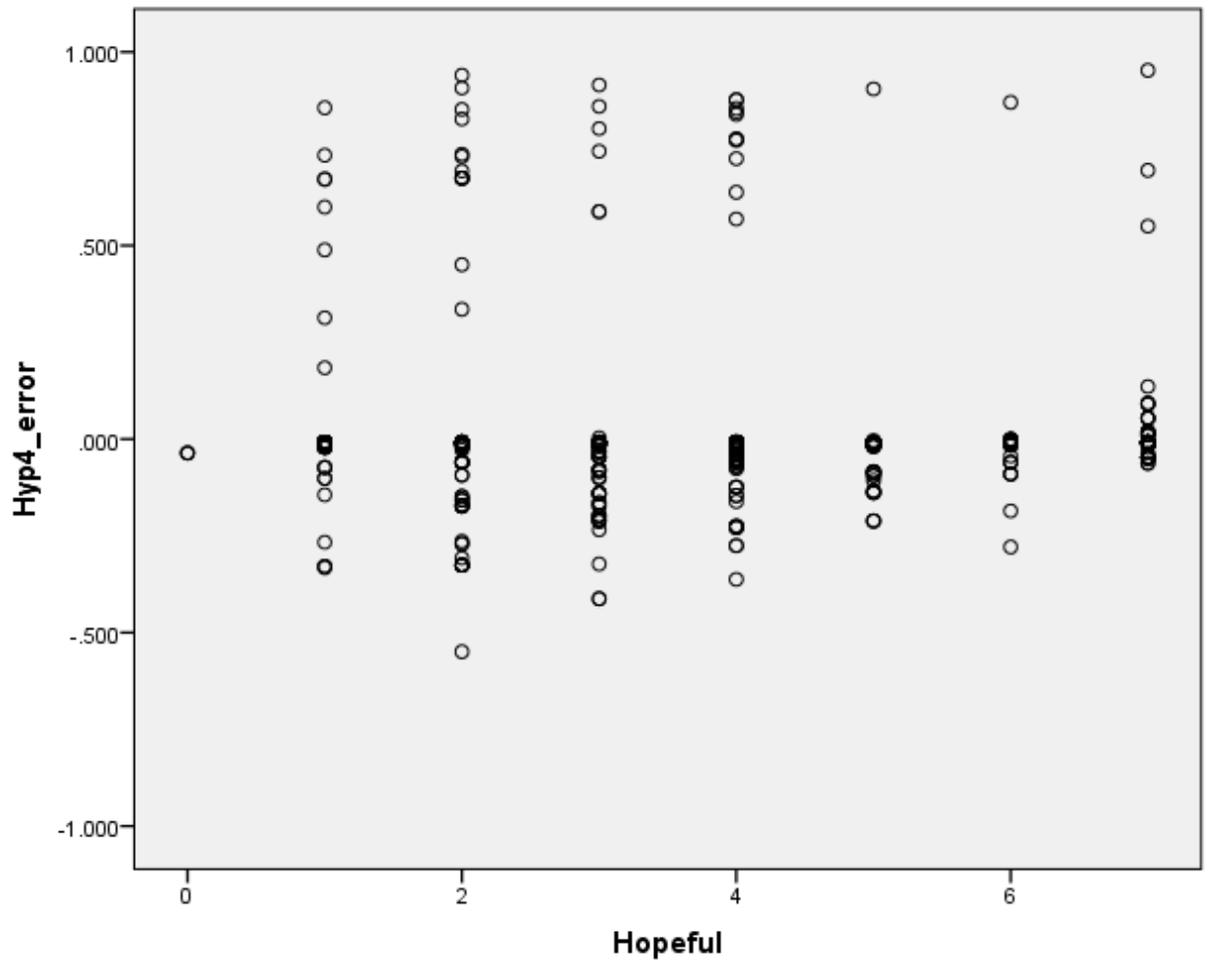


Figure 10. Scatterplot of hypothesis four independent variable and corresponding error variances.

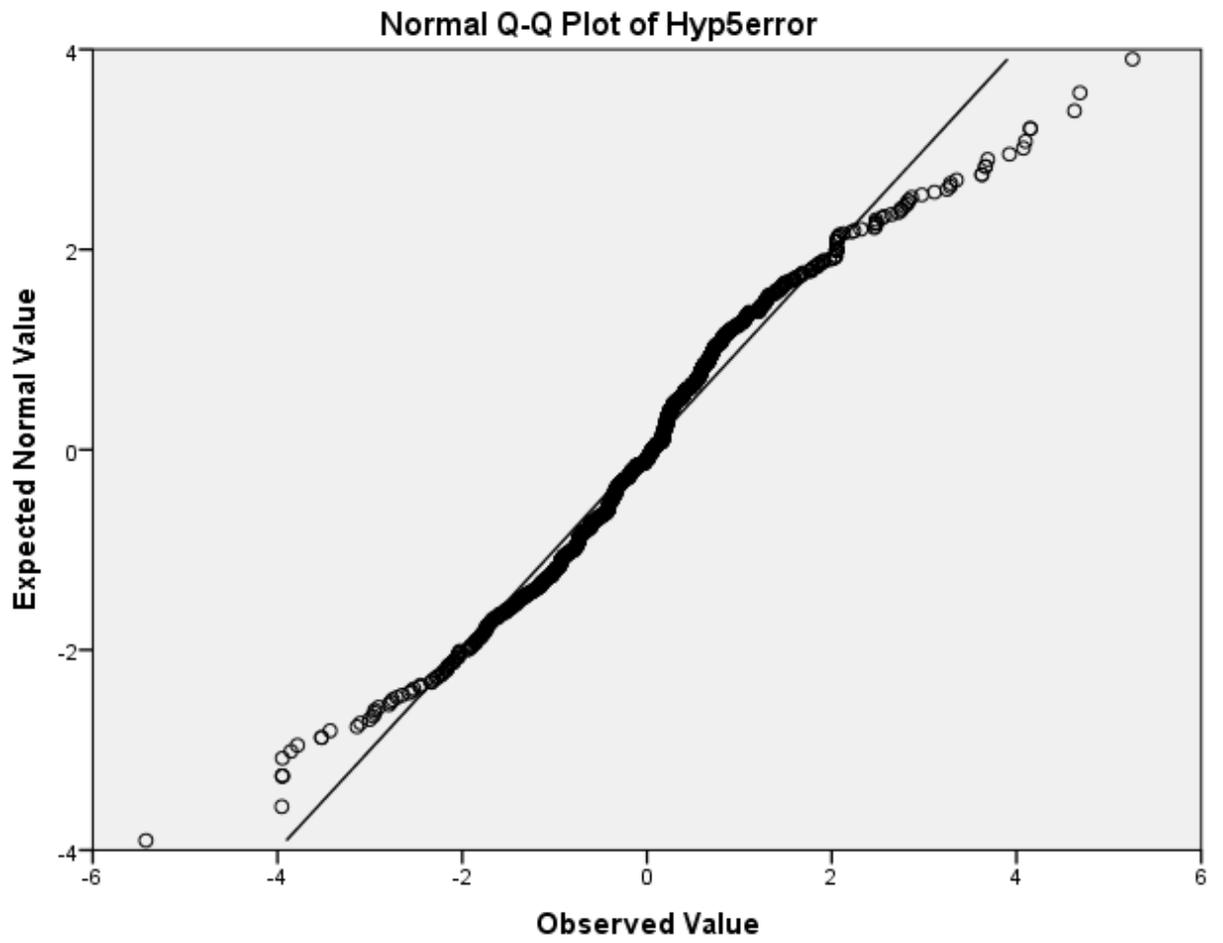


Figure 11a. Q-Q plot of hypothesis five error variances.

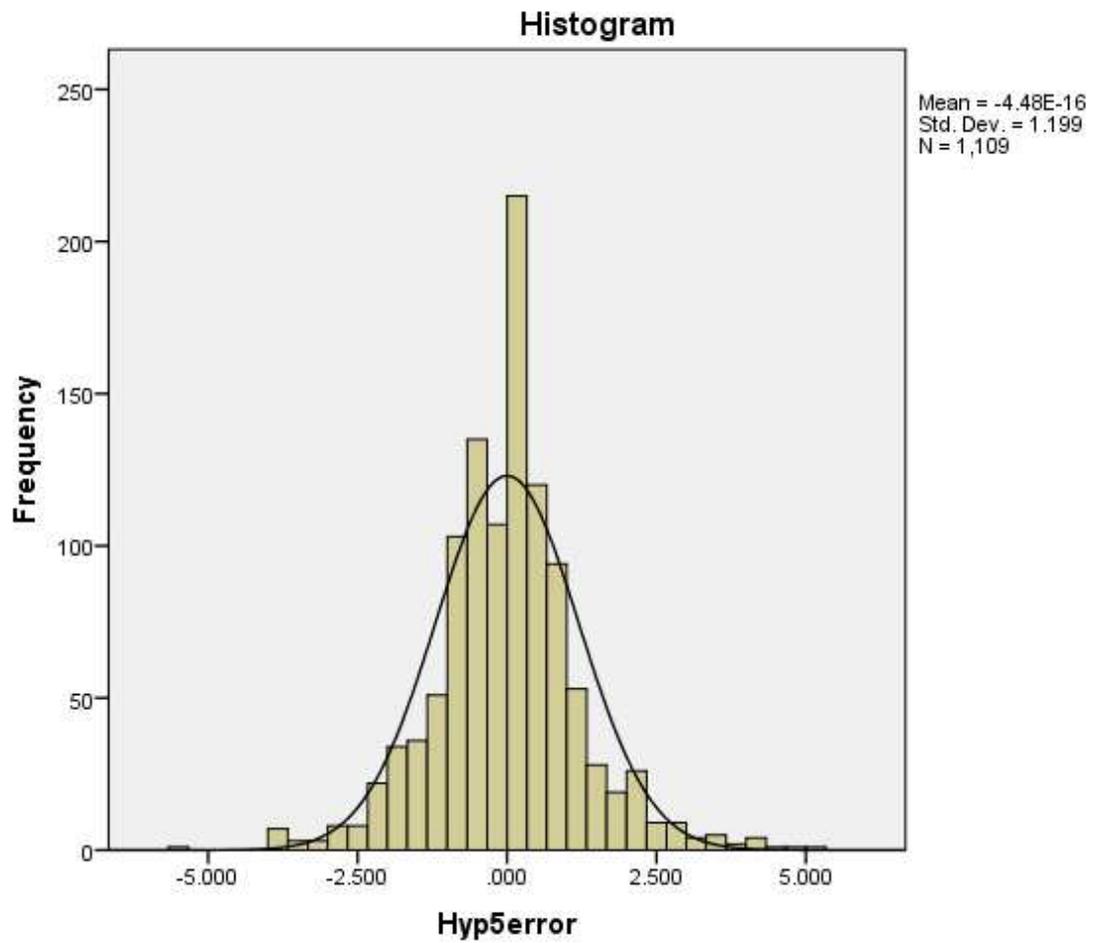


Figure 11b. Histogram of hypothesis five error variances.

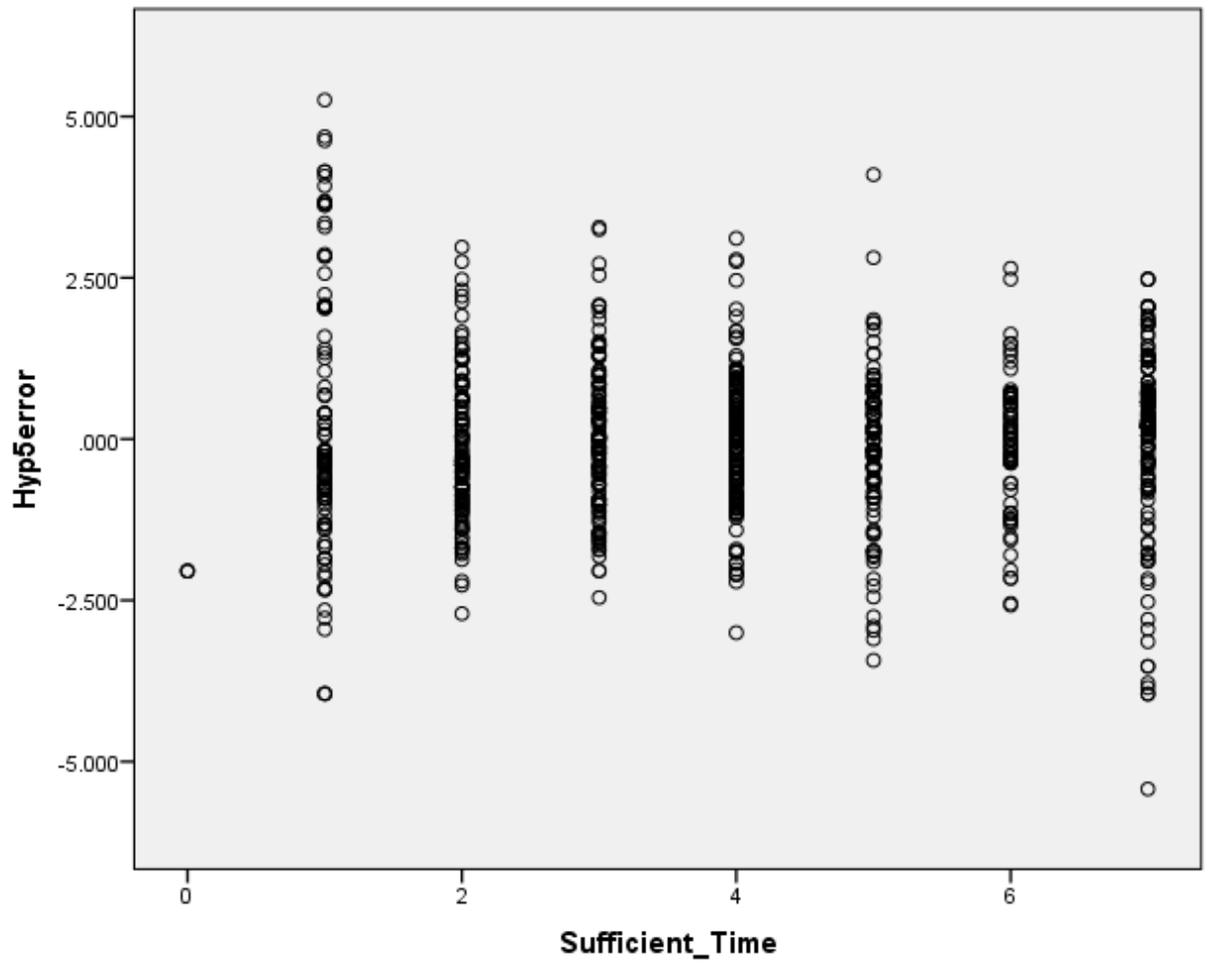


Figure 11c. Scatterplot of hypothesis five independent variable and corresponding error variances.

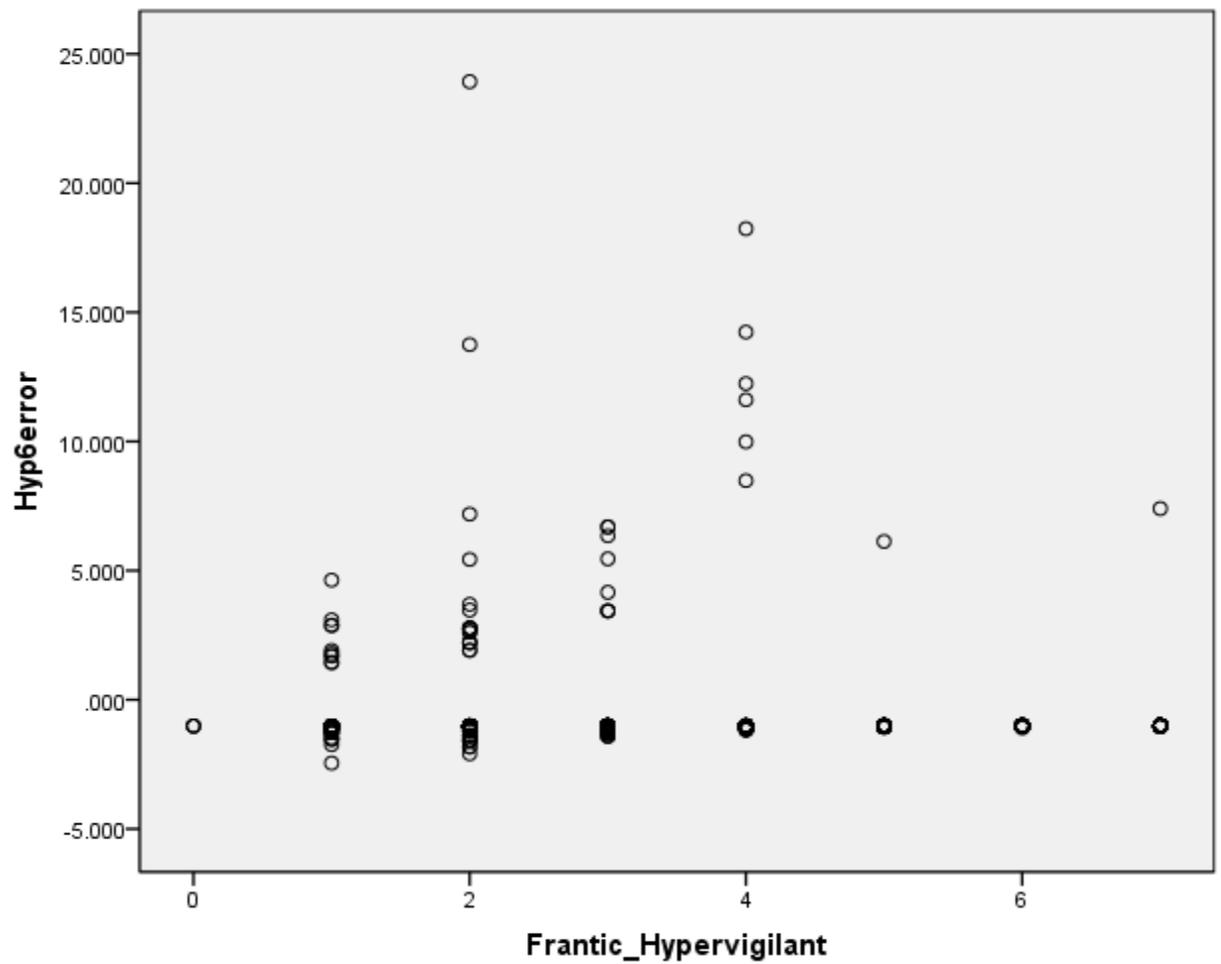


Figure 12. Scatterplot of hypothesis six independent variable and corresponding error variances.

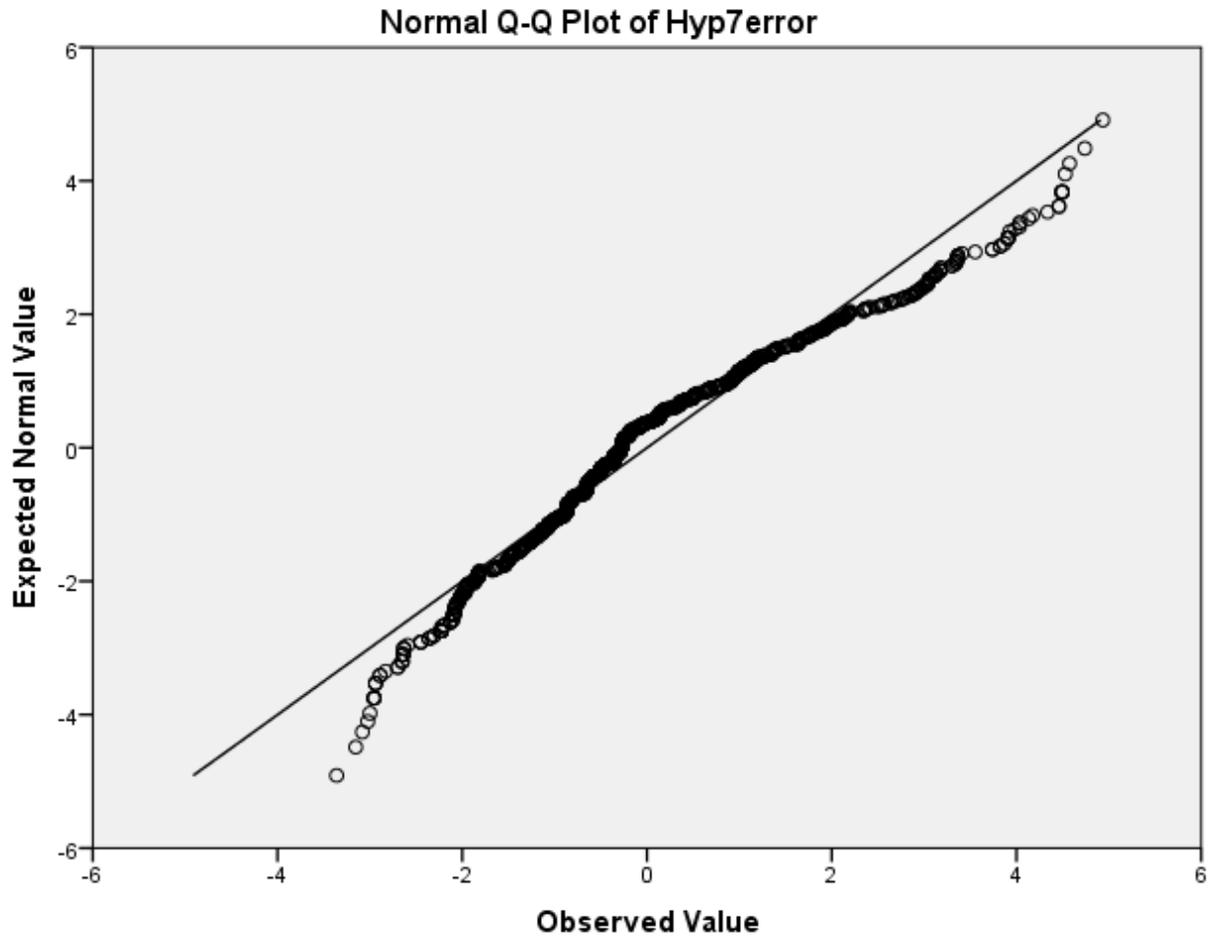


Figure 13a. Q-Q plot of hypothesis seven error variances.

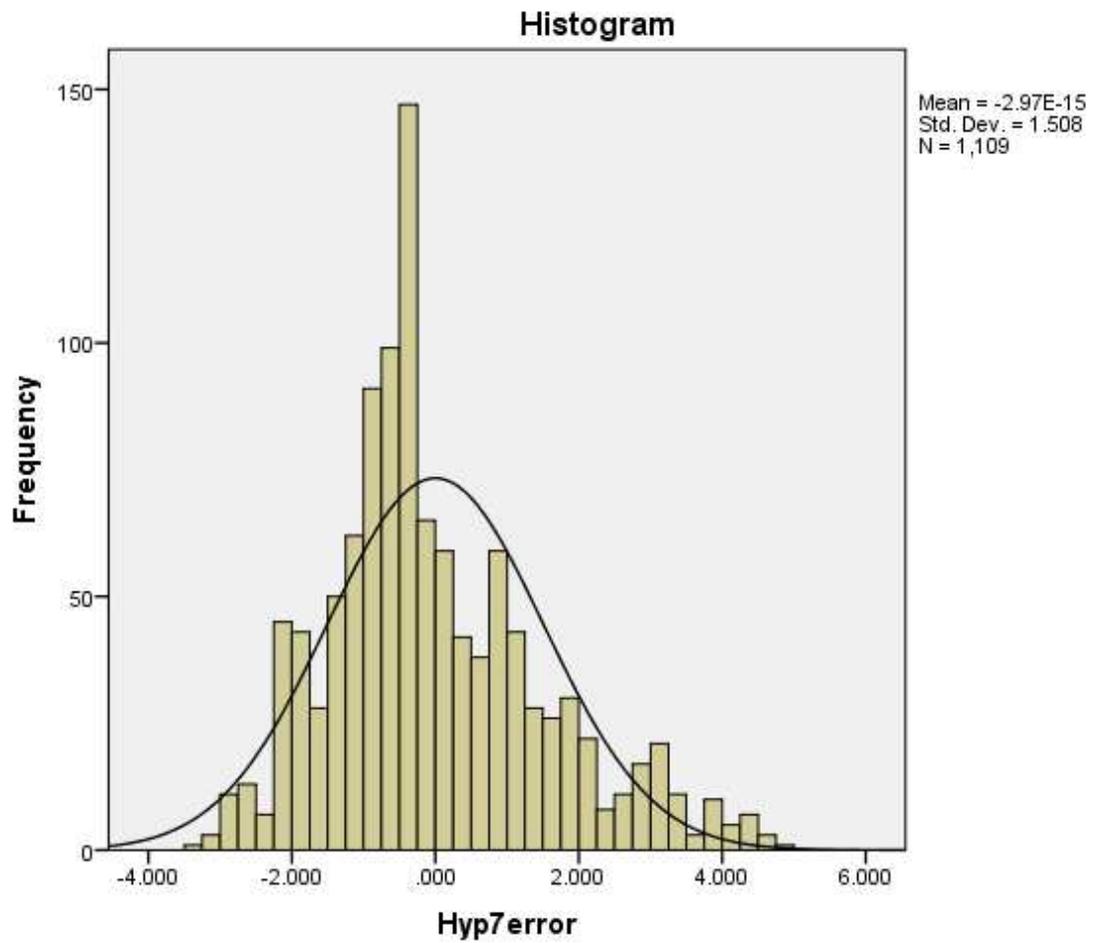


Figure 13b. Histogram of hypothesis seven error variances.

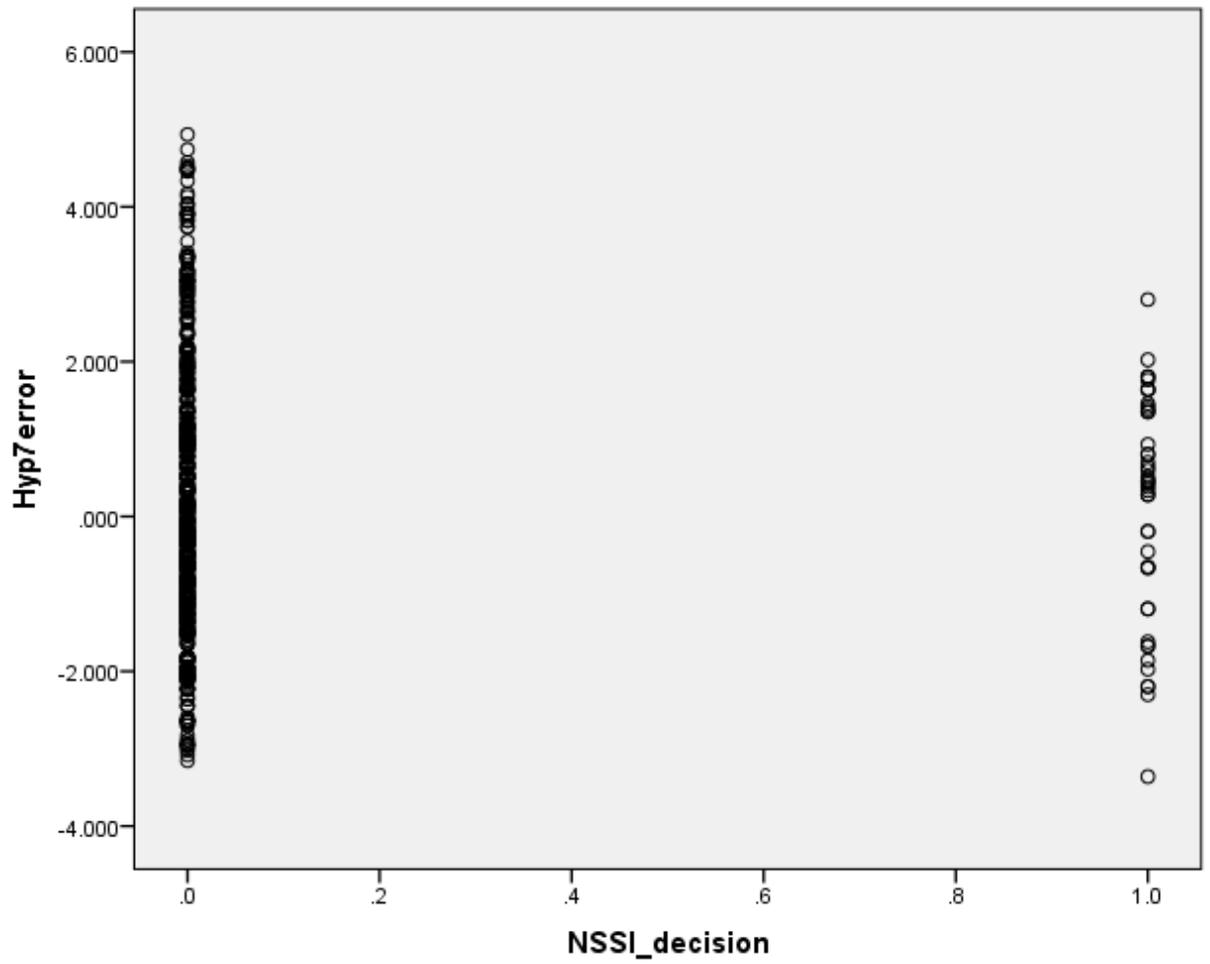


Figure 13c. Scatterplot of hypothesis seven independent variable and corresponding error variances.

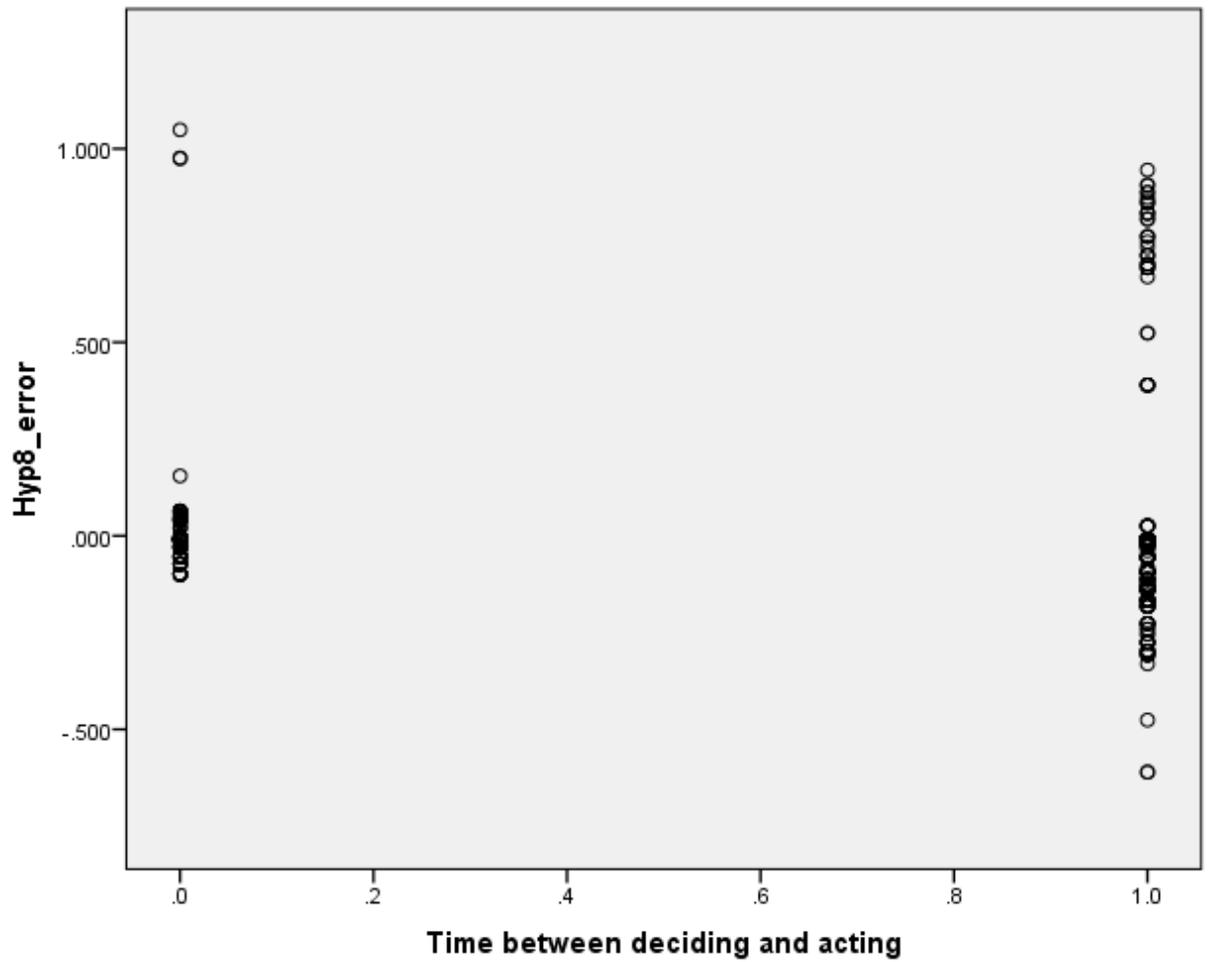


Figure 14. Scatterplot of hypothesis eight independent variable and corresponding error variances.