

COGNITIVE INHIBITION, RUMINATION, AND INSOMNIA IN DEPRESSED
SUICIDE-PRONE INDIVIDUALS

By

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Submitted to the graduate degree program in Psychology and the Graduate Faculty of the
University of Kansas in partial fulfillment of the requirements for the degree of Doctor of
Philosophy.

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Abstract

The overall goal of this investigation was to broaden our understanding of suicidality among those with depression. Specifically, I sought to clarify the relationship between rumination, cognitive inhibition, insomnia, and suicidal ideation. Prior research has shown that suicide is highly correlated with rumination, cognitive inhibition deficits, and insomnia. Yet, although various studies have examined these factors individually, little information exists regarding possible associations between these constructs within suicidal individuals. Given that these constructs are related to both depressive and suicidal phenomenon, it is important to consider how these factors may interrelate in order to gain a better understanding of the potential mechanisms which lead to suicidality.

The aims of the present study were to: (1) examine whether cognitive inhibition deficits exist among those with suicidal ideation; (2) test the hypothesis that rumination mediates the relationship between cognitive inhibition deficits and suicidality; (3) examine whether insomnia serves as a moderating variable in the relationship between cognitive inhibition and suicidality; (4) expand previous research by directly comparing three suicidal mental states (i.e., suicidal ideation, suicidal attempts, and the combination of both); and (5) examine the variables of interest in a more precise sample of suicidal individuals than currently present in the literature.

The results indicated cognitive inhibition deficits and an affective bias for negative stimuli among both of the groups with current suicidal ideation. Furthermore, it was hypothesized that the relationship between cognitive inhibition and suicidal ideation would be mediated by depressive rumination, and moderated by insomnia severity. Two moderated

mediation path models were evaluated using Structural Equation Modeling. Contrary to expectations, the results did not indicate that there was a good fit between either model and the data. However, individual path analysis revealed that insomnia partially mediated the relationship between cognitive inhibition and rumination. Clinical implications and suggestions for future research are also discussed.

Acknowledgements

First, I would like to offer a special thanks to my advisor, Dr. Rick Ingram for all that he's done over the course of my graduate career. Without your guidance and support, this would not have been possible. I would also like to express my sincerest gratitude to each of the faculty members on my dissertation committee, Drs. Ruth Ann Atchley, Nancy Hamilton, Sarah Kirk, and Margaret Severson.

In addition, I would like to thank all of my family and friends for providing me with unwavering love and support. Finally, I would like to thank my partner, Craig Lane. Your patience, support, and commitment have been outstanding, and I am so grateful to have you in my life.

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Cognitive Inhibition, Rumination, and Insomnia in Depressed Suicide-Prone Individuals

Suicidal thoughts, intentions, and actions are considered among the most serious and concerning consequences of all psychological illnesses. In fact, suicide is the tenth leading cause of death among Americans (Anderson & Smith, 2003; CDC, 2014; Kessler, Borges, & Walters, 1999) and costs an estimated \$35 billion annually in medical costs and productivity losses (Corso et al., 2007). Suicide often generates considerable hardships as well. Whereas chronic suicidal ideation creates immeasurable suffering for the individual, suicide completion can leave families and communities with significant burdens. Therefore, many prominent health organizations have highlighted the need to further our knowledge of suicidality and stated that the reduction of suicide is a significant public health priority for the United States government (CDC, 2010; US Department of Health, 2012; US Public Health Service, 1999; World Health Organization, 2012).

Although suicide completion represents the apogee of self-harming behaviors, suicidality is believed to exist on a continuum which also includes suicidal ideation and nonfatal attempts (Sher, 2004). With regards to ideation, an estimated 8.5 million adults experience suicidal thoughts during the course of a year. Of these individuals, it is estimated that 2.2 million generate an actual suicide plan (CDC, 2014; Crosby, Han, Ortega, Parks, & Gfoerer, 2011). In addition, research suggests that for every suicide there are an additional 20-25 suicide attempts that occur. Thus, in 2012 alone, an estimated one million U.S. adults reported making a suicide attempt (CDC, 2014).

It should be noted, that significant gender disparities exist with regard to frequency, methods, and outcomes for a broad range of suicidal behaviors. Across most countries, women

have higher rates of suicide ideation than men and are more likely to attempt suicide (CDC, 2010; Moscicki, 1994; World Health Statistics Annual, 1996). Yet, suicide completion rates among men are four times higher than among women, with men comprising approximately 80% of all suicides (CDC, 2010; Moscicki, 1994). It has been argued that the more lethal suicidal behaviors of men are what accounts for the observed discrepancies in the rates of suicide completion. Specifically, the most commonly used method in male suicide attempts is firearms, whereas pill poisoning is the most commonly used method among females (Callanan & Davis, 2012; CDC, 2010). Research has also demonstrated that women typically score higher on measures of suicidality that overlap with depression assessments, thus making it more likely that clinicians will identify at-risk females prior to a suicide attempt and/or completion (Langhinrichsen-Rohling, O'Brien, Klibert, Arata, Bowers, 2006). In addition to rate differences, longitudinal studies also suggest that different risk factors predict suicidal behavior among high-risk men and women (Boeninger, Masyn, Feldman, & Conger, 2010; Oquendo et al., 2007). Therefore, it is crucial, perhaps particularly for men, that research attempt to identify risk factors for suicidality. Furthermore, given the widespread and serious nature of this phenomenon, research aimed at understanding and reducing the incidence of suicide is of considerable importance. For these reasons, the overall goal of this investigation was to broaden our understanding of suicidality by attempting to clarify the relationship between various suicidal risk factors. In addition, although suicide is a problem for a wide variety of psychological illnesses, the current study will specifically focus on suicidality among those with depression.

Theoretical Models of Suicidality

Several different theories have been offered as possible explanations of suicidality. Early suicide research is often said to have begun with Morselli's (1881) book on suicide comparisons, and Durkheim's (1897) proposal that low social integration is a driving force for the development of suicidality following an examination of government death records. Even Freud (1914) offered his views on this phenomenon, suggesting that suicide stems from unconscious and repressed tendencies and can be thought of as anger turned inwards. However, it was arguably Edwin Shneidman, often considered to be the father of modern suicide work, who attempted to provide the first comprehensive theory for suicide. He argued that suicide results from personal dislike, a restricted mental focus, a disturbed state of mental functioning, and the perception that there is nothing that can be done to ease the pain (Shneidman, 1976). Shneidman went on to expand this psychological theory of suicide, proposing that some individuals experience intense emotional pain, which he called "psychache," that comes about as a result of unmet psychological needs (Shneidman, 1993). Specifically, these psychological needs include constructs such as achievement, autonomy, social affiliation, and feelings of love and self-acceptance. In Shneidman's Theory of Psychache, he also posited that individuals possess differing thresholds for psychological pain and that the individual may choose suicide if his or her subjective level of psychache is deemed to be intolerable. Thus, it is this psychache that causes suicidality.

Likewise, a similar theory has stressed the importance of psychological pain and of suicide representing a conscious choice. Baumeister (1990) proposed that suicide allows for an "escape from the self" and suggested that there are six stages which lead to the formation of suicidality. Baumeister (1990) posited that when people experience failures that do not meet their

expectations, they may attribute these negative outcomes to themselves, leading to feelings of inferiority or incompetency. In turn, this may then lead to dysfunctional cognitive states and reduced behavioral inhibition, which ultimately lead to the decision to escape painful feelings and life problems through suicide. As such, this escape theory emphasizes psychological needs such as achievement and the avoidance of shame. Interestingly, through his escape theory, Baumeister (1990) has offered an explanation for what moves an individual from suicidal ideation to actual suicidal completion or attempts. That is, behavioral disinhibition allows a person to overcome any thoughts about repercussions and/or fears about causing physical pain and thus represents that stage of “finality.” Baumeister’s escape theory and Shneidman’s Theory of Psychache are consistent in sharing ideas about cognitive distortions and in viewing suicide as an escape from mental pain.

Other researchers have proposed theories that have primarily relied on cognitive approaches. In general, such theories propose that suicidal ideations and behaviors may be understood through the consideration of individuals' cognitive processes and vulnerabilities. In other words, individuals turn to suicide primarily because of the way they think. Cognitive vulnerabilities to suicide are then said to be “...faulty beliefs, cognitive biases, or structures that are hypothesized to set the stage for later psychological problems when they arise” (Riskind & Black, 2005, p. 122).

Perhaps the most widely recognized cognitive model for suicide is that of Beck, Brown, Berchick, Stewart, and Steer (1990) who translated many of Beck’s ideas from depression into the realm of suicidology. In particular, they suggested that through the activation of negative cognitive schemas, an individual comes to filter and construe his or her experiences in a negative

manner. This ultimately leads to a pattern of depressotypic negative thinking which Beck called “the cognitive triad.” This cognitive triad consists of pessimistic thoughts and expectations related to three different domains of experience, that is, the self, the world, and the future. Thus, Beck et al. (1990) initially postulated that suicide, much like depression, is caused by a disruption of this classic cognitive triad. However, later proposals have suggested that, in addition to maladaptive schemas, suicide potentiation is also conferred by negative cognitive biases in attention, information processing, and memory (Wenzel & Beck, 2008; Wenzel, Brown, & Beck, 2009). Wenzel and Beck (2008) expanded upon this original model and proposed that suicide is influenced by three main constructs: dispositional vulnerability factors, cognitive processes related to pre-existing psychiatric disturbances, and cognitive processes related to suicidology. With regard to the cognitive processes of suicidality, this updated model particularly emphasized the importance of schemas related to hopelessness and intolerable states.

Although various theorists have noted the potential significance of hopelessness (e.g., Beck, 1967; Shneidman, 1987), Alloy and Abramson extends their hopelessness model for depression (Abramson, Metalsky, & Alloy, 1989; Abramson, Alloy, & Metalsky, 1990) into a more explicit theory for suicide potentiation (Abramson et al., 1998). In particular, they suggested that individuals who make specific, unstable, and external attributions for positive events, yet global, stable, and internal attributions for negative events will be more prone to suicide than those who do not. Furthermore, this is especially true if these individuals believe that these attributions are indicative of a negative future. They proposed that such individuals are prone to developing a specific subtype of depression, called hopelessness depression, which is

believed to then account for suicidal ideations or behaviors. Therefore, hopelessness can be thought of as mediating the relationship between negative attributional styles and suicidality.

Cognitive models by Beck and Abramson and Alloy have provided important theoretical perspectives for the consideration of suicide and have inspired a substantial amount of relevant research. However, over the past few decades, cognitive models have become increasingly integrative and some have now begun to emphasize the role of life events, genetics, and behavior as well. Alternative work investigating the predictors of suicide has often used diathesis-stress models, much like Beck's theory, to explain the occurrence of suicidal behaviors. These diathesis-stress models of suicide propose that pre-existing vulnerabilities interact with stressors in such a way that individuals are left susceptible to developing suicidal ideations (e.g., O'Connor & O'Connor, 2003). Within the literature, these stressors are generally defined as any environmental issues or life events that are perceived as threatening or those which exceed an individual's coping abilities (Lazarus & Folkman, 1984).

Joiner's (2005) Interpersonal-Psychological Theory of Suicide has garnered a great deal of research attention and is an integrative approach that proposes a three factor model for suicide risk. He suggests that perceived burdensomeness, thwarted belongingness, and an acquired capability to die are the necessary components for suicidal ideations and behaviors. Perceived burdensomeness refers to beliefs about being a burden on those around us, and thwarted belongingness refers to beliefs about not being sociality affiliated or accepted. These two factors are believed to develop following the occurrence of negative life events or stressors (Van Orden et al., 2010) and are the elements which cause suicidal ideation and the desire to die. Whereas, acquired capability refers to a process in which an individual gains an increased willingness to

engage in suicidal behaviors as a result of a lowered fear for pain or death following repeated painful or negative experiences. It is then this element which, when combined with the perceived burdensomeness and thwarted belongingness factors, allows the individual to carry out the suicide attempt. Therefore, beliefs about perceived burdensomeness and thwarted belongingness lead to thoughts that one's death would be harmless or even worthwhile to others. But it is the acquired fearlessness for taking one's own life which may be sufficient for overcoming self-preservation instincts. Clearly, Joiner's (2005) theory also relates to the psychological needs of affiliation, closeness, productivity, and achievement. Interestingly, two of Joiner's main factors are in fact interpersonal cognitive perceptions (i.e., beliefs about burdensomeness and belongingness), and for this reason it is often said that the theory aligns well with cognitive perspectives.

Williams and colleagues' "Arrested Flight or Cry of Pain Model" represents another important integrative model of suicide. The theory proposes that suicide is driven by environmental sensitivities and cognitive perceptions of being unable to escape and of one's current situation as being indefinite (Williams, Crane, Barnhofer, & Duggan, 2005). More specifically, when individuals experience a negative life event that generates feelings of humiliation or rejection, they attempt to solve this problem but may be unsuccessful. Subsequently, if these individuals perceive their problem-solving to be unsuccessful or deficient, they will feel powerless. The term "arrested flight" was borrowed from the animal behavior literature and is typically defined as a situation in which an animal is defeated and yet cannot escape. With regard to the model's alternative name, Williams and colleagues' have suggested that suicidal behaviors more accurately depict a "cry of pain" rather than the traditional "cry for

help” (Williams, 2001; Williams & Pollock, 2000). This model has been studied little since its proposal, but according to Rory O’Connor it was one of the main inspirations for his later Integrated Motivational-Volitional (IMV) Model of Suicidal Behavior (O’Connor, 2011).

The IMV Model of Suicidal Behavior represents a recent attempt to unify the major theoretical components from the dominant models of suicidality. This model considers a complex interplay of driving factors and suggests that suicidal behavior can be conceptualized as existing with three different phases: the pre-motivational phase, the motivational phase, and finally, the volitional phase. The pre-motivation phase represents a period in time prior to the formation of suicidal ideation, and is comprised of the traditional diathesis, environment, and life event factors. In other words, background factors such as vulnerabilities and life events such as stressful circumstances determine an individual’s baseline for engaging in suicidal behaviors. Within the motivational phase, suicidal ideation is prompted by feelings of entrapment which are triggered by the experience of humiliation and/or defeat. Thus, suicide comes to be viewed as a practical solution to escape this entrapment. Furthermore, feelings of entrapment are exacerbated by motivational moderators such as attentional biases, pessimistic thinking styles, poor problem-solving, and deficient coping skills. During the volitional phase individuals move from suicidal ideation to intended, attempted, or completed suicidal behaviors. This transition is influenced by volitional moderators, many of which are borrowed from Williams’ Arrested Flight Model and Joiner’s Interpersonal-Psychological Theory. Specifically, O’Connor (2011) identified the following as being important contributing factors: access to suicidal means, a capacity for suicide, knowledge of others who have engaged in suicidal behaviors, and impulsivity.

Clearly there are many theoretical perspectives with regards to suicidality, but it is important to acknowledge the cognitive nature of many of these models for suicide. Even very early conceptualizations of suicide considered the importance of thinking styles and cognitive characteristics (e.g., Kelly, 1961; Morselli, 1881; Neuringer, 1961; Neuringer, 1964). Moreover, most researchers agree that cognitive processes play a prominent role in the generation and maintenance of suicidal ideations and behaviors. Given the potential significance of cognitive functioning, the current study will therefore investigate such cognitive vulnerabilities. Generally, within such theories, these cognitive processes are said to interact with dispositional vulnerability factors and increase the likelihood of suicidal thoughts and behaviors. In other words, these negative cognitive processes work to facilitate the biased information processing that is thought to underlie suicide.

Likewise, as was discussed, diathesis-stress models offer an alternative viewpoint for the consideration of suicidality. Although the vulnerabilities, or diatheses, can take on many forms, the past couple of decades have seen a particular spark in interest for investigating cognitive vulnerability. As such, a number of cognitive factors which serve as predictors for various suicidal ideation and behaviors have been identified. These include hopelessness (Beck, Steer, Kovacs & Garrison, 1985), dichotomous thinking (Litinsky & Haslam, 1998), perceived burdensomeness (Joiner et al., 2002), overgeneral autobiographical memory (Williams & Broadbent, 1986a; Williams & Dritschel, 1988) and impaired problem solving (Pollock & Williams, 2004). The present investigation will focus on two such alternative predictors: rumination and cognitive inhibition, as well as insomnia, a stressor that is commonly considered within the suicide literature.

Potential Correlates of Suicidality

Cognitive Variables

Efforts aimed towards understanding and reducing the incidence of suicide have led researchers to investigate the cognitive styles and neurocognitive dysfunctions of suicidal individuals. As such, recent work has begun to examine whether suicidal individuals have a tendency to repeatedly engage in persistent negative self-thoughts which, for many, takes the form of rumination. A large body of literature has previously demonstrated that rumination is linked to depression (e.g., Nolen-Hoeksema, Parker, & Larson, 1994; Robinson & Alloy, 2003) and is associated with longer and more severe periods of depression (Lyubomirsky & Nolen-Hoeksema, 1993). More broadly as well as historically, Beck's (1967) cognitive model emphasized the importance of negative self-statements, which are conceptually similar, if not identical to, rumination.

Researchers have differentiated between two types of rumination; reflection and brooding rumination (Treyner, Gonzalez, & Nolen-Hoeksema, 2003). Reflective rumination is defined as contemplative self-focus or problem-solving in response to depressive symptoms, whereas brooding rumination is conceptualized as maladaptive gloomy pondering in which an individual engages in self-blame or compares his or her current situation to more ideal circumstances. It is this brooding rumination that has been implicated in both the development and maintenance of symptoms of depression (e.g. Grassia & Gibb, 2008; Treyner et al., 2003), suggesting that brooding may be the more emotionally corrosive component of rumination. Likewise, brooding rumination is also the type of self-thought that exhibits the strongest association with suicidality (Morrison & O'Connor, 2008). In fact, research has demonstrated that brooding rumination is

predictive of both suicidal ideations and behaviors and that it may ultimately diminish the ability to problem-solve, which in turn may facilitate the decision to act upon suicidal thoughts (Grassia & Gibb, 2009; Morrison & O'Connor, 2008).

With regard to neurocognitive dysfunctions, research has also started to examine whether inhibitory processes play a role in suicidality. Cognitive inhibition, a mechanism of executive control, has been broadly defined as an active suppression process that limits or restricts irrelevant stimuli, thereby preventing the activation of unnecessary information (Friedman, & Miyake, 2004; Hasher, Zacks, & May, 1999). Findings indicate that depressed individuals exhibit impairments in the inhibition of negative stimuli and that these cognitive deficits are also associated with depressive episodes that are more severe and longer in duration (Alloy et al., 2000; Frings, Wentura, & Holtz, 2007; Goeleven, Raedt, Baert, & Koster, 2006). Thus, the relationship between cognitive inhibition and suicide has begun to generate research attention. A recent meta-analysis demonstrated that cognitive inhibition deficits are strongly associated with suicide attempts (Richard-Devantoy et al., 2012). Surprisingly, however, cognitive inhibition has not yet been examined in relation to suicidal ideation.

In order to gain a better understanding of the potential mechanisms that lead to suicidality, it is important for researchers to identify how risk factors may be interrelated. Such discoveries would allow for the identification of the most appropriate points for therapeutic intervention. A number of theorists have proposed that the inability to restrict or remove negative information from working memory sets the stage for rumination (Hertel, 1997; Joormann, 2010). In fact, Joormann (2006) found that depressed individuals with a tendency to ruminate exhibited a lack of inhibition for emotionally charged words despite being instructed to ignore them,

whereas, individuals who scored lower on a rumination scale showed adequate inhibition. Zetsche, D'Avanzato, and Joormann (2012) also found that both reflective and brooding rumination were associated with deficits in the ability to remove irrelevant negative information from working memory for those with depressive symptoms. Additionally, research investigating executive processes has found that the activation of rumination caused inhibitory deficits in dysphoric subjects only (Philippot & Brutoux, 2008). Thus, these studies support the idea that reduced inhibition is associated with increased rumination among individuals with depression. However, such investigations have been limited to the context of mood states. In other words, the relationship between these processes has not yet been examined in suicidal phenomenon. Therefore, the current study examined both rumination and cognitive inhibition and specifically tested the hypothesis that rumination mediates the relationship between cognitive inhibition deficits and suicidality. Improving our understanding of the cognitive impairments that may exist during suicidal mental states may be crucial for the development of effective neurocognitive treatments specifically designed to reduce suicide.

Insomnia

In addition to cognitive variables, problematic sleep is one of the most common complaints for individuals suffering from depression. Research has consistently demonstrated that depression and insomnia are highly correlated (Breslau, Roth, Rosenthal, & Andreski, 1996; Gregory et al., 2011). Indeed, some investigations have estimated that between 60 and 90% of depressed individuals report that they have had sleeping difficulties or an overall decline in their quality of sleep as compared to premorbid functioning (Kloss & Szuba, 2003; Tsuno, Besset, & Ritchie, 2005). In a 17-week longitudinal study examining sleep disturbances in individuals with

major depressive disorder, Sbarra and Allen (2009) found that the largest decreases in depressive symptoms happened only after high levels of insomnia had first been reduced. Therefore, the relationship between depression and insomnia has been thoroughly established.

Likewise, insomnia is also considered to be a substantial risk factor for suicidality. The research literature has consistently documented a high prevalence of insomnia symptoms among suicidal individuals (Winsper & Tang, 2014; Wojnar et al., 2009). Prospective studies have also confirmed that sleep disturbances are predictive of suicidal attempts and death even after adjusting for depression and other mental health symptoms (Fawcett et al., 1990; McCall, 2011). Among suicidal populations, typical complaints include difficulty falling asleep, sleep disruptions, frequently or repeatedly waking up, shorter periods of sleep, and non-restorative sleep. Thus, research has demonstrated a consistent link between insomnia and suicide as well.

Furthermore, insomnia and sleep problems in general have been associated with inhibitory deficits (Fortier-Brochu, Beaulieu-Bonneau, Ivers, & Morin, 2012; Killgore, 2012). In fact, psychobiological theories have suggested that, in addition to high cortical arousal, deficient inhibitory processes would also be necessary in order to sustain the severity and frequency of sleep difficulties seen in insomnia (Espie, 2002). A recent study using Polysomnographic (PSG) and Event-Related Potentials (ERP) confirmed that individuals with insomnia do exhibit deficits in cortical inhibition (Bastien, St-Jean, Morin, Turcotte, & Carrier, 2008). Given these established relationships, the current study also examined insomnia as a potential moderator of the relationship between cognitive inhibition and suicidality.

Guiding Conceptual Model

Given that rumination, cognitive inhibition, and insomnia are all related to both depressive and suicidal phenomenon, it is important to consider why some depressed individuals may become suicidal whereas many depressed individuals do not. Within the existing suicide literature, suicidality is frequently conceptualized as belonging on the extreme end of the depression continuum. Thus, researchers largely argue that it may be the frequency and severity of suicidal risk factors which is what truly pushes a depressed individual to develop ideation or suicidal behaviors. For example, studies have demonstrated that depressed and suicidal individuals have significantly higher levels of hopelessness, anxiety, sleep disturbances, and feelings of worthlessness and guilt than depressed individuals who are not suicidal (Kumar & Mandal, 2010; Wolfersdorf, Steiner, Keller, Hautzinger, & Hole, 1990). Thus, it may be that certain risk factors do not contribute to the development of suicidality until those factors reach a certain threshold.

These ideas may suggest a potential conceptual framework to guide the present study. Suicidal individuals may exhibit greater cognitive inhibition deficits than those who are not suicidal; research has previously shown that individuals with a history of suicide attempts exhibit greater executive functioning issues, including inhibition, than individuals of comparison groups. Additionally, these dysfunctions increase in conjunction with the severity of suicidality and the group differences remain even after controlling for depressive symptoms (Keilp et al., 2001). Greater cognitive inhibition deficits may then lead to increased brooding rumination for suicidal individuals, meaning that these populations would display higher levels of brooding as well. Such an idea is consistent with previous proposals that cognitive inhibition may set the stage for rumination (Hertel, 1997; Joormann, 2010). In turn this increased brooding rumination may lead

to suicidality. Research has supported this pathway as well, demonstrating that rumination is positively associated with suicidality (for a review, see Morrison & O'Connor, 2008).

Furthermore, longitudinal studies indicate that rumination – and often brooding rumination in particular – is predictive of future suicidal ideation (e.g., Miranda & Nolen-Hoeksema, 2007; O'Connor, O'Connor, & Marshall, 2007). Thus, as can be seen in Figure 1, the theoretical model for the current study proposes that increased cognitive inhibition may prompt increased brooding rumination which then leads to increased suicidality.

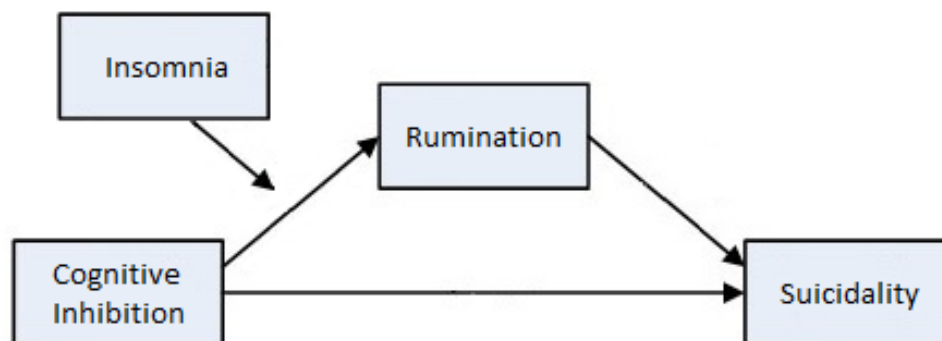


Figure 1. Proposed Model for Cognitive Inhibition, Rumination, Insomnia, and Suicidality

Mental Illness and Suicidality

It has long been suggested that psychological illnesses represent one of the leading risk factors for attempted or completed suicide (Barraclough, Bunch, Nelson, & Sainsbury, 1974; Henriksson et al., 1993; Robins, Murphy, Wilkinson, Gassner, & Kayes, 1959). Current estimates suggest that approximately 95% of individuals who commit suicide are suffering from some form of mental illness and that of those individuals, as many as 55% had a major

depressive disorder (Hawton, & Van Heeringen, 2009; Kessler, Berglund, Borges, Nock, & Wang, 2005a). In fact, depression is the single most common disorder associated with suicide-related behaviors and ideations (Conwell et al., 1996). Epidemiological research indicates that nearly 16% of those diagnosed with Major Depressive Disorder have attempted suicide at some point in their life (Chen & Dilsaver, 1996). Moreover, additional research suggests that between 2 and 12% of individuals who experience a Major Depressive Episode will ultimately end their lives through suicide (Bostwick & Pankratz, 2000).

Depression therefore represents a clear risk factor for suicide, yet other affective disorders, substance misuse, schizophrenia, and post-traumatic stress disorder (PTSD) are also associated with suicidality. Arguably, there may be great variability in the causes, symptoms, and consequences of suicidality that is depression-driven versus suicidality resulting from alternative disorders. In other words, depressed individuals may have a very different experience of suicidal phenomenon than those individuals who experience suicidality as a result of psychosis. Yet, little research has examined suicidality in the exclusive context of depression. Thus, this study examined suicidality among those who are depressed and excluded individuals endorsing symptoms consistent with alternative diagnoses, thus offering a more homogeneous sample. It is also important to mention, that by examining suicidality through the lens of depression, an additional avenue of consideration is provided. That is, it makes sense to examine variables that have been consistently implicated in the etiology of depression given that depression acts as one of the strongest suicidal predictors.

Comparison of Suicidal Mental States

In addition to the aforementioned goals to examine whether cognitive inhibition deficits exist among those with suicidal ideation, to test the hypothesis that rumination mediates the relationship between cognitive inhibition deficits and suicidality, and to examine whether insomnia serves as a moderating variable in the relationship between cognitive inhibition and suicidality, the present study offered one additional objective. Suicidality exists in various stages, ranging from ideas and gestures, to plans, attempts, and suicide completions (Sher, 2004). Given that past behaviors serve as the best predictor of eventual suicide completion (O'Connor & Sheehy, 2000), research often focuses on those with suicidal ideations or prior behaviors (e.g., suicide attempts, threats to commit suicide, etc.) to help identify risk factors and predictors of suicide. However, very few studies have directly compared these varying suicidal mental states. Instead, investigations have generally compared healthy controls to those with one aspect of suicidality. The current study attempted to expand previous research by examining rumination, cognitive inhibition, and insomnia among individuals with current suicidal ideation, individuals with previous suicidal attempts, and those with both current suicidal ideations and a history of previous suicidal attempts. This comparison of suicidal mental states may help to provide insights into the underlying processes of varying degrees of suicidality.

The Present Study

As mentioned, research has demonstrated that rumination is predictive of both suicidal ideations and behaviors, and that cognitive inhibition deficits are also strongly associated with suicide attempts. However, research has not yet investigated whether a link exists between cognitive inhibition and suicidal ideations. Likewise, researchers have suggested that, in the context of suicidal phenomenon, reduced inhibition may set the stage for increased rumination.

Existing data have provided preliminary evidence for such a relationship among individuals with depression, but this concept has not yet been explored amongst those with suicidal ideations or previous suicide attempts. Therefore, the present study was intended to extend previous research by examining how these variables are related to one another in suicide-prone individuals. Thus, the current study aims were to: (1) examine whether cognitive inhibition deficits exist among those with suicidal ideation; (2) test the hypothesis that rumination mediates the relationship between cognitive inhibition deficits and suicidality; (3) examine whether insomnia serves as a moderating variable in the relationship between cognitive inhibition and suicidality; (4) expand previous research by directly comparing three suicidal mental states (i.e., suicidal ideation, suicidal attempts, and the combination of both); and (5) examine the variables of interest in a more precise sample of suicidal individuals than currently present in the literature.

To examine these questions, participants completed questionnaires related to rumination and sleep, as well as a commonly used task to assess cognitive inhibition, in order to identify the potential presence and quality of these factors. Participants also answered prescreening questionnaires so that current and past levels of suicidality and depressive symptomatology could be ascertained.

Method

Participants

Data were collected from 400 female participants between the ages of 21 and 55, who were recruited through Amazon's Mechanical Turk (MTurk), a program in which workers complete online tasks and are paid small amounts of money for participants' time. Although it is a relatively new medium for research data collection, studies have suggested that data collected

through MTurk is of high-quality and reliable and allows for the recruitment of a more demographically diverse sample than college student convenience samples or than alternative internet-recruited samples (for a review see Burmeister, Kwang, & Gosling, 2011).

In order to compare differences in suicidality, four groups of participants, each containing 100 individuals, were recruited for this study. Previous attempters were individuals with a previous history of depression and one or more concurrent suicide attempts. There was a group of individuals with current suicidal ideation who had no history of previous suicidal attempts. These individuals had to also have a current diagnosis of depression or be exhibiting clinically significant depressive symptoms. There was another group of individuals with current suicidal ideation who reported at least one previous suicidal attempt and a previous history of depression. These individuals also had to have a current diagnosis of depression or be exhibiting clinically significant depressive symptoms at the time of the study. Finally, control subjects had no current or past history of suicidal ideation or self-harming behaviors. Individuals endorsing a history of substance abuse, psychosis, or PTSD symptoms were excluded. Because of the computer task, only fluent English speakers were eligible to participate.

With regard to the selection of participants, individuals have the opportunity to participate in brief qualification surveys through MTurk where they are assessed on a number of characteristics in order to determine their eligibility for certain studies. A total of 9,098 individuals entered the qualification survey for the current study and 8,950 completed it. Only individuals who positively endorsed items matching the inclusion criteria were eligible for the current study.

Inclusion criteria were assessed through questions from the mood module of the Structured Clinical Interview for the DSM-IV-TR - Non-patient Edition (SCID-I/NP) and from the Beck Depression Inventory – Second Edition (BDI-II; Beck et al., 1996). Specifically, participants were asked questions from the SCID-I/NP relating to current suicidal ideation and past history of suicidal attempts, as well as the individual's history of unipolar depression. For example, participants were asked, "have you ever attempted suicide during a depressive episode?" in order to assess for previous suicide attempts.

In order to meet criteria for the previous attempters group, individuals had to endorse that they have attempted suicide during a depressive episode. For previous depressive episodes, these individuals had to endorse the past experience of five or more DSM-V-TR depressive symptoms for at least two weeks and one of these symptoms had to include depressed mood or anhedonia. In addition, these symptoms must have occurred just prior to or concurrently with a suicide attempt. Finally, these individuals had to deny current suicidal ideation. For the current suicidal ideation group, individuals had to endorse reoccurring thoughts of death or of hurting themselves. In addition, they also had to be exhibiting clinically significant depressive symptoms or endorse a current diagnosis of depression. Therefore, these individuals must have consistently experienced at least five of the DSM-V-TR depressive symptoms for at least two weeks and again, one of these symptoms had to include depressed mood or anhedonia. Individuals could also score 20 or above on the BDI-II in order to demonstrate clinically significant depressive symptoms. Finally, these individuals had to also deny a previous history of suicidal attempts. For the group of individuals with current suicidal ideation and a previous history of suicidal attempts, these individuals had to meet criteria from both of the previous groups.

Measures

Demographic Questionnaire

Individuals answered questions pertaining to their demographic information. Specifically, these questions asked about age, gender, socioeconomic status, and race or ethnicity. The average age of participants was 35.38 ($SD=10.30$) with a range of 21 through 55 years. Finally, the majority of participants described themselves as Caucasian (51.7%; $n=207$), while the remaining race representation was 19.3% African American ($n=77$), 18.2% Asian ($n=73$), 7.0% Hispanic ($n=28$), and 3.8% other ($n=15$). Participants did not significantly differ with respect to age, ethnicity, or income (see Table 1). Therefore, these variables were not included as covariates in the study analyses.

Structured Clinical Interview for the DSM-IV-TR

The Structured Clinical Interview for the DSM-IV-TR - Non-patient Edition (SCID-I/NP; First et al., 2002) is a commonly used semi-structured interview that assists clinicians in making DSM-IV-TR diagnoses. Questions related to each disorder help guide the interviewer through the process of determining whether the examinee meets criteria for a diagnosis. For the purposes of this study, all questions will be presented in a self-report questionnaire format. Thus, current suicidal ideation and past history of suicidal attempts, as well as the individual's history of unipolar depression, were assessed through participants self-report to questions from the mood module of the SCID-I/NP. For example, participants were asked, "have you ever attempted suicide during a depressive episode?" in order to assess for previous suicide attempts. These questions asked participants to indicate whether they have experienced specific depressive symptoms or suicidal ideation. Therefore, these questions allow for the identification of either

Table 1

Table 1: Summary of Participants' Descriptive Characteristics & Group Differences on Measures

	Controls	Previously Attempted	Currently Suicidal	Currently Suicidal + Previous Attempts	All Participants
	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)
N	100	100	100	100	400
Age	35.6 (9.8)	35.1 (11.0)	35.1 (10.8)	35.7 (9.6)	35.4 (10.3)
Caucasian	45%	63%	53%	46%	51%
African American	16%	13%	13%	35%	19%
Asian	26%	13%	22%	12%	18%
Hispanic	10%	5%	9%	4%	7%
Other Ethnicity	3%	6%	3%	3%	3%
BDI-II Score	1.4 (1.5)	12.6 (11.1)	31.5 (8.0)	37.9 (10.7)	20.8 (17.0)
BSS Score	0.01 (0.1)	0.11 (0.6)	14.08 (3.4)	15.60 (3.2)	7.45 (7.8)
RRS Total	35.7 (13.4)	45.9 (16.2)	63.6 (9.6)	64.2 (9.8)	52.3 (17.4)
Brooding	7.5 (3.4)	9.7 (4.2)	13.8 (3.0)	13.7 (2.8)	11.2 (4.3)
Reflection	8.8 (2.6)	10.5 (3.3)	12.9 (2.5)	14.1 (2.3)	11.6 (3.4)
Insomnia	3.5 (4.0)	9.0 (6.8)	14.7 (5.1)	16.0 (4.6)	10.8 (7.2)

BDI-II: Beck Depression Inventory – II

BSS: Beck Scale for Suicidal Ideation

RRS: Ruminative Responses Scale

past or current depressive episodes or suicidality. Questions were also included that ask about substance abuse, psychosis, and PTSD or bi-polar symptoms.

Beck Depression Inventory-II

Beck Depressive Inventory –II (BDI-II; Beck et al., 1996) was used to select participants eligible for the study and to assess the severity of depressive symptoms. The BDI-II is a 21-item self-report measure and is one of the most common questionnaires used to assess depressive symptoms. For each item, individuals are asked to rate their depressive symptoms over the past 2 weeks on a Likert scale ranging from 0 to 3. Scores on the BDI-II can range from 0 to 63. Beck, Steer, and Brown (1996) suggested that scores should be interpreted as follows: absence of depression (0-14); mild depression (14-19); moderate depression (20-28); and clinically severe depression (28-63). Although the BDI-II possesses a high degree of sensitivity, the measure is not particularly specific when using these cutoff scores (Shean & Baldwin, 2008; Wang & Gorenstein, 2013). The BDI-II has demonstrated good test-retest reliability, a great degree of convergent validity and adequate discriminant validity (Beck et al., 1996).

Beck Scale for Suicidal Ideation

The Beck Scale for Suicidal Ideation (BSS; Beck & Steer, 1991) is a 21-item self-report measure that was used to assess for the presence and severity of suicidal ideation. Specifically, this questionnaire assesses both passive and active ideation through questions regarding wish to die, suicidal plans, and access to lethal means. Items 1-19 present statements which the individuals are asked to rank on a Likert scale ranging from 0 to 2. Item 20 asks about the number of previous suicide attempts, and item 21 asks about the seriousness of intention to die associated with the last attempt. Only those who have previously attempted suicide are asked to

complete item 21. The severity of ideation is calculated by summing the responses from the first 19 items, with total scores ranging from 0 to 38. The BSS has demonstrated high construct and convergent validity, as well as high internal consistency (Beck, Steer & Ranieri, 1988).

Ruminative Responses Scale

The Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991; Treynor et al., 2003) is a 22-item scale commonly used to assess aspects of depressive rumination. This scale assesses how often individuals engage in various responses during a negative mood state and focuses on the meaning of ruminative thoughts as well as the feelings, symptoms, and possible causes and consequences. Each item is scored on a four-point scale where responses indicate 1 = “almost never,” 2 = “sometimes,” 3 = “often,” and 4 = “almost always.” This scale has demonstrated good test–retest reliability (Nolen-Hoeksema, Parker, & Larson, 1994), and good internal consistency (Nolen-Hoeksema & Morrow, 1991). The RRS also possesses adequate convergent and predictive validity (Butler & Nolen-Hoeksema, 1994; Kuehner & Weber, 1999). Of particular interest, this study examined the brooding and reflection subscales from the RRS. Both subscales have exhibited adequate internal consistency and retest reliability over one-year (Treynor et al., 2003). Numerous studies have also supported the validity of these subscales (Grassia & Gibb, 2008; Joormann, Dkane, & Gotlib, 2006; Treynor et al., 2003).

Insomnia Severity Index

The Insomnia Severity Index (ISI; Bastien, Vallières, & Morin, 2001) is a seven-item self-report questionnaire used to assess individuals’ perceptions of their insomnia. Individuals were asked to respond to each item based on a 0 to 4 scale in order to rate their sleep difficulties over the past two weeks. The items assess the severity of problems with delayed sleep onset,

sleep maintenance, early morning awakenings, and interference with daily functioning, as well as how much others notice impairment from the sleep problem, whether the individual is satisfied with his or her current sleep pattern, and how much the individual worries about the sleep problems. Scores on the ISI can range from 0 to 28 and scores should be interpreted as follows: absence of insomnia (0-7); sub-threshold insomnia (8-14); moderate insomnia (15-21); and severe insomnia (22-28). A number of previous studies have reported adequate to good psychometric properties (reliability, validity, and internal consistency) for the ISI (Bastien et al., 2001; Blais, Gendron, Mimeault, & Morin, 1997).

Go/No-Go Task

Participants also completed a go/no-go computer task which allows for the effective study of cognitive inhibition (Murphy et al., 1999). In this design, participants were presented with one emotionally valent word at a time, either a target or a distracter. Participants were instructed to evaluate the valence of the target word as being either positive or negative for words that appeared in green colored letters and instructed not to respond to distracter words that appeared in red colored letters. Thus, in each trial, the target words appeared in green letters and the distracter words appeared in red letters.

This task was administered through the program Inquisit, which collected response times and responses for each trial. This data is considered to be a valid measure of the inhibitory processing of emotional information. The words used in this design were selected from the Affective Norms for English Words (ANEW) database which was developed to provide a set of normative words rated on emotional valence (Bradley & Lang, 1999). The negative and positive word sets were balanced to be similar on emotional valence, arousal and word length. The final

set of 150 positive words had an average valence rating of $M=7.725$ ($SD=.43$), an arousal rating of $M=5.64$ ($SD=1.01$), and the average word length was $M=6.38$ ($SD=1.70$). Whereas the final set of 150 negative words had an average valence rating of $M=2.34$ ($SD=0.43$), an average arousal rating of $M=5.66$ ($SD=1.03$) and the average word length was $M=6.23$ ($SD=1.62$).

During this task, exactly 70% of the words appeared in green letters, with 35% being negatively valenced words and 35% being positively valenced words. The remaining 30% appeared in red letters, with 15% being negatively valenced words and 15% being positively valenced words. Each trial was designed so that a word was presented on the screen for 150 milliseconds. Once the word was removed, a fixation cross then appeared for 1500 milliseconds. Participants were instructed to respond to each word as quickly as possible. Each participant completed 300 trials, for a total of 150 negative words and 150 positive words. This computer task took approximately 8 minutes to complete.

Procedure

Participants who completed the qualification survey on Amazon MTurk and met the inclusion criteria were able to view and access the current study. Those who chose to participate had to select the study link through Amazon MTurk, which redirected them to Qualtrics where the actual study was conducted. Participants saw a consent statement first which informed them of the study purpose, the anonymous nature of the study, their right to discontinue, and the expected time length.

Consenting participants completed one administration of the following questionnaires: a demographic survey (age, gender, etc.), the BDI-II, the RRS, the ISI, the BSS, and select questions from the Structured Clinical Interview for the DSM-IV-TR. Participants also

completed the go/no-go task in which they were presented with words, either a target and a distractor, and asked to evaluate the valence of the target words as being either positive or negative. The order of the questionnaires and computer task were randomized. After participants completed these questionnaires and the computer task they were thanked for their time and presented with the research information again, should they want more information. In addition, all participants were provided with contact information for the National Suicide Prevention Lifeline. This study took approximately 25 minutes to complete, for which participants were compensated one dollar for their time.

Results

Statistical Analyses

All of the administered questionnaires were used in the analyses, except for questions from the mood module of the SCID-I/NP, which was administered during the qualification survey through MTurk and solely used to determine research eligibility and to categorize participants into the appropriate group (healthy controls, individuals with current suicidal ideations, individuals with a history of suicide attempts, or individuals with both current suicidal ideation and a history of suicide attempts). Analysis of variance (ANOVA) and chi square tests were used in order to examine group differences on demographic information. With regard to comparing the three dimensions of suicidality, analysis of variance (ANOVA) tests were conducted in order to determine whether group differences existed on any of the constructs of interest. All significant ANOVAs were followed up with post-hoc Tukey's tests.

For cognitive inhibition measures, it was decided *a priori* that analyses would exclude any trials in which the participant responded incorrectly to the normed valence of the word.

Trials with reaction times below 150 ms or over 5000 ms were also excluded from analyses, since research has indicated that such times are often made without regard for the stimulus (Matthews & Southall, 1991). In order to examine whether cognitive inhibition deficits may exist among those with suicidal ideation, an ANOVA was conducted examining the errors of commission during the trials with red words from the go/no-go computer task results. This element of whether the participants responded despite being instructed not to is what served as the measure of inhibition. This analysis was also used to investigate whether any of the groups made higher rates of errors of commission. In order to evaluate whether any of the groups demonstrated a bias for negative versus positive words, a mixed 4 x 2 ANOVA was employed, consisting of a four-level between subjects factor for suicidal status (healthy controls, previously attempted, currently suicidal, and currently suicidal and previously attempted) and a two-level within-subjects factor for word valence (negative, positive).

Finally, this study conducted moderated mediation analyses to test the extent to which rumination mediates the relationship between cognitive inhibition and suicidality and the extent to which insomnia moderates the relationship between cognitive inhibition and rumination or rumination and suicidality. It was hypothesized that rumination would act as a partial mediator for the relationship between cognitive inhibition and suicidality, as well as that insomnia would moderate the relationship between cognitive inhibition and rumination. For these analyses, two path models were evaluated using Structural Equation Modeling.

Descriptive Statistics

Mood and Affect

A one-way between-subjects ANOVA was conducted to compare BSS scores in control, previously attempted, currently suicidal, and both currently suicidal and previously attempted conditions; results indicated that there were statistically significant differences among groups, $F(3, 396) = 1299.84, p < .001$. Post-hoc tests showed that the currently suicidal and previously attempted group ($M = 15.60$) endorsed a significantly higher degree of suicidal ideation than any of the other groups (see table 1). In addition, the currently suicidal group ($M = 14.08$) endorsed significantly higher suicidal ideation than that of the previously attempted ($M = .11$) and control groups ($M = .01$). However, there was no statistically significant difference between the control and previously attempted groups.

Analysis of BDI-II scores using a one-way between-subjects ANOVA indicated the presence of a statistically significant difference, $F(3, 396) = 374.85, p < .001$, such that currently suicidal and previously attempted participants endorsed significantly higher depression scores ($M = 37.95$) than any of the other groups. Moreover, the currently suicidal group ($M = 31.47$) reported significantly higher depression scores than both the previously attempted ($M = 12.56$) and control groups ($M = 1.38$). Likewise, the difference between previously attempted and control participants was also statistically significant.

Data Analysis Plan

The proposed analysis of moderated mediation refers to a model wherein the mediated effect varies across levels of a moderator. In such theoretical models, the effect of the predictor variable on the mediator depends on the moderator or alternatively, the partial effect of the mediator on the outcome would depend on the moderator (Muller et al., 2005). In either case, the efficacy of the mediating process clearly depends on the moderator, thus, the indirect

relationship between the predictor and outcome variable relies heavily on the moderator (Muller et al., 2005). For ease of understanding, some have described moderated mediation as a combination of simple mediation and simple moderation (Baron & Kenny, 1986). Yet, while the literature contains many studies of moderation or mediation, far fewer studies have tested for moderated mediation effects. The structural model proposed in the current study hypothesized that (1) rumination would serve as a mediating variable between cognitive inhibition and suicidal ideation and that (2) insomnia would moderate the relationship between cognitive inhibition and rumination.

To test the proposed moderated mediation model, Structural Equation Modeling (SEM) was chosen as the statistical analysis technique. SEM estimates the fit of a proposed model and provides information about the relationship between latent variables by estimating the underlying factor structure of measurements. In addition, SEM's modeling of factor structures reduces the influence of error variance on the parameter estimates, which represent the relationships between latent variables of interest (Kline, 2005). Thus, SEM is considered a highly useful technique in the field of behavioral sciences, where latent variables and measurement errors are hypothesized to exist.

In line with methodological suggestions, it was decided *a priori* that a simple mediation model would be conducted in addition to the full moderated mediation model to determine which was a better fit for the study data. Thus, two path models were constructed to determine the plausibility of the hypothesized associations. First, a mediation model was tested with rumination (total score on RRS) as an intervening variable between cognitive inhibition (errors of commission during no-go computer trials) and suicidal ideation (total score on the BSS). The

second path model, the full moderated mediation model, included the hypothesized moderation effect. Using the initial input model, insomnia (total score on the ISI) was added as an intervening variable between cognitive inhibition and rumination.

Preliminary Analyses

Shapiro-Wilk tests were conducted on each of the dependent variables, for the four different groups, in order to test whether the data fit a normal distribution. Any data passing the Shapiro-Wilk test was considered to be normally distributed and was not examined any further. However, this data screening revealed that numerous variables possessed slightly non-normal distributions. Therefore, the data's skewness and kurtosis were also examined in such cases in order to determine whether the data had truly violated the assumptions of normality. Skewness refers to symmetry of the distribution, whereas kurtosis relates to the distribution peaks of the data. Skewness and kurtosis values falling within the generally accepted cutoff range of -2 to +2 indicates that the data are not highly skewed and that the shape of the distribution still approximates a normally distributed data set (Kendall, Stuart, Ord, & Arnold, 1999).

Shapiro-Wilk tests demonstrated that RRS scores for both the currently suicidal group and the currently suicidal and previously attempted group were normally distributed. In addition, skewness and kurtosis scores fell within acceptable limits for RRS scores from both the control group and previously attempted group (see table 2). Therefore, normalization transformation techniques were not applied to this data. The Brooding and Reflection subscales from the RRS were also examined for normality. Shapiro-Wilk tests demonstrated that the RRS Brooding subscale was normally distributed for the currently suicidal group. The skewness and kurtosis scores fell within acceptable limits for the RRS Brooding subscale score for the three remaining

Table 2

Table 2: Summary of Shapiro-Wilk, Skewness, and Kurtosis Scores

	Controls	Previously Attempted	Currently Suicidal	Currently Suicidal + Previously Attempted
	<i>Skew/Kurtosis</i>	<i>Skew/Kurtosis</i>	<i>Skew/Kurtosis</i>	<i>Skew/Kurtosis</i>
RRS	1.59/1.63	0.45/-0.75	*	*
RRS Brooding	1.53/1.83	0.77/-0.41	*	0.37/-0.43
RRS Reflection	1.47/1.83	0.52/-0.41	-0.26/-0.43	0.07/0.32
ISI	1.43/1.72	0.55/-0.42	*	*
BSS	10/100	6.49/45.15	0.143/1.75	0.73/1.90
CI Positive	7.13/56.23	1.36/2.67	6.11/40.91	5.32/40.75
CI Negative	4.86/30.32	1.96/8.60	6.31/41.73	8.68/81.23

* indicates data passed the Shapiro-Wilk test for Normality

groups (control group, previously attempted group, currently suicidal and previously attempted group). Although none of the four groups passed the Shapiro-Wilk test for the RRS Reflection subscale, all fell within acceptable skewness and kurtosis limits. With regards to ISI scores, Shapiro-Wilk tests demonstrated that both the currently suicidal group and the currently suicidal and previously attempted group possessed normally distributed scores. Likewise, the skewness and kurtosis scores fell within acceptable limits for ISI scores from both the control group and previously attempted group. Therefore, normalization transformation techniques were not applied to any of this data. However, normality violations were found in BSS scores and

cognitive inhibition reaction time scores for both negative and positive valenced words. Due to these violations, these variables were square-root transformed prior to analyses.

Group Comparisons

Rumination

A one-way ANOVA on the RRS scores revealed significant differences across groups, $F(3, 396) = 124.06, p < .001$. Specifically, the control group ($M = 35.68$) had statistically significantly lower overall rumination scores than the previously attempted group ($M = 45.88$), the currently suicidal group ($M = 63.57$), and the currently suicidal plus previously attempted group ($M = 64.15$). Furthermore, the previously attempted group also endorsed significantly lower rumination than both the currently suicidal group and the currently suicidal plus previously attempted group. However, no significant difference existed between the currently suicidal group and the currently suicidal plus previously attempted group.

ANOVAs were also used to examine group differences on both the Brooding and Reflection subscales of the RRS. In terms of brooding, $F(3, 396) = 84.83, p < .001$, the control group ($M = 7.53$) endorsed significantly lower scores than the previously attempted ($M = 9.68$), currently suicidal ($M = 13.86$), and currently suicidal plus previously attempted ($M = 13.73$) groups. Likewise, the previously attempted group endorsed lower brooding than the currently suicidal and the currently suicidal plus previously attempted groups. No statistically significant difference existed between the currently suicidal and currently suicidal plus previously attempted groups. Furthermore, differences were revealed on RRS Reflections scores as well; $F(3, 396) = 76.64, p < .001$. The control group ($M = 8.81$) displayed a similar pattern, reporting significantly lower scores than all other groups. Reflection scores from the previously attempted group ($M =$

10.50) were also significantly lower than those from the currently suicidal group ($M = 12.85$), as well as the currently suicidal plus previously attempted group ($M = 14.08$). Finally, the currently suicidal group also endorsed significantly lower reflection than the currently suicidal plus previously attempted group.

Insomnia

Analyses of the ISI demonstrated that there was a statistically significant difference between groups as determined by one-way ANOVA; $F(3, 396) = 120.15, p < .001$. The control group ($M = 3.50$) reported significantly fewer insomnia symptoms than any of the other three groups. Statistically significant differences were also found between both the previously attempted group ($M = 8.99$) and the currently suicidal group ($M = 14.68$), as well as between the previously attempted group and the currently suicidal plus previously attempted group ($M = 16.02$). Although the currently suicidal group possessed slightly lower ISI scores than the currently suicidal plus previously attempted group, these differences were not significant.

Go/No-Go Computer Task Analyses

A 4 (group status: control, previously attempted, currently suicidal, and currently suicidal plus previously attempted) x 2 (word valance: positive, negative) ANOVA revealed a statistically significant interaction between the effects of groups status and word valance on participant reaction times, $F(3, 68929) = 820.93, p < .001$. A follow-up analysis using Tukey's test revealed significantly different reaction times among group's for positively valenced words, $F(3, 68929) = 461.23, p < .001$. Specifically, control participants responded more quickly to positive words than participants from any of the other groups (see table 3). In addition, the previously attempted group responded significantly more quickly to positive words than the

Table 3

Table 3: Mean Reaction Times for Group and Valance on the Computer Task in milliseconds

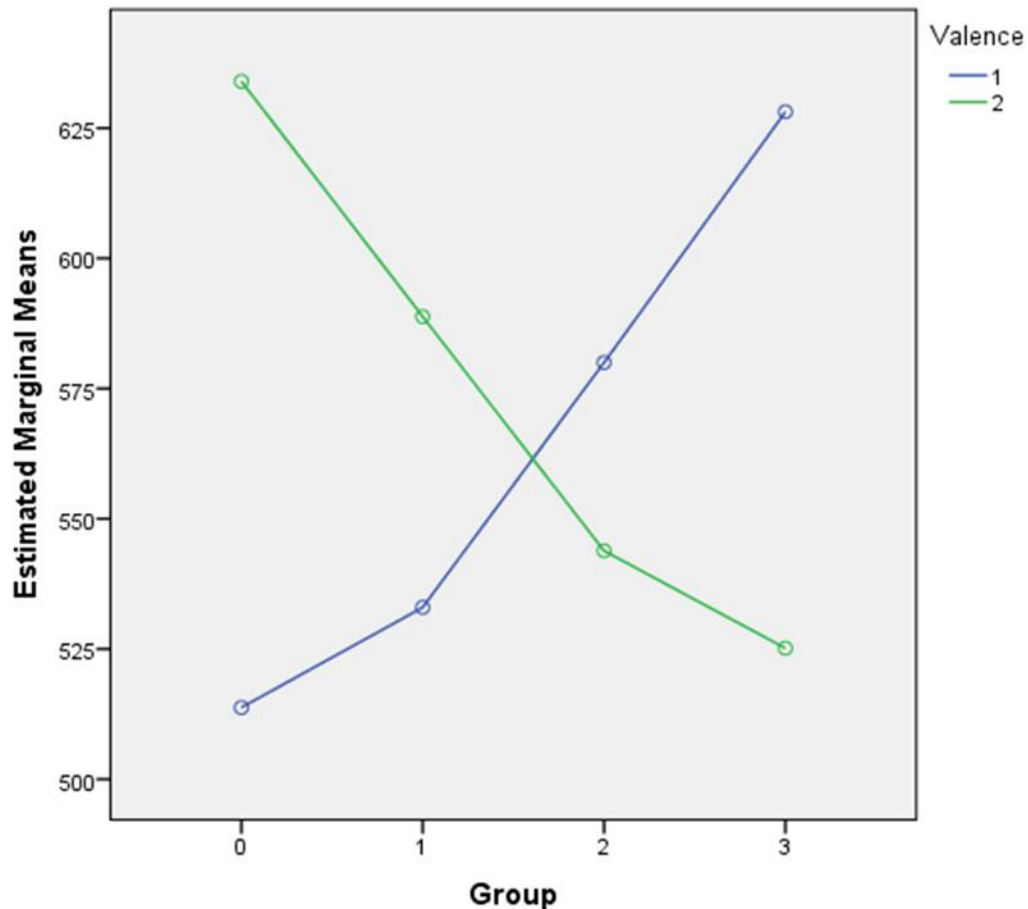
	Positive Valance	Negative Valance	Total
	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)
All Participants	563.13 (233.19)	572.68 (229.44)	567.68 (231.46)
Controls	513.75 (202.52)	633.98 (238.80)	569.94 (228.24)
Previously Attempted	533.00 (210.38)	588.80 (223.11)	559.64 (218.33)
Currently Suicidal	580.00 (239.21)	543.84 (225.00)	562.80 (233.25)
Currently Suicidal + Previously Attempted	628.12 (260.12)	525.14 (214.80)	577.85 (244.55)

currently suicidal group or the currently suicidal plus previously attempted group. The currently suicidal group was also significantly quicker to respond than the currently suicidal plus previously attempted group. Further analyses for simple main effects also revealed significant group differences in reaction times for negatively valenced words, $F(3, 68929) = 381.46, p < .001$, such that the currently suicidal plus previously attempted group was quicker to respond than any other group. The currently suicidal group also responded significantly more quickly to

negative words than both the previously attempted and control groups. Finally, the previously attempted participants were also significantly quicker in responding than control participants. In sum, with regards to positively valenced words, the control group responded the quickest, followed by the previously attempted group, and with the currently suicidal plus previously attempted group being the slowest (see figure 2). However, the opposite pattern was found for negatively valenced words. In this case, the currently suicidal plus previously attempted group responded the quickest, followed by the currently suicidal group, and with the control group responding the slowest.

Figure 2

Interaction between Group and Valence for Computer Task Reaction Times



Analyses also examined errors of commission during no-go trials with red words. A one-way ANOVA revealed that a significant difference existed between groups in the number of responses to red words, $F(3, 396) = 16.09, p < .001$. A post-hoc Tukey's test demonstrated that control participants committed a greater number of errors of commission for positively valenced words than did any of the three other groups (see Figure 3). Moreover, the previously attempted participants also committed a greater number of errors of commission for positively valenced words than the currently suicidal or currently suicidal plus previously attempted groups. Whereas, for negatively valenced words, the currently suicidal plus previously attempted participants made greater rates of errors of commission than the other groups (see Figure 4). Furthermore, the currently suicidal participants made greater rates of errors of commission than the previously attempted or control participants.

Correlations between Variables

Before testing the structural models, correlation coefficients were calculated in order to determine significant relationships between the variables of interest. The results of the correlation analyses are presented in Table 4. All of the variables were significantly correlated, with the strength of the correlation ranging from medium to large. As expected, suicidality was positively correlated with insomnia ($r = .59, p < .01$), rumination ($r = .63, p < .01$), and cognitive inhibition deficits ($r = .60, p < .01$). Likewise, insomnia showed a significant positive correlation with both rumination ($r = .73, p < .01$), and cognitive inhibition deficits ($r = .374, p < .01$). Finally, rumination and cognitive inhibition deficits were also significantly related ($r = .40, p < .01$). Thus, the prerequisite hypotheses necessary to test mediation and moderated mediation were satisfied.

Figure 3

Figure 3: Errors of commission during no-go trials for positively valanced words. Higher values indicate a greater number of errors of commission.

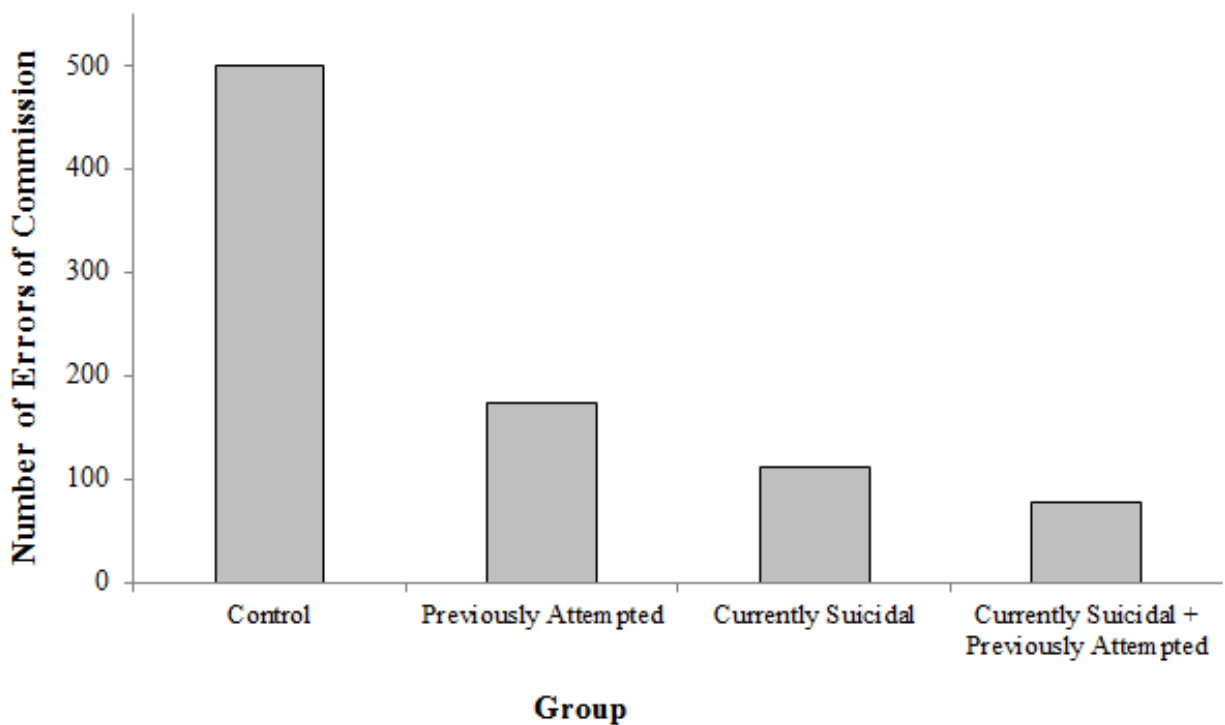


Figure 4

Figure 4: Errors of commission during no-go trials for negatively valanced words. Higher values indicate a greater number of errors of commission.

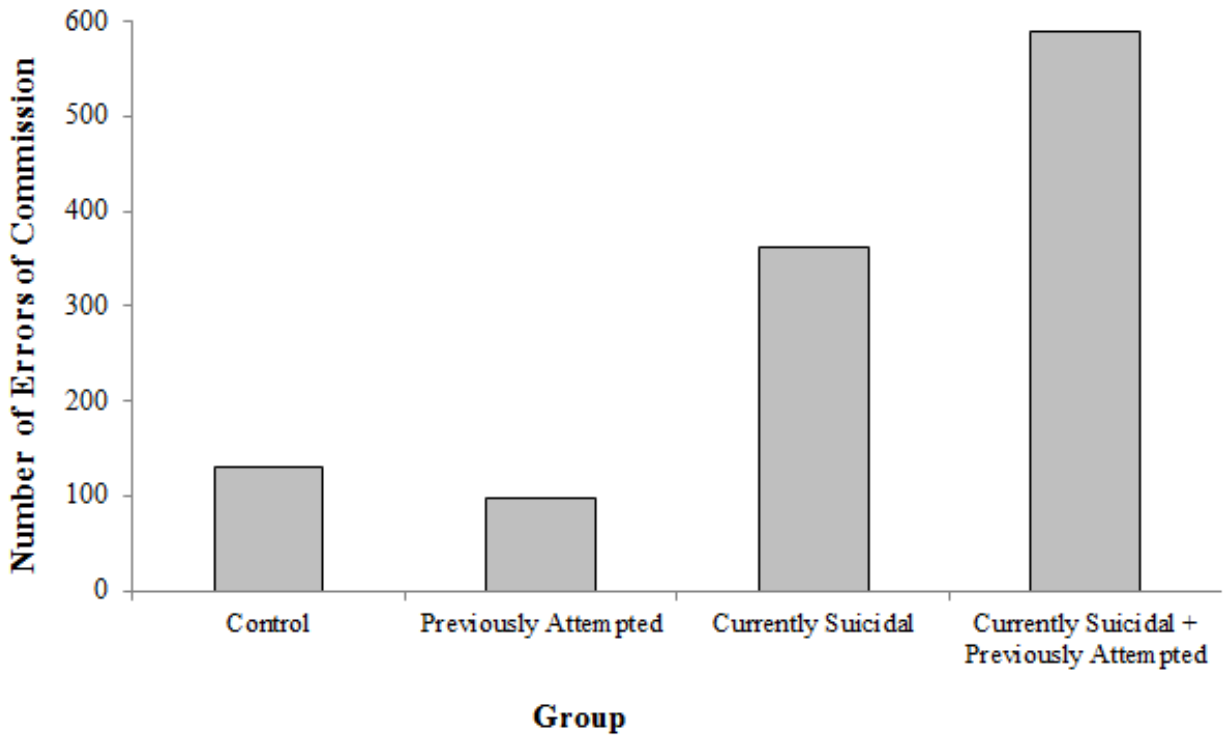


Table 4

Table 4: Correlation Matrix of Major Variables

	Rumination	Insomnia	Cognitive Inhibition	Suicidality
Rumination	---			
Insomnia	0.733**	---		
Cognitive Inhibition	0.403**	0.375**	---	
Suicidality	0.633**	0.594**	0.598**	---

Note: Rumination = total score on RRS; insomnia = total score on the ISI; cognitive inhibition = errors of commission during no-go computer trials; suicidality = total score on the BSS.

** $p < 0.01$

Mediation Model

As explained in the Data Analysis Plan section above, in order to test each of the hypotheses, an initial mediation model was created with rumination as the intervening variable between cognitive inhibition and suicidal ideation. This model was “just-identified,” meaning that the number of data points was equal to the number of parameters to be estimated. In other words, the current model possessed zero degrees of freedom, which is not an uncommon situation for SEM applications (Muthén & Muthén, 2013; Raykov, Marcoulides, & Patelis, 2013). In such structural models, the degrees of freedom are equal to the number of parameters in the measurement model minus the number of parameters in the null model. Therefore, contrary to many other types of statistical analyses, degrees of freedom are unrelated to the sample size in path models (Kline, 2005; Raykov et al., 2013).

Just-identified models have a perfect fit with the data, which is not necessarily advantageous over alternative models, given that perfect model fits possess their own unique limitations. For example, study data almost always contains random error and perfect-fitting models may be fitting sampling errors as well. In addition, conceptually different just-identified models actually have the same empirically perfect fit, which means just-identified models cannot be evaluated based on traditional fit indices (Kline, 2005; Lei & Wu, 2007). As such, interpretation of the fit for a just-identified model is limited to the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) indexes. All other fit indexes are uninterpretable either because they cannot be determined (e.g., RMSEA) or they have a seemingly perfect fit (e.g., TFI or NFI). AIC and BIC both require scores below the 0.08 cut-off in order to indicate a good fitting model (Browne & Cudeck, 1993; Kline, 2005). The current mediation model yielded an AIC value of 1734.35 and a BIC value of 1757.44 indicating that the overall model was likely not a good fit with the sample data. Despite this, the model results can still be interpreted given that this data is limited and therefore inconclusive (as is the case with all just-identified models).

As discussed, it was hypothesized that rumination would act as a partial mediator for the relationship between cognitive inhibition and suicidality. Prior data screening had revealed that the BSS data possessed normality violations. In addition, some of the other indicators were also trending towards non-normality, although these deviations were deemed acceptable based on skewness and kurtosis values. Maximum likelihood (ML) estimation procedures require that data meet the multivariate normality assumption, otherwise fit statistics and parameter estimates can

be distorted (Kline, 2012). Therefore, to adjust for issue of non-normality, the model was analyzed with maximum likelihood estimation with robust standard errors (MLR). Table 5 provides a summary of the mediated structural model. Contrary to expectations, support was not found for an indirect effect of cognitive inhibition on suicidality through depressive rumination, as none of the paths were significant (see figure 5). Therefore, this hypothesis was not supported by the current data and model.

Table 5

Table 5: Model Summary for Mediation Model

	Estimate	S.E.	Est/S.E.
Suicidality on:			
Cognitive Inhibition	0.035	0.041	0.390
Rumination	0.043	0.073	0.581
Rumination on:			
Cognitive Inhibition	-0.064	0.096	-0.670

*p < .05

Figure 5

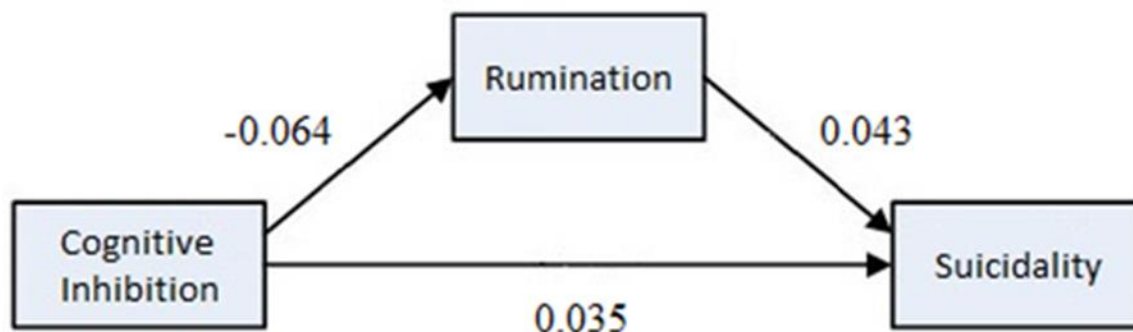


Figure 5: Standardized regression weights for the simple mediation model with rumination as the mediating variable.

* $p < .05$

Moderated Mediation Model

This study's primary hypothesis stated that, in addition to rumination acting as a mediating variable between cognitive inhibition and suicidal ideation, insomnia would also moderate the relationship between cognitive inhibition and rumination. In other words, we predicted that mediation would depend on the degree of insomnia severity. To test this, a moderated mediation structural equation model was created with rumination coded as an intervening variable between cognitive inhibition and suicidal ideation, and with insomnia coded as an intervening variable between cognitive inhibition and rumination.

The moderated mediation model was tested using a Bayesian approach, a technique that has received increasing attention in recent years as it provides numerous advantages when applied to moderated mediation analysis (Wang & Preacher, 2015). Wang and Preacher (2015)

recently reported that, as compared to frequentist estimation methods such as maximum likelihood (ML) techniques, the Bayesian approach yields unbiased estimates and would possess comparable or higher power than ML methods, depending on the specific approach. In the perspective of frequentist approaches, model parameters are believed to be unknown and are usually fixed at 0. In comparison, with the Bayesian approach, model parameters are considered to be random quantities with small variances on the parameters (Muthén & Asparouhov, 2012). By allowing parameters to vary in a small range, this approach solves potential problems of model under-identification and often allows for a conceptually easier analysis (Gelman & Hill, 2007). Furthermore, the Bayesian approach also shows some flexibility in SEM, as it relaxes the traditional assumption of an asymptotic distribution for the covariance matrix. This assumption would require that the data be independently and identically distributed, follow a multivariate normal distribution, and have quite a large sample size, and thus, is often unrealistic for practical applications (Muthén & Asparouhov, 2012).

Finally, the Bayesian approach estimates model parameters from posterior distributions, since they are not fixed at 0, which requires us to specify the prior distribution of the variables. The prior distributions can be specified using either subjective or objective methods, depending largely on the researcher's prior knowledge. The subjective approach imposes specific and definite information about the parameters onto the model, whereas the objective approach is based upon a vague, non-flat prior distribution and adds very little prior information (Press, 2003). Given the prior literature, the current study employed the objective approach and used Mplus' prior defaults for estimation.

The Markov Chain Monte Carlo (MCMC) algorithm is the most commonly used approach for approximating the posterior distribution and was implemented for the current study. In order to evaluate the fit of a model using Bayesian approaches, a posterior predictive checking procedure can be run based upon convergence of the MCMC chains (Asparouhov & Muthén, 2010), which produces a posterior predictive p-value (PPP). Typically, a *PPP* value below .05 is used to indicate a poor model fit (Asparouhov & Muthén, 2010). Results of the posterior predictive checking procedure revealed the model was a poor fit to the data ($p < .01$), indicating that the moderated mediation hypothesis was not supported. Table 6 provides a model summary for the moderated mediation structural model. Although the model as a whole was not supported by the data, path coefficients suggested that insomnia partially mediated the relationship between cognitive inhibition and rumination ($\beta = .86, p < .01$). Yet, Contrary to expectations, none of the other paths were significant (see figure 6).

Figure 6

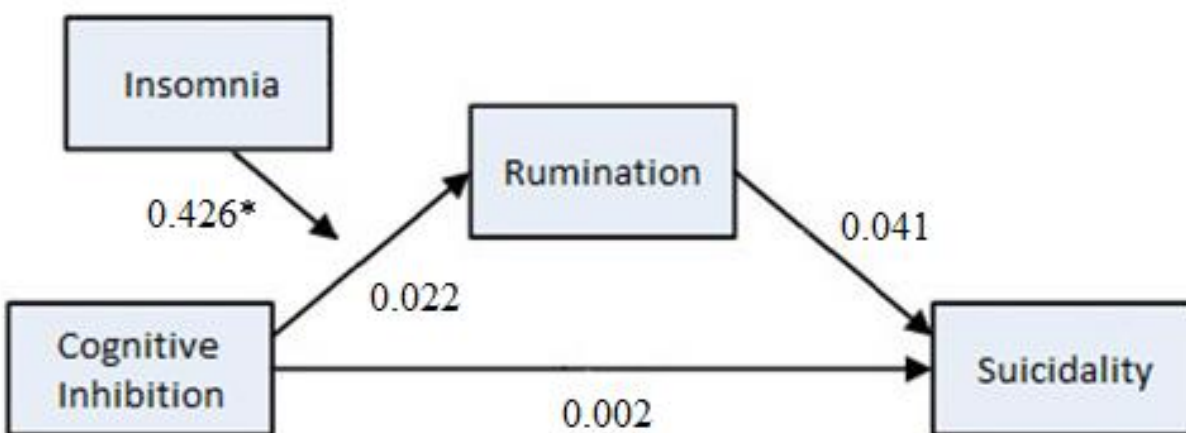


Figure 6: Standardized regression weights for the moderated mediation model with rumination as the mediating variable and insomnia as the moderating variable.

* $p < .05$

Table 6

Table 6: Model Summary for Moderated Mediation Model

	Estimate	S.D.	P-Value
Suicidality on:			
Cognitive Inhibition	0.002	0.003	0.280
Rumination	0.041	0.071	0.280
Rumination on:			
Cognitive Inhibition	0.022	0.065	0.368
Insomnia on:			
Cognitive Inhibition & Rumination	0.426	0.057	0.000

*p < .05

Discussion

The purpose of the present study was to extend previous research by examining whether cognitive inhibition deficits exist among those with suicidal ideation and by examining how rumination, cognitive inhibition, and insomnia are related to one another in suicide-prone individuals. This study was also intended to shed light on how these variables differ in various suicidal mental states (i.e., suicidal ideation, suicidal attempts, and the combination of both). As expected, healthy controls reported the lowest levels of overall rumination and brooding rumination as compared to the other groups. Results also revealed that individuals with a history

of attempted suicide endorsed lower levels of rumination and brooding than currently suicidal individuals; yet, these scores were also significantly higher than that of the controls. This is consistent with previous findings that brooding rumination is higher among individuals with previous suicidal attempts than those without such a history (Grassia & Gibb, 2009) and supports suggestions that disordered thinking may continue to be a problem among those who have exhibited past suicidal behaviors. Although differences in rumination and brooding have not yet been compared between current suicidal ideators and previous attempters, it is perhaps unsurprising that currently suicidal individuals would display higher levels of this form of dysfunctional thinking. With regard to both overall rumination and brooding, significant differences were not observed between the currently suicidal and currently suicidal plus previously attempted groups.

Surprisingly, healthy controls endorsed the lowest levels of reflection, a form of self-focus which is generally considered to be beneficial. Previously attempted participants also endorsed lower levels of reflection than either of the groups with current suicidal ideation. Moreover, the currently suicidal plus previously attempted group reported higher reflection than the currently suicidal group. This contrasts with previous research which has found never suicidal participants to have significantly higher levels of reflection than those with previous suicidal attempts (Crane, Barnhofer, & Williams, 2007). Yet, previous work has demonstrated that brooding is more strongly related to suicidality than reflection (Miranda and Nolen-Hoeksema, 2007) and other research has called into question whether reflection truly plays a role in suicidality (O'Connor & Noyce, 2008; Chan, Miranda, & Surrence, 2009). Given the current findings, this may suggest that reflection is an extraneous factor in the context of suicidal

phenomenon. Alternatively, it may be that suicidal individuals attempt to engage in reflection, which is often characterized by problem-solving, yet are unable to do so successfully or instead arrive at unhelpful solutions. This would indicate that reflective rumination does not have the same protective effect for suicidality that it is believed to have within depression.

Results indicated that healthy controls had the lowest levels of insomnia. These findings are congruent with a large body of literature showing that sleep disturbances are associated with greater levels of suicidal ideation, as well as with attempted suicide (Agargun, Kara, & Solmaz, 1997; Winsper & Tang, 2014; Wojnar et al., 2009). In addition, previously attempted participants also experienced lower levels of insomnia symptoms than the two groups with current suicidal ideation. The data provide interesting and unique information on the differences between these three different phases of suicidality. As might be expected, those with a past history of attempts who are also presently struggling with ideation seem to be those who suffer the most from insomnia, suggesting that the combination of these states may have an additive effect. Moreover, current ideation seems to leave individuals more vulnerable to insomnia than a history of previous attempts.

The results revealed a significant interaction effect between participant group status and emotional word valence on reaction times. Control participants were the fastest to respond to positive words and the slowest in responding to negative words. This indicates the presence of a processing bias for positive words in healthy individuals which is consistent with previous findings (e.g., McCabe & Gotlib, 1995). Likewise, the previously attempted group displayed this same pattern of responding more quickly to positive words relative to negative words, although the difference was less pronounced among these participants. Both the currently suicidal and

currently suicidal plus previously attempted groups displayed the opposite pattern. Specifically, the currently suicidal participants responded more quickly to negative words than positive words. This difference was even more pronounced among currently suicidal and previously attempted participants, with this group being the fastest to respond to negative words and the slowest to response to positive words.

Findings have been mixed as to whether suicide attempters exhibit attentional biases for emotional words versus neutral words (e.g., Becker, Strohbach, & Rinck, 1999; Williams & Broadbent, 1986a). These results build upon that literature and suggest that any failure to find an attentional bias toward emotional words may have resulted from the non-specificity of emotional valence, given the differential processing of negative and positive words. Interestingly, the pattern of responding displayed by the previous attempters also seems to suggest that their speed of emotional processing more closely mirrors that of controls than those who are currently suicidal. As such, while these individuals may not return to their pre-attempted baseline, there is evidence that they recover from the negative processing bias seen among those with current suicidality. Furthermore, while these attentional biases have been examined within suicide attempter and other at-risk samples, such investigations have been largely overlooked among those endorsing current suicidality. The present study found a bias for negative information within both of the currently suicidal groups, which helps fill the current gap in the literature and demonstrates a consistent link between suicidality and an affective bias for negative stimuli.

Regarding errors of commission, the results indicated that the control group had difficulty inhibiting the processing of positively valenced information, which again demonstrates the existence of a positive processing bias for healthy individuals. Impairments were also found in

the inhibition of positive stimuli in individuals with a history of previous suicidal attempts, which is inconsistent with prior findings from a recent meta-analysis (Richard-Devantoy et al., 2012). However, studies from that meta-analysis included participants meeting criteria for differing affective disorders (unipolar, bipolar, schizophrenia), as well as both outpatients and inpatients. Therefore, the literature is still unclear as to whether individuals with a history of suicide attempts and depression only can be characterized by impaired cognitive inhibition.

In contrast, impairments in the inhibition of negative stimuli were found within the currently suicidal population, as well as among those with current suicidal ideation and a history of previous attempts. This suggests that suicide may be characterized by an inhibitory deficit for negative information, in the context of emotional information processing. In other words, currently suicidal individuals are likely to have a decreased ability to disinhibit from mood-congruent input. If true, this would mean that suicidal individuals would spend an increased amount of time focusing on negative information which may in turn serve to exacerbate symptoms. As such, it may be important for future studies to investigate whether interventions aimed toward improving inhibitory abilities are helpful in reducing suicidal ideations.

The present study also extended previous research by examining a moderated mediation model depicting the relationships between cognitive inhibition, rumination, insomnia, and suicidality. It was hypothesized that the effect of cognitive inhibition on suicidality would be mediated by depressive rumination, and further that this mediational relationship would be moderated by insomnia severity. In line with methodological suggestions, a simple mediation model was run in addition to the full mediated moderation model to determine which was a better fit for the study data. The results demonstrated that the data were not a good fit for the

simple mediation model, suggesting that this relationship was not supported in the current sample.

Results of the present study also failed to support the proposed moderated mediation model. Overall, rumination did not function as a mediator between cognitive inhibition and suicidality. Yet, the data did support insomnia as a moderator within the specified model, suggesting that insomnia may partially account for the association between cognitive inhibition and rumination. In other words, the relationship between cognitive inhibition and rumination may vary with differing degrees of insomnia severity. However, given the model's poor fit with data, this result must be interpreted with caution and would thus need to be replicated by future research.

Given that neither the simple mediation model nor the full mediated moderation were a good fit for the present data, the current study did not support the proposed mediation or moderation pathways. Yet, correlational analyses revealed that cognitive inhibition, rumination, insomnia, and suicidality were all significantly related, with medium to large strength effects. Thus, although the current study contributes to the literature by examining these variables in a more precise sample of suicidal individuals than what is currently present and by comparing the variables within three differing suicidal mental states, further research is clearly needed in order to clarify the precise relationship between these correlates.

Limitations and Future Directions

This study possessed several limitations which should be acknowledged. First, study recruitment was conducted via MTurk and all study variables were assessed through a web-based survey. Although, research has suggested that MTurk offers several advantages and can be

applied to the study of clinical disorders and clinically relevant phenomenon, it is important to mention that very little work has investigated the use of MTurk for studying clinical populations (Shapiro, Chandler, & Mueller, 2013). Thus, it is possible that this method may have introduced a sampling bias into the study, which potentially restricts the generalizability of the findings. For example, participants must have had internet access and knowledge of MTurk in order to participate in this study. Yet, given the novelty of the current study and inherent difficulty in obtaining the types of populations used in this research, the current study certainly provides initial information and a potential foundation for future work.

In addition, the study possessed some inherent limitations with the measures of suicidality and depression that were used for group classification. All self-report measures possess a degree of limitation as to whether we can be completely certain that their results are indicative of clinically relevant phenomenon. Individuals were categorized in the current study based upon their self-report of past and current suicidal ideation, suicidal attempts, and depressive episodes. Therefore, the diagnoses of ‘currently suicidal’ and ‘previously attempted’ may not have been completely accurate. Likewise, the characterization as currently depressed or previously depressed, for the purposed of group classification, are also not definitive in terms of a major depressive episode. It is thus possible that the present findings might differ from studies in which depressive status is confirmed by a structured diagnostic interview. Yet, for the purposes of this study, assessing suicidality and depression through the use of two different measures (questions from the SCID-I/NP in addition to the BSS and BDI) helped to increase the clinical utility of the current results. Future research should consider using structured clinical

interviews and/or verifying information with past medical records in order to increase the reliability of the groups.

Finally, although the study results yield interesting information about the relationships between these variables, we cannot discern the nature of the directional relationship between constructs, given that the cross-sectional design only allows for speculative interpretations of aspects that distinguished the current groups. Although suicidality, cognitive inhibition, rumination, and insomnia were all significantly associated, we cannot determine whether certain variables develop first and cause or intensify the experience of other symptoms, or whether these variables arise in conjunction. In other words, determining the specific progression from risk factors to symptomatology to the development of suicidal thoughts or intent is difficult without longitudinal data. As such, future research should consider the use of a longitudinal design in order to further clarify the exact relationship between these constructs.

Conclusions

The present study examined the relationships between rumination, cognitive inhibition, and insomnia within suicide-prone individuals, which revealed several potentially important findings. Correlational analyses revealed that cognitive inhibition, rumination, insomnia, and suicidality were all significantly associated, suggesting that relationships do exist among these variables. The data also supported insomnia as a moderator within the specified moderated mediation model, suggesting that insomnia partially accounts for the association between cognitive inhibition and rumination. However, given the model's poor fit with data, this result must be interpreted with caution and need to be replicated by future research.

Group comparisons of overall rumination, brooding rumination, reflection, insomnia, and cognitive inhibition deficits revealed that healthy controls reported the lowest levels of each. In general, the currently suicidal and currently suicidal plus previously attempted groups endorsed higher levels of these variables than the previous attempted participants. However, there were mixed findings as to whether there were differences between currently suicidal and currently suicidal plus previously attempted participants. Overall, these findings suggest that current ideation seems to leave individuals more vulnerable to these symptoms than a history of previous attempts. Furthermore, since those with a past history of attempts who are also presently struggling with ideation demonstrated elevations on some of the constructs above those with current suicidal ideation only, this may suggest that the combination of these suicidal states may have an additive effect. If true, this would indicate that individuals with multiple suicidal experiences would have the highest need for treatments that reduce rumination, insomnia, and cognitive inhibition deficits.

The results revealed a significant interaction effect between group status and emotional word valence on the reaction times computer task, suggesting that the speed of emotional processing among previous attempters more closely mirrors that of controls than those who are currently suicidal. Thus, these individuals likely recover from the negative processing bias seen among those with current suicidality, yet, do not return to their pre-attempted baseline. The present study also found a negative information bias within both of the currently suicidal groups, a relationship which has previously been untested. Finally, data regarding errors of commission suggested that currently suicidal individuals are likely to have a decreased ability to disinhibit from mood-congruent input. Interventions which teach inhibitory skills may prove to be

beneficial for treating suicidality and therefore, future research should work toward developing such interventions and evaluating their efficacy.

Although replication is needed, the results from this study demonstrate the existence of relationships between cognitive inhibition, rumination, insomnia, and suicidality. Future research should attempt to clarify the precise relationship between these correlates. The current study also provides information about the differences between various suicidal mental states through the comparison of multiple suicidal groups. Such investigations may provide insights into the underlying processes of varying degrees of suicidality. Thus, future research should also attempt to include participants from multiple suicidal states within their investigations.

Suicidality is considered one of the most severe and life-threatening consequences of all psychological illnesses and is a significant public health issue. Given the widespread and serious nature of this phenomenon, research aimed at understanding and reducing the incidence of suicide is of considerable importance. The current study helps to fill the gap in literature pertaining to suicidality among those with depression, yet, significant endeavors and advancements are still needed. Identifying the relationship between factors that contribute to suicidality would be an important step in increasing our knowledge of risk and causality, the construct of suicide itself, and potentially help us develop more effective intervention strategies.

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Appendix A

Post Hoc Analyses

Subsequent analyses investigated the proposed mediation and moderation relationships through a series of multiple regression analyses using all four groups. An examination of these individual path coefficients revealed that the path from rumination to suicidality ($\beta = .63, p < .01$) and the path from cognitive inhibition to suicidality ($\beta = .12, p < .01$) were both significant. Likewise, the moderation pathway for insomnia between cognitive inhibition and rumination was also significant ($\beta = .73, p < .01$). Whereas, the path from cognitive inhibition to rumination was non-significant ($\beta = .05, p = .29$). This suggests that these variables may indeed play a role for suicidality and further research should attempt to clarify the precise relationship between these correlates.