The Association Between Nocturnal Panic Attacks and Suicidal Ideation, Plans, and Attempts

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Highlights

- Panic groups reported more suicidal ideation and plans than non-panic group
- Nocturnal panic group reported more suicide attempts than daytime only panic
- Nocturnal panic group judged themselves more likely to make future suicide attempts
Abstract

Panic and sleep disturbances are established risk factors for suicide. Nocturnal panic attacks, which occur out of sleep, represent an intersection of these risk factors. Only one study to date has examined this relationship, but measured suicidality as a unitary construct. This represents a significant gap in the literature, considering most individuals who think about suicide do not make a plan and most who make a plan never make an attempt. We sought to expand upon existing research by examining how nocturnal panic relates to suicidal ideation, plans, and attempts separately. We predicted nocturnal panic would be associated with more suicidal ideation, plan, and attempt history than daytime only panic and no panic. Participants recruited from an online community sample were thoroughly screened for nocturnal and daytime panic history and completed questionnaires about past suicidal ideation, plans, and attempts. Nocturnal and daytime panic groups did not differ in past suicidal ideation or plans, but both groups exceeded the non-panic group. The nocturnal panic group reported more suicide attempts than the daytime and non-panic groups and judged themselves as more likely to make an attempt in the future. These results indicate a promising avenue for future research and suicide prevention efforts.
1. Introduction

Suicide is a global public health problem with over 800,000 people dying by suicide each year (Naghavi, 2019). Although global suicide rates have steadily decreased (Naghavi, 2019), in the United States (US), suicide rates have increased 31% since 2001 (Centers for Disease Control [CDC], 2019). According to the most recent US estimates, over 47,000 individuals died by suicide and approximately 1.4 million adults attempted suicide in 2017 (CDC, 2019; Substance Abuse Mental Health Services Administration [SAMHSA], 2019). In addition to lives lost, the estimated direct medical and work loss costs associated with suicide attempts and deaths is estimated to be $70 billion annually (Stone et al., 2018).

There is accumulating evidence indicating that suicide attempts are often preceded by sudden increases in agitation (Britton et al., 2012; Ribeiro et al., 2015; Ribeiro et al., 2014) and accompanied by regulatory disturbances (e.g., sleep disturbances; Pigeon et al., 2012). In line with this evidence, panic disorder and sleep disorders are two factors that have independently been associated with increased rates of suicidal thoughts and behaviors (Pigeon et al., 2012; Santos et al., 2018) and are characterized by disrupted regulatory systems and increased agitation. Nocturnal panic (panic attacks that occur during sleep) is an understudied topic in the suicide literature but may represent a malleable risk factor that increases suicide risk. Importantly, there are evidence-based psychotherapeutic treatments for anxiety and sleep-related disorders/symptomology (Ashworth et al., 2015; Barlow et al., 2000; Gould et al., 1995; Okajima et al., 2011) that may decrease suicide risk (Zalsman et al., 2016).

1.1. Sleep disturbances and suicide

Research to date has consistently linked sleep disturbances to suicidal ideation, suicide attempts, and suicide risk (Bernert and Nadorff, 2015; Goodwin and Marusic, 2008; Nadorff et
al., 2014; Wojnar et al., 2009). Notably, sleep disturbances encompass several different factors that contribute to poor overall sleep such as chronic sleep problems (e.g., difficulty falling asleep, difficulty staying sleep), insomnia symptoms, nightmares, and sleep duration. In adult samples, previous research has found that several facets of sleep disturbance are associated with suicidal ideation including nightmares (Bernert and Nadorff, 2015), chronic sleep problems (Wojnar et al., 2009), and insomnia symptoms (Nadorff et al., 2011). Research has also indicated a relationship between sleep and suicide attempts such that chronic sleep problems (Wojnar et al., 2009), nightmares (Bernert and Nadorff, 2015), and shortened sleep duration (Goodwin and Marusic, 2008) have all been found to be associated with suicide attempts.

Research to date also suggests that the influence of sleep on suicide related variables (e.g., suicidal ideation, suicide attempts) occurs independently of mental health symptoms with sleep implications (e.g., depression, anxiety, Post Traumatic Stress Disorder [PTSD]). Specifically, research to date has found that nightmares are associated with suicidal ideation, suicide attempts, and suicide risk independent of common risk factors for suicide including interpersonal-psychological theory of suicide variables, depression, anxiety, and PTSD symptoms (Nadorff et al., 2011; Nadorff et al., 2014). Lastly, there is also some evidence that insomnia symptoms are independently associated with suicidal ideation when controlling for depression and IPTS variables (Nadorff et al., 2014).

1.2. Panic attacks and suicide

Anxiety disorders have consistently been linked to suicidal ideation and suicide attempts (Bentley et al., 2016; Borges et al., 2008; Franklin et al., 2017) and anxiety disorders are listed as an important risk factor for suicide by several national organizations (American Foundation for Suicide Prevention [AFSP], 2020; National Suicide Prevention Lifeline, 2020). Specifically,
panic disorder is an anxiety disorder that is reliably associated with suicidal thoughts and behaviors (Nock et al., 2010; Nock et al., 2018; Santos et al., 2018). Individuals with panic disorder fear recurring panic attacks and display avoidant behaviors to ensure they do not occur again (APA, 2013).

Several hypotheses exist for the relationship between panic disorder and suicidal thoughts and behaviors. For example, Beck’s cognitive model of suicide (Wenzel and Beck, 2008), posits that when a schema for suicide is activated, anxiety and agitation may serve as attentional fixations on suicide and ultimately increase suicide risk. Consistent with Baumeister’s theory of suicide as an escape from the self (Baumeister, 1990), another purported hypothesis for this link is that the intense surges of discomfort in panic attacks may cause a person to search for an escape from aversive conditions. This may hold especially true for people who are fearful of experiencing the cognitive symptoms (i.e., anxiety sensitivity cognitive concerns; ASCC) associated with panic attacks, as findings suggest that panic attack symptoms most related to ASCC (e.g., fears of losing control, fearing they might die) most strongly predict suicide attempts in individuals with depression (Capron et al., 2012; Yaseen et al., 2011). Lastly, panic disorder aligns with two recently proposed diagnostic entities: 1) Acute Suicidal Affective Disturbance (ASAD; Tucker et al., 2016) and 2) Suicide Crisis Syndrome (SCS; Cohen et al., 2018), which are based on the growing evidence that acute anxious states (e.g., increased arousal and agitation, panic attacks) are present immediately prior to suicide attempts. ( Britton et al., 2012; Ribeiro et al., 2015; Ribeiro et al., 2014).

1.3. Nocturnal panic and suicide

Nocturnal panic attacks are panic attacks that occur out of a sleeping state (Craske and Rowe, 1997). They comprise the same symptoms as panic attacks that occur during wakeful
states (daytime panic) and result in awakening from sleep in the midst of a panic attack (Freed et al., 1999). Much like uncued daytime panic attacks, nocturnal panic occurs without obvious triggers such as nightmares or loud noises (Craske and Rowe, 1997). People often have difficulty returning to sleep following a nocturnal panic attack and avoid sleep due to fear of additional panic attacks (Tsao and Craske, 2003). Those who experience nocturnal panic are also more likely to report sleeping fewer than five hours each night compared to those who experience only daytime panic (Singareddy and Uhde, 2009). Thus, nocturnal panic constitutes an intersection of the suicide risk factors that accompany both sleep disturbance and panic attacks. Only one study to date has examined the association between nocturnal panic and suicide. Ağargün and Kara (1998) found that chronic nocturnal panic was related to increased suicidality in panic disorder patients. This study, however, did not separate suicidal ideation, plans, and attempts but rather addressed suicidality as a unitary construct. This is a major limitation, because most individuals with suicidal thoughts do not go on to make a plan, and most that make a plan do not go on to make an attempt (Joiner, 2005). Ağargün and Kara (1998) also did not describe how nocturnal panic was differentiated from other sleep disturbances. This also constitutes a limitation, because sleep disturbances such as nightmares and sudden awakenings due to unexpected noises may be mistakenly reported as nocturnal panic attacks (Craske and Tsao, 2005). Further research is needed to replicate these findings and determine the nature of the increased suicidality previously observed in those who experience nocturnal panic attacks.

1.4. Aims and hypotheses

The current study seeks to replicate and expand upon the existing literature by further characterizing the association between nocturnal panic attacks and suicidality. This study is the first to examine how nocturnal panic relates to suicidal ideation, suicide plans, and suicide
attempts as separate constructs. We predict that individuals with nocturnal panic will report more frequent and intense lifetime suicidal ideation compared to individuals with only daytime panic and individuals who do not experience panic attacks. We also predict that those with only daytime panic will report more frequent and intense lifetime suicidal ideation compared to those who do not panic. We expect suicide plans to follow a similar pattern, with the nocturnal panic group containing the largest number of individuals reporting lifetime suicide plans, the daytime panic group reporting an intermediate number of suicide plans, and the non-panic group reporting the fewest suicide plans. Finally, we predict that report of past suicide attempts will follow the same pattern with individuals who experience nocturnal panic reporting the most past attempts, those with only daytime panic reporting an intermediate number of attempts, and individuals without panic attacks reporting the fewest past suicide attempts.

Further, we examined differences in judgements of likelihood of future ideation, plans, and attempts in relation to nocturnal panic. Nock and colleagues (2010) found that self-reported judgements of likelihood of future suicide attempts predicted actual future attempts better than other self- and clinician-report measures. Individuals who experience nocturnal panic, who may feel unable to react properly to threats in states of non-vigilance, may also unable to cope appropriately with suicidal crises. Highly emotional states (e.g., suicidal crises) may elicit the same out of control feeling that non-vigilant states do for individuals with nocturnal panic, resulting in the judgement that they would be unable to prevent such crises from occurring again. This study is the first to examine judgements of future suicidal thoughts and behaviors in the context of nocturnal panic. We predict that individuals with nocturnal panic will judge themselves to be more likely to experience suicidal ideation, make a suicide plan, and make a suicide attempt in the future compared to those with only daytime panic and those who do not
experience panic attacks. We also predict that individuals with only daytime panic will judge themselves as more likely to experience ideation, plans, and attempts in the future compared to those who do not experience panic attacks. Participants’ predictions of their own future suicide risk may contribute additional information about the ways in which nocturnal panic related to suicidal cognitions.

2. Methods

2.1. Participants

Participants ($N = 168$) were adults recruited through Amazon’s Mechanical Turk (MTurk) system to participate in a research study about anxiety, sleep disturbances, and suicide. Inclusion criteria required participants to be at least 18 years of age, living in the United States, and have an MTurk approval rating of 95% or higher. Participants were sorted into nocturnal panic (NP), daytime panic (DP), and without panic (WP) groups based on reported panic attack history. Responses to the Nocturnal Panic Screen, used by Craske and Tsao (2005) to create similar groups, and the Daytime Panic Screen were used to determine group membership. Participants who endorsed nocturnal panic attacks alone or in addition to daytime panic attacks comprised the NP group ($N = 56$). Participants who endorsed daytime panic attacks only comprised the DP group ($N = 52$). Participants who did not endorse daytime or nocturnal panic attacks comprised the WP group ($N = 60$). Participants were recruited through a series of batches on MTurk such that each panic group contained roughly the same number of participants. That is, once a sufficient number of WP group members were recruited, individuals who did not endorse a history of panic attacks were excluded, allowing recruitment of DP and NP participants until all groups reached a sufficient number of participants.
Due to the overlap between DP and NP and other conditions (e.g., stress, worry, nightmares) we created a novel stringent screening system. Participants were excluded if they endorsed a history of nocturnal or daytime panic attacks but failed the corresponding panic attack definition check. The definition checks required participants to choose the correct description of a daytime panic attack from four alternatives then choose a nocturnal panic attack from four alternatives. Participants were also excluded if they endorsed a history of panic attacks but reported never experiencing four or more panic symptoms during a single panic attack, according to DSM-5 criteria (APA, 2013). No demographic differences were found when comparing those included and excluded from the study.

Participants ranged in age from 20 - 72 ($M = 35.6, SD = 10.6$) and were nearly evenly split between biological sexes ($N = 94$ female; 55.6%). The majority of participants identified as white (70.4%) and not Hispanic (82.2%). Demographic characteristics of the panic groups are displayed in Table 1. Participants in the NP group were more likely than the DP and WP groups to have served in the military (23.2%), to identify as having a disability as defined by the Americans with Disabilities Act (ADA; 12.5%), to identify as having a sexual orientation other than heterosexual (30.4%), and to identify as transgender (17.9%).

### 2.2. Procedure

Participants who met eligibility criteria completed self-report questionnaires online through MTurk. Participants who failed the panic attack definition checks were directed to a message informing them that they did not qualify for the study prior to completing the outcome questionnaires. Participants who correctly answered the definition checks completed the outcome questionnaires and were awarded 75 cents as compensation for their time. All study procedures were approved by the university’s Institutional Review Board, and informed consent was
obtained from all participants prior to data collection. The full dataset, prior to analysis is available via Mendeley Data (Smith et al., 2020).

2.3. Self-report measures

2.3.1. Nocturnal Panic Screen

The Nocturnal Panic Screen (Craske and Tsao, 2005) is an 18-item questionnaire used to assess history of nocturnal panic attacks in terms of frequency, symptom severity, and timeline (e.g., *When was your most recent panic attack from a sleeping state?*). The measure provides a detailed description of a nocturnal panic attack that is displayed throughout the screener so that participants may easily distinguish nocturnal panic from awakenings due to nightmares or loud noises. Participants also rate the severity of the 14 panic symptoms that may occur during a panic attack, according to the DSM-5 on a 5-point Likert scale ranging from 0 (*Not at all*) to 4 (*Extreme*). The Nocturnal Panic Screen was designed to be administered in person but was adapted for a digital administration for this study. The final question on the Nocturnal Panic Screen was a definition check that was added in this study to confirm that participants were reporting true nocturnal panic. Participants were asked to identify a nocturnal panic attack from four alternatives including descriptions of waking from a nightmare, waking due to a thunderstorm, waking from a nocturnal panic attack, and panicking after being awake for some time. The nocturnal panic description was not displayed during this question, requiring participants to correctly identify the nocturnal panic attack from memory.

2.3.2. Daytime Panic Screen

The Daytime Panic Screen was adapted from the structure and wording of the Nocturnal Panic Screen (above). It contains 19-items that measure the frequency, symptom severity, and timeline of daytime panic attacks (e.g., *Have you ever experienced a panic attack while awake*?).
This measure also provides a detailed description of a daytime panic attack. The description is displayed throughout the screener so that participants may easily differentiate panic attacks from other feelings of nervousness or anxiety. Participants rate the severity of the 14 symptoms that may occur during a panic attack, according to the DSM-5 on a 5-point Likert scale ranging from 0 (Not at all) to 4 (Extreme). The final question on the Daytime Panic Screen was a definition check that served to confirm that participants were reporting true daytime panic attacks. The daytime panic attack description was removed from view and participants were asked to identify a daytime panic attack from four alternatives including descriptions of worry about an upcoming stressful event, a daytime panic attack, performance anxiety, and anxiety following a stressful event.

2.3.3. Self-Injurious Thoughts and Behaviors Interview-Short Form (SITBI-Short Form)

The SITBI-Short Form (Nock et al., 2007) is a structured interview containing 72 items in six modules that measure the presence, frequency, and characteristics of six types of self-injurious thoughts and behaviors: 1. suicidal ideation (e.g., Have you ever had thoughts of killing yourself?), 2. Suicide plan (e.g., Have you ever actually made a plan to kill yourself?), 3. Suicide gesture (e.g., Have you ever done something to lead someone to believe that you wanted to kill yourself when you really had no intention of doing so?), 4. Suicide attempt (e.g., Have you ever made an actual attempt to kill yourself in which you had at least some intent to die?), 5. thoughts of non-suicidal self-injury (e.g., Have you ever had thoughts of purposely hurting yourself without wanting to die? (for example, cutting or burning)), and 6. non-suicidal self-injury (e.g., Have you ever actually engaged in non-suicidal self-injury?). Each module began with a screening question to assess lifetime prevalence. If participants answered “yes” to the screening question, the rest of the module was administered. If participants answered “no” to the screening
question, they were redirected to the screening question for the next module. Denying suicidal ideation did not result in bypassing the plan, gesture, and attempt modules so as to include individuals who might report engaging in one of those behaviors without thinking about it first. The SITBI-Short Form was designed to be administered in person to allow for follow-up questions but has been used in self-report format in prior web-based studies (Stanley et al., 2015).

2.4. Data analytic plan

Prior to conducting analyses, free text response items were reviewed to screen for automated responses and careless responding. Responses to free text items that appeared illogical or unrelated to the item content were considered to indicate careless or automated responding. One case of automated responding was detected that had not been screened out by the group determination process and was removed prior to analyses. The free text responses of all remaining cases appeared appropriate and logical. One-tailed N-1 chi-square analyses were run to determine group differences in lifetime suicidal ideation, plans, and attempts. Due to the reduced number of individuals reporting past suicidal ideation, plans, and attempts, the N-1 chi-square analysis was chosen as the most appropriate analysis based on previous literature and theoretical models, as described by Campbell (2007). The NP group had the largest number each of individuals reporting lifetime suicidal ideation, plans, and attempts and the WP group had the smallest number each. Therefore, N-1 chi-square analyses were run comparing the NP group to the DP group and the DP group to the WP group. Skewness and kurtosis were examined for worst-point ideation intensity, worst-point plan intensity, and estimated likelihoods of future ideation, plans, and attempts. Worst-point plan intensity was negatively skewed (-1.29). This measure was rank transformed using Blom’s formula to more accurately estimate a normal
distribution (ranged from -1.49 to 0.64; Blom, 1958). No other measures violated normality assumptions. Next, chi-square analyses were run to identify group differences in demographic variables. Finally, one-way ANCOVAs were conducted on continuous variables using demographic variables that significantly differed between groups as covariates. Planned contrasts were run to compare the NP group to the DP group and the DP group to the WP group. False positive rates were controlled for using the false discovery rate control method described by Glickman and colleagues (2014) to minimize type I error. Analyses were conducted using SPSS version 24.

3. Results

3.1. Correlations

Overall means and correlations for each continuous variable are reported in Table 5. Judgements of future likelihood of suicidal thoughts and behaviors were most strongly correlated with one another, indicating people made similar judgements regarding future suicidality regardless of which dimension was being reported. Similarly, worst-point intensity of ideation and plans were also strongly positively correlated with one another.

3.2. Group comparisons of suicidal ideation, plan, and attempt

To examine group differences on categorical variables, a series of chi-square analyses were conducted. For each outcome variable (ideation, plan, and attempt), the NP group had the highest numbers, followed by the DP group, followed by the WP group. To limit the number of analyses, comparisons were made only between the NP and DP groups and between the DP and WP groups.

3.2.1. Lifetime ideation
N-1 Chi-square analyses revealed a non-significant difference between the NP and DP groups $\chi^2(1, 108)=.42, p=.26$. The difference between DP and WP groups, however, was significant, $\chi^2(1, 112)=19.11, p<.001$, with a medium effect size (phi coefficient=.41) based on Cohen’s (1988) criteria. Daytime and nocturnal panic groups were more likely to report lifetime suicidal ideation than the without panic group. Experiencing nocturnal panic attacks, however, did not increase the likelihood of reporting lifetime suicidal ideation beyond that of individuals who panic only while awake. Crosstabulation of lifetime ideation is reported in Table 2.

3.2.2. Lifetime plans

N-1 Chi-square analyses revealed a non-significant difference between the NP and DP groups $\chi^2(1, 108)=2.34, p=.06$. The difference between DP and WP groups was significant, $\chi^2(1, 112)=7.36, p=.003$, with a small effect size (phi coefficient=.26). Similar to ideation results, nocturnal and daytime panic groups were more likely to report having made a suicide plan compared to the without panic group but experiencing nocturnal panic attacks had no effect compared to those who panic only while awake. Crosstabulation of lifetime plans is reported in Table 3.

3.2.3. Lifetime attempts

N-1 Chi-square analyses revealed a significant difference between the NP and DP groups $\chi^2(1, 108)=3.59, p=.03$ with a small effect size (phi coefficient=.18). The difference between DP and WP groups was also significant, $\chi^2(1, 112)=3.47, p=.03$, with a small effect size (phi coefficient=.18). Experiencing panic attacks while awake and/or while asleep may have some effect on an individual’s likelihood of reporting a past suicide attempt. Crosstabulation of lifetime attempts is reported in Table 4.

3.3. Group comparisons of suicide risk variables
To examine group differences on reported worst-point intensity and likelihood of future suicidal thoughts and behaviors, a series of one-way ANCOVAs was conducted. Each analysis used military status, disability status, sexual orientation, and self-identification as transgender as covariates because there were significant differences between groups. Correlations were run on the covariates to test for multicollinearity. No two covariates correlations exceeded the suggested cut-off of $r=0.80$ (Pallant, 2016) and so, the multicollinearity assumption was not violated. Refer to Table 5 for group means and standard deviations for worst-point and future likelihood measures. Unless otherwise stated, no assumptions were violated in the following analyses.

3.3.1. **Worst-point Intensity**

There was a non-significant main effect for worst-point ideation intensity, $F(2, 48)=2.08, p=0.14$. Levene’s test was violated for this analysis ($p=0.03$), and a Kruskal-Wallis Test was performed as a non-parametric alternative. The Kruskal-Wallis Test was also non-significant ($p=0.11$). Thus, the groups did not differ on estimates of worst-point intensity of suicidal ideation. The main effect for worst-point plan intensity was non-significant, $F(2, 30)=0.563, p=0.58$, indicating the groups did not differ on estimates of worst-point plan intensity.

3.3.2. **Likelihood of future suicidal ideation, plan, and attempt**

There was a non-significant main effect for likelihood of future ideation, $F(2, 48)=0.65, p=0.52$. The main effect for likelihood of future plan was also non-significant, $F(2, 30)=2.72, p=0.09$. Finally, the main effect for likelihood of future attempt was significant, $F(2, 19)=6.14, p=0.02$, with a large effect size (partial eta squared = 0.51). Planned contrasts revealed that the NP group significantly differed from the DP group ($p=0.02$), but the DP group did not significantly differ from the other groups.

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2 Analyses were run without covariates. Trends in significance did not change.
3 Analyses were run without covariates. Trends in significance did not change for likelihood of future ideation. Likelihood of future plan was significant, $F(2, 30) = 4.73, p = .02$. Likelihood of future attempt was also significant, $F(2, 19) = 6.28, p = .01$. 
differ from the WP group \( (p=.34) \). Thus, individuals with nocturnal panic did not differ from individuals with only daytime panic on their estimation of the likelihood of future ideation or plans but were more likely to anticipate a future suicide attempt. Individuals who experience only daytime panic and those who do not experience panic attacks did not differ in their estimation of the likelihood of future ideation, plans, or attempts.

4. Discussion

The purpose of the current study was to replicate and expand upon the extant literature examining the associations between nocturnal panic attacks and suicidal thoughts and behaviors. We expanded upon prior research by examining components of suicide including lifetime prevalence of ideation, plans, attempts, worst-point intensity, and the estimation of future attempts in relation to nocturnal panic attacks. Our hypotheses were partially supported with group differences across lifetime ideation, plans, and attempts. Individuals who had never experienced a panic attack were least likely to report a history of suicidal ideation, plans, and attempts. Individuals who experienced nocturnal panic and those who experienced only daytime panic did not differ on reported history of ideation or plans. Panic groups only differed in that the nocturnal panic group was more likely than the daytime panic group to report past suicide attempts. Additionally, results indicated group differences on estimation of the likelihood of a future attempt. Groups did not differ, however, on estimates of the likelihood of future suicidal ideation or plan, nor did they differ on estimates of worst-point ideation or plan.

Results of the current investigation emphasized the impact of panic on lifetime suicide ideation, plans, and attempts. A history of panic was associated with more reported lifetime suicidal ideation, plans, and attempts compared to those who had never experienced a panic attack. These results are consistent with prior research indicating an association between panic
and suicide (Nock et al., 2018; Santos et al., 2018). There are several conceptual models that are in line with this result. Catastrophic fears also frequently accompany panic attacks, including fear of dying, fear of going crazy (Ottaviani and Beck, 1987) and, in the case of nocturnal panic, fear of loss of vigilance (Tsao and Craske, 2003). Katz and colleagues (2011) hypothesized that within a positive feedback loop, emotional distress is amplified by catastrophic cognitions. If unchecked, suicidal ideation develops and, for some, suicide attempts are used as a means to end the growing distress (Katz et al., 2011). The Depression-Distress Amplification Model (DDAM) builds on this theory by suggesting that anxiety sensitivity cognitive concerns, catastrophic fear of the consequences of cognitive anxiety symptoms, amplifies the distress associated with cognitive symptoms of both depression and anxiety (Capron et al., 2013). Distress increases to the point where suicidal ideation becomes increasingly frequent and intense (Capron et al., 2013).

Individuals who experienced nocturnal panic were even more likely than those who experienced only daytime panic to report a history of suicide attempts. Those with nocturnal panic were also more likely than those with only daytime panic and those without panic attacks to indicate that they were likely to engage in a future suicide attempt. There is evidence to suggest that recurring sleep loss has been associated with increased severity of anxious and depressive symptoms (Tkachenko et al., 2014). Furthermore, sleep disorders have been identified as a precursor to suicide attempts (Pigeon et al., 2012). Nocturnal panic represents the intersection of two established suicide risk factors: panic attacks and sleep disturbance. The results of the current study suggest that episodes of extreme agitation and anxiety coupled with shortened sleep duration may influence the transition from suicidal ideation and planning to the decision to make a suicide attempt. Sleep loss has been shown to negatively impact inhibitory
control (Demos et al., 2016), flexible problem solving (Harrison and Horne, 1999), risk evaluation (Mckenna et al., 2007), and moral judgement (Olsen et al., 2010). Deficits in these areas following chronic sleep loss may weaken an individual’s ability to successfully cope with a suicidal crisis, leading to a suicide attempt. For individuals who experience nocturnal panic, sleep loss and extreme agitation are persistently present, creating an emotional state conducive to a suicide attempt.

Prior research has suggested that a fear of loss of vigilance separates individuals with nocturnal panic from individuals with only daytime panic (Tsao and Craske, 2003). Individuals who experience nocturnal panic fear states in which their ability to respond to threats or protect themselves from danger is compromised, such as during sleep or meditation. These individuals likely experience more fear of dying in their sleep as a result of a sudden heart attack or natural disaster. Longitudinal research has identified that panic attacks in which the individual fears dying increases odds of a future suicide attempt (Yaseen et al., 2013). Repeated exposures to fear of dying in one’s sleep may reduce the sensitivity to such fears over time, consistent with Joiner’s (2005) theory that non-suicidal self-injury gradually reduces pain sensitivity and fear of death, thereby increasing capability for a suicide attempt.

It has been estimated that for each person who attempts suicide, two or three people ideate without making an attempt (Nock et al., 2008). Due to this discrepancy, Klonsky and May (2015) emphasized the need to identify risk factors that led to the progression from suicidal ideation to suicide attempts. Our results are consistent with the idea that nocturnal panic attacks may be a catalyst for the progression from ideation to attempts given the significant group differences between NP and DP regarding lifetime attempts. Additionally, theoretically, nocturnal panic attacks fit the criteria of sudden increases in agitation and regulatory
disturbances that have been highlighted in the literature as precursors to suicide attempts (Britton et al., 2012; Pigeon et al., 2012; Ribeiro et al., 2015; Ribeiro et al., 2014). The current study is the first to address the association between nocturnal panic and specific components of suicidality (i.e., ideation, plans, and attempts) separately. Therefore, the current study provides foundational research to further investigate how nocturnal panic may represent a risk factor for suicide attempts and subsequent suicide deaths in future longitudinal work.

The results of the current study should be interpreted alongside the study’s weaknesses. Primarily, the study was cross-sectional in nature, limiting causal interpretations of nocturnal panic on suicide risk factors. Future research should examine longitudinal effects of nocturnal panic on individual’s acute suicidal ideation, plans, and attempts. While the results of the current study provide generalizability to the general population, future research would be strengthened by examining the presence of nocturnal panic amongst suicide attempt survivors.

Individuals who experienced nocturnal panic attacks were more likely than those who experienced daytime only or no panic attacks to identify as transgender and were less likely to identify as heterosexual. Gender and sexual minority status has been demonstrated to be a meaningful risk factor for suicide (Haas et al., 2010); however, the limited number of participants reporting past suicide attempts in the present study made analyses that would control for these demographic differences, such as binary logistic regression, ill-suited to the data. Future studies should inquire about gender identity and sexual orientation, particularly in samples of suicide attempt survivors to better disentangle nocturnal panic from gender and sexual minority status with regard to suicide risk. This relationship is especially important to replicate and examine, as this is the first study to report gender identity and sexual orientation demographics related to nocturnal panic attacks.
Despite these limitations, this study has a number of notable strengths. Primarily, a novel and rigorous screening procedure was employed to ensure correct panic group membership. Previous studies have used single item self-report of daytime and nocturnal panic attack history (Smith et al., 2019; Tsao and Craske, 2003; O’Mahoney and Ward, 2003) or clinical interviews requiring trained study personnel conducting one-on-one evaluations (Craske et al., 2001; 2005; Freed et al., 1999). The screening process used in the current study represents a thorough and efficient means of separating individuals who report nocturnal panic, only daytime panic, and no panic. Additionally, this study is the first of its kind to examine the association between nocturnal panic attacks and specific suicide-related variables. Prior research demonstrated an association between nocturnal panic and suicidality but examined suicidality as a single construct (Ağargün and Kara, 1998). The current study was the first to clarify the association between nocturnal panic and suicide attempts specifically.

Overall, this study builds upon previous research on the association between nocturnal panic attacks and suicidality. Results provide support for previous literature identifying panic attacks as a risk factor for suicidal ideation and plans. The current study brought forth novel findings of the differences between individuals who experience nocturnal panic and those who experience only daytime panic regarding suicide attempts and estimated likelihood of future attempts. Future research should longitudinally examine how nocturnal panic attacks affect the presence and intensity of ideation, plans, and attempts.

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Table 1.

Demographic characteristics by group

<table>
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<tr>
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<th>Nocturnal Panic</th>
<th>Daytime Panic</th>
<th>Without Panic</th>
<th>( \chi^2 )</th>
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<tr>
<td><strong>Biological Sex</strong></td>
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<tr>
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<td>73.2%</td>
<td>67.3%</td>
<td>71.7%</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>5.4%</td>
<td>13.5%</td>
<td>11.7%</td>
<td></td>
</tr>
<tr>
<td>Latinx</td>
<td>10.7%</td>
<td>13.5%</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1.8%</td>
<td>3.8%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>American Indian</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Mixed races</td>
<td>1.8%</td>
<td>1.9%</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td>.17</td>
</tr>
<tr>
<td>Hispanic</td>
<td>25.0%</td>
<td>13.5%</td>
<td>13.3%</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
<td>.07</td>
</tr>
<tr>
<td>Never married</td>
<td>46.4%</td>
<td>59.6%</td>
<td>55.0%</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>44.6%</td>
<td>25.0%</td>
<td>41.7%</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>8.9%</td>
<td>15.4%</td>
<td>3.3%</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td>.24</td>
</tr>
<tr>
<td>High school diploma</td>
<td>8.9%</td>
<td>7.8%</td>
<td>20.0%</td>
<td></td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>21.4%</td>
<td>17.6%</td>
<td>13.3%</td>
<td></td>
</tr>
<tr>
<td>College Degree</td>
<td>69.6%</td>
<td>74.6%</td>
<td>66.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
<td></td>
<td>.46</td>
</tr>
<tr>
<td>Unemployed</td>
<td>5.5%</td>
<td>9.6%</td>
<td>3.3%</td>
<td></td>
</tr>
<tr>
<td>Employed part-time</td>
<td>14.5%</td>
<td>17.3%</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>Employed full-time</td>
<td>80.0%</td>
<td>73.1%</td>
<td>86.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Military Status</strong></td>
<td></td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Not a veteran</td>
<td>76.8%</td>
<td>96.2%</td>
<td>96.7%</td>
<td></td>
</tr>
<tr>
<td>Veteran</td>
<td>8.9%</td>
<td>1.9%</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td>Active duty</td>
<td>12.5%</td>
<td>1.9%</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td>Reserve</td>
<td>1.8%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td><strong>Disability</strong></td>
<td>12.5%</td>
<td>7.7%</td>
<td>0.0%</td>
<td>.02</td>
</tr>
<tr>
<td><strong>Sexual Orientation</strong></td>
<td></td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Heterosexual</td>
<td>69.6%</td>
<td>80.8%</td>
<td>98.3%</td>
<td></td>
</tr>
<tr>
<td>Homosexual</td>
<td>1.8%</td>
<td>1.9%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Bisexual</td>
<td>26.8%</td>
<td>15.4%</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td>Asexual</td>
<td>0.0%</td>
<td>1.9%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Pansexual</td>
<td>1.8%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Transgender</td>
<td>17.9%</td>
<td>1.9%</td>
<td>0.0%</td>
<td>&lt; .001</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>34.7 (10.3)</td>
<td>35.8 (8.9)</td>
<td>36.3 (12.4)</td>
<td>p = .70</td>
</tr>
</tbody>
</table>
Table 2.

Panic group comparison of lifetime suicidal ideation

<table>
<thead>
<tr>
<th></th>
<th>Suicidal Ideation</th>
<th>No Suicidal Ideation</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nocturnal Panic (%)</td>
<td>25 (44.6%)</td>
<td>31 (55.4%)</td>
<td>.52</td>
</tr>
<tr>
<td>Daytime Panic (%)</td>
<td>20 (38.5%)</td>
<td>32 (61.5%)</td>
<td></td>
</tr>
<tr>
<td>Without Panic (%)</td>
<td>3 (5.0%)</td>
<td>57 (95.0%)</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

Note. Nocturnal Panic, $n = 56$. Daytime Panic, $n = 52$. Without Panic, $n = 60$.

Table 3.

Panic group comparison of lifetime suicidal plans

<table>
<thead>
<tr>
<th></th>
<th>Suicide Plan</th>
<th>No Suicide Plan</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nocturnal Panic (%)</td>
<td>18 (32.1%)</td>
<td>38 (67.9%)</td>
<td>.13</td>
</tr>
<tr>
<td>Daytime Panic (%)</td>
<td>10 (19.2%)</td>
<td>42 (80.8%)</td>
<td></td>
</tr>
<tr>
<td>Without Panic (%)</td>
<td>2 (3.3%)</td>
<td>58 (96.7%)</td>
<td>.01</td>
</tr>
</tbody>
</table>

Note. Nocturnal Panic, $n = 56$. Daytime Panic, $n = 52$. Without Panic, $n = 60$.

Table 4.

Panic group comparison of lifetime suicide attempts

<table>
<thead>
<tr>
<th></th>
<th>Suicide Attempts</th>
<th>No Suicide Attempts</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nocturnal Panic (%)</td>
<td>13 (23.2%)</td>
<td>43 (76.8%)</td>
<td>.06</td>
</tr>
<tr>
<td>Daytime Panic (%)</td>
<td>5 (9.6%)</td>
<td>47 (90.4%)</td>
<td></td>
</tr>
<tr>
<td>Without Panic (%)</td>
<td>1 (1.7%)</td>
<td>59 (98.3%)</td>
<td>.06</td>
</tr>
</tbody>
</table>

Note. Nocturnal Panic, $n = 56$. Daytime Panic, $n = 52$. Without Panic, $n = 60$.

Table 5.

Means, standard deviations, and intercorrelations for worst-point and future likelihood measures

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Worst-point ideation</td>
<td>2.9</td>
<td>1.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Worst-point plan</td>
<td>3.3</td>
<td>1.0</td>
<td>.79**</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Likelihood of future ideation</td>
<td>2.2</td>
<td>1.2</td>
<td>.40**</td>
<td>.42*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Likelihood of future plan</td>
<td>2.1</td>
<td>1.3</td>
<td>-.04</td>
<td>.10</td>
<td>.77**</td>
<td>-</td>
</tr>
<tr>
<td>5. Likelihood of future attempt</td>
<td>2.3</td>
<td>1.2</td>
<td>-.26</td>
<td>-.07</td>
<td>.68**</td>
<td>.84**</td>
</tr>
</tbody>
</table>

Note. **$p < .01$. *$p < .05$.**