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Panic symptoms and elevated suicidal ideation and behaviors among trauma exposed individuals: Moderating effects of post-traumatic stress disorder

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Abstract

Panic attacks (PAs) are highly prevalent among trauma exposed individuals and have been associated with a number of adverse outcomes. Despite high suicide rates among trauma exposed individuals, research to date has not examined the potential relation between panic symptoms and suicidal ideation and behaviors among this high risk population. The current study tested the association of panic with suicidal ideation and behaviors among a large sample of trauma exposed smokers. Community participants (N = 421) who reported a lifetime history of trauma exposure were assessed concurrently for current panic, suicidal ideation and behaviors, and psychiatric diagnoses. Those who met criteria for a current panic disorder diagnosis were removed from analyses to allow for the assessment of non-PD related panic in line with the recent addition of the PA specifier applicable to all DSM-5 disorders. Findings indicated that panic symptoms were significantly associated with suicidal ideation and behaviors beyond the effects of depression and number of trauma types experienced. Further, post-traumatic stress disorder (PTSD) diagnostic status significantly moderated this relationship, indicating that the relationship between panic and suicidal ideation and behaviors is potentiated among individuals with a current PTSD diagnosis. This investigation suggests that panic symptoms may be a valuable clinical target for the assessment and treatment of suicidal ideation and behaviors among trauma exposed individuals.
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1. Introduction

Death by suicide claims over 30,000 lives in the United States and nearly 1 million lives worldwide each year, making it the 11th leading cause of death in the United States and 14th leading cause of death worldwide (see [37] for a review). Despite declines in suicide rates in response to treatment [43], the global burden of suicide has been projected to grow in the coming decades [31,32]. Death by suicide is most strongly predicted by suicide attempt, which is in turn predicted by suicidal ideation and behaviors [26,60]. Therefore, identifying malleable factors that predict suicidal ideation and behaviors may hold promise in reducing the personal and societal burden of suicide.

An estimated 22% of all suicide attempts are related to exposure to a psychologically traumatic event [51]. Trauma exposure is highly prevalent (61% to 80%; [27,28]) and has been consistently linked with increased risk for suicide [16,40]. Some researchers have posited the relationship between trauma exposure and suicidal ideation and behaviors to be mediated by factors such as depression and PTSD [55,59]. However, this is contradicted by epidemiological investigations demonstrating significant effects of trauma exposure on suicidal ideation and behaviors beyond the effects of psychopathology [34]. In a seminal review, Stein et al. [51] analyzed trauma exposure and suicidal ideation and behaviors data from 102,245 adults in 21 countries. Findings revealed that trauma exposed individuals were at greater risk for suicidal ideation and suicide attempt even when controlling for PTSD. Similarly, Belik et al. [5] analyzed data from 5877 American adults collected through the National Comorbidity Survey and found that traumatic event exposure predicted suicidal ideation and behaviors above and beyond the effects of psychiatric disorders. Collectively, these findings indicate that psychiatric diagnoses are insufficient to explain the full relationship between trauma

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exposure and suicidal ideation and behaviors, positing the need for a more nuanced investigation of trauma-relevant factors that may elevate suicidal ideation and behaviors

One risk factor that may be particularly salient to suicidal ideation and behaviors among trauma exposed individuals is panic, an abrupt surge of fear or discomfort that peaks within minutes [1]. Using data from the Epidemiological Catchment Area (ECA) study, Weissman et al. [60] were among the first to report that individuals with panic disorder (PD) were at significantly greater risk for suicide when compared to other psychiatric conditions. A number of studies since have supported a relationship between PD and suicidal ideation and behaviors (e.g., [10,25,49]). However, some studies investigating this phenomenon among "pure" PD samples without comorbid diagnoses have failed to find a significant association [4,39,44]. These discrepant findings suggest that panic attacks in the presence of co-occurring stressors or psychopathology, such as trauma exposure and PTSD, may be associated with elevated suicidal ideation and behaviors, and not PD per se.

Non-PD related panic attacks appear to be both highly prevalent among trauma exposed individuals as well as indicative of more severe trauma-relevant symptomology. High rates of panic have been reported among trauma exposed young adults [7], individuals reporting symptoms of acute stress disorder in hospital settings [9,36], rape victims within 72 h of the assault [42], and individuals seeking treatment for trauma-related symptomology [13]. Trauma exposed adults who report experiencing non-PD panic attacks have also been shown to experience greater trauma-relevant symptoms and overall distress. Marshall-Berenz et al. [30] assessed 91 trauma exposed adults and found that the experience of panic predicted greater PTSD re-experiencing and hyperarousal symptoms when controlling for relevant covariates. In addition, Cougle et al. [11] examined data from the National Comorbidity Study — Replication (NCS-R) and found that individuals who experienced non-PD panic reported greater re-experiencing and avoidance/numbing symptoms of PTSD, greater disability, and detriments in work performance.

It is clear that psychiatric diagnoses are insufficient to explain the elevated suicide risk among trauma exposed individuals [5,34,51] and that trauma exposed individuals who experience non-PD panic symptoms report greater adverse trauma-related outcomes [11,30]. However, research to date has not evaluated whether non-PD panic is associated with elevated suicide risk among these individuals. Panic is a highly treatable psychiatric symptom [46,47,54]. Therefore, determining whether the presence of non-PD panic contributes to suicidal ideation and behaviors in this high-risk population is crucial for effective treatment following trauma exposure.

1.1. Current study

The current study seeks to investigate the association of non-PD related panic attacks on suicidal ideation and behaviors among a trauma exposed sample of community participants using pre-treatment, cross-sectional data from participants enrolled in a smoking cessation study. It was hypothesized that trauma exposed individuals who report greater current panic symptoms would also report greater suicidal ideation and behaviors. Additionally, extant research has linked PTSD with increased suicidal ideation and behaviors [53] and has demonstrated individuals with a PTSD diagnosis who experience panic to have greater symptom severity [11]. Therefore, it was hypothesized that the relationship between panic and suicidal ideation and behaviors would be stronger for trauma exposed individuals with a PTSD diagnosis compared to those without a PTSD diagnosis.

2. Methods

2.1. Participants

The current sample included 421 community adults from a larger study investigating the effects of a smoking cessation program. Participants were recruited at two sites (University of Vermont, Burlington, VT and Florida State University, Tallahassee, FL) at which identical procedures were implemented. All data used in the current investigation were collected at baseline prior to the smoking cessation program. Eligibility requirements included: minimum age of 18 years, daily smoking for at least one year, smoking a minimum of 8 cigarettes per day, and reported motivation to quit smoking. Following a semi-structure interview (Structured Clinical Interview for DSM-IV-TR; [15]) individuals who met eligibility criteria provided informed consent and then completed a baseline assessment including self-report measures assessing demographics, trauma exposure, smoking, and psychological constructs prior to randomization for the smoking cessation treatment. The study was approved by both universities' Institutional Review Boards.

Participants for the current investigation were drawn from the larger sample based on their endorsement of exposure to a traumatic event in their lifetime. Those with a clinician verified PD diagnosis (n = 18) were not included in this sample to assess the association of non-PD related panic symptoms on suicidal ideation and behaviors among a trauma exposed sample. Ages ranged from 18 to 68 (M = 38.22, SD = 13.33) with relatively equal gender distribution (48.9% female). The majority (83.6%) of participants were Caucasian, followed by 8.8% Black/Non-Hispanic, 3.3% Hispanic, 1.2% Asian, 0.7% Black/Hispanic, and 2.4% other (e.g., bi-racial).

2.2. Measures

2.2.1. Inventory of Depression and Anxiety Symptoms (IDAS)

The IDAS [58] is a 64-item questionnaire designed to assess an individual's current experience of depressive and anxiety symptoms. Respondents are asked to rate the degree to which each statement describes their feelings and experiences during the past two weeks using a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely*). The

IDAS yields 10 specific symptom scales. Research has demonstrated that the IDAS subscales demonstrate very good internal consistency [58]. In the current study, the panic (e.g., *My heart was racing or pounding*, *I was short of breath*), dysphoria (e.g., *I felt depressed, I had little interest in my usual hobbies or activities*), and suicidality (e.g., *I had thoughts of suicide, I hurt myself purposely*) subscales were used to assess current symptoms of panic, depression, and suicidal ideation and behaviors, respectively. Internal consistency in the current sample was very good for the IDAS panic (α = .87) and dysphoria (α = .92) subscales and adequate for the IDAS suicidality subscale (α = .78).

2.2.2. Posttraumatic Diagnostic Scale (PDS)

The PDS [17] is a 49-item questionnaire in which respondents are asked to report whether they have experienced any of 12 traumatic events, as well as which event they consider the most disturbing. Respondents are then asked to indicate the extent to which they have experienced 17 PTSD symptoms in the past month. Research has demonstrated the PDS to have strong psychometric properties, including excellent internal consistency and good convergent validity, with 82% PTSD diagnosis agreement when compared to a Structured Clinical Interview [18]. In the current study, the PDS Total PTSD Symptoms subscale of the PDS demonstrated strong internal consistency (α = .92). The PDS was used to determine traumatic event exposure as well as to index the number of types of traumatic events experienced.

2.2.3. Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I/NP)

The SCID-I/NP [15] is a well-validated and widely used semi-structured clinical interview to assess DSM-IV-TR Axis I diagnoses. The SCID was administered at baseline by doctoral level clinical psychology graduate students with extensive training in its administration and scoring and supervised by independent doctoral level professionals. Diagnostic interviews were audiotaped and the reliability of a random selection of 12.5% of interviews was checked for accuracy. No cases of diagnostic coding disagreement were noted. In the current study, the SCID was used to assess the presence of all current Axis I conditions including PTSD and PD diagnoses as well as the diagnosis of panic attacks. Individuals were deemed to have experienced panic attacks if they endorsed a discrete period of intense fear or discomfort in which four or more panic-related symptoms developed within 10 min.

Table 1
Means, standard deviations and intercorrelations for included measures.

Measure	1	2	3	4	M	SD
1. PDS No. trauma types	–				2.90	1.73
2. IDAS panic	.23*	–			11.14	4.25
3. IDAS dysphoria	.18*	.58*	–		19.32	7.91
4. IDAS suicidality	.17*	.53*	.56*	–	6.99	2.11

IDAS = Inventory of Depression and Anxiety Symptoms; PDS = Posttraumatic Diagnostic Scale.

* $p < .01$.

3. Results

3.1. Sample descriptives

Means, standard deviations, and intercorrelations for the variables included in these analyses can be found in Table 1. Mean scores for the IDAS panic, dysphoria, and suicidal ideation and behaviors subscales were comparable to those found in other samples of community adults [58] as was number of trauma types experienced [14,57]. Current panic symptoms, as assessed by IDAS panic, were endorsed by 67.9% of participants. Criteria for a current PTSD diagnosis were met for 6.4% of participants. Criteria for the experience of panic attacks were met for 49.2% of participants. Preliminary analyses revealed no threats to or violations of multicollinearity or homoscedasticity.[1]

Among individuals with a PTSD diagnosis, the most frequently endorsed traumatic event was a natural disaster (55.6%), followed by sexual contact while younger than 18 years old with an individual at least 5 years older (48.1%), sexual assault by a family member or someone the individual knew (44.4%), a serious accident, fire, or explosion (44.4%), non-sexual assault by a family member or someone the individual knew (37.0%), and non-sexual assault by a stranger (29.6%).

3.2. Primary analyses

Linear regression was performed to assess the simple association between current panic symptoms and current suicidal ideation and behaviors to establish the effect of panic on suicidal ideation and behaviors among trauma exposed individuals. Results demonstrated that IDAS panic significantly predicts IDAS suicidal ideation and behaviors (β = .53, t = 12.78, $p < .001$, sr^2 = .28). Of the total sample, 32.30% reported suicidal ideation and behaviors with co-occurring panic and 4.51% reported suicidal ideation and behaviors without co-occurring panic (see Fig. 1).

Multiple regression was then performed to determine if the relationship between current panic symptoms and current suicidal ideation and behaviors remained significant after controlling for relevant covariates. Number of types of trauma experienced and current depressive symptoms were included as covariates due to the established relationships between these variables and suicidal ideation and behaviors [3,6,51]. The full model was statistically significant ($F_{(3, 418)} = 85.36, p < .001$) and accounted for 38.2% of variance in IDAS suicidality

[1] The distribution of IDAS suicidality scores was positively skewed. Models were tested using both untransformed and square root transformed IDAS suicidality scores, and results were consistent across all models. Therefore, only the results using the untransformed IDAS suicidality are reported.

scores. Among covariates, IDAS dysphoria significantly predicted IDAS suicidality ($\beta = .384$, $t = 8.11$, $p < .001$, $sr^2 = .10$). Number of trauma types did not significantly predict IDAS suicidality ($\beta = .03$, $t = .79$, $p = .43$, $sr^2 < .001$). After accounting for these variables, greater IDAS panic significantly predicted greater IDAS suicidality ($\beta = .30$, $t = 6.29$, $p < .001$, $sr^2 = .06$).

Next, we tested the hypothesis that the relationship between current panic and current suicidal ideation and behaviors is moderated by PTSD diagnostic status. Multiple regression was performed to test the interaction of current PTSD diagnostic status and current panic symptoms predicting current suicidal ideation and behaviors. Current PTSD diagnostic status and IDAS panic were mean-centered prior to creating the interaction term. IDAS dysphoria was included as a covariate. Number of trauma types was not included as a covariate because it was not a significant predictor of IDAS suicidality when accounting for other covariates in this model. The full model, including the interaction of PTSD diagnostic status and IDAS panic, mean-centered lower order terms, and IDAS dysphoria, accounted for 39.9% of variance in IDAS suicidality, $F_{(4,419)} = 69.01$, $p < .001$. The interaction of PTSD diagnostic status and IDAS panic significantly predicted IDAS suicidality ($\beta = .15$, $t = .3.57$, $p < .001$, $sr^2 = .02$). Among lower order terms, the IDAS panic ($\beta = .26, t = 5.46, p < .001, sr^2 = .04$) significantly predicted suicidal ideation and behaviors. IDAS dysphoria ($\beta = .39$, $t = 8.22$, $p < .001$, $sr^2 = .10$) was also a significant predictor of IDAS suicidality. PTSD diagnostic status did not significantly predict IDAS suicidality ($\beta = -.02$ $t = -.60$, $p = .55$, $sr^2 < .001$).

In the next step, we probed the hypothesized interaction of current PTSD diagnostic status and current panic symptoms predicting current suicidal ideation and behaviors. IDAS dysphoria was included as a covariate. As predicted, IDAS panic had a stronger relationship with IDAS suicidality among individuals with a current PTSD diagnosis ($\beta = .61$, $t = 6.31$, $p < .001$, $sr^2 = .06$) than among individuals without a current PTSD diagnosis ($\beta = .24$, $t = 4.78$, $p < .001$, $sr^2 = .03$) such that trauma exposed individuals who reported greater panic symptoms with co-occurring PTSD were at greatest risk for suicidal ideation and behaviors (See Fig. 2).

4. Discussion

The current study is the first to establish a relationship between non-PD related panic symptoms and suicidal ideation and behaviors among a trauma exposed sample. The correlation observed between the IDAS panic and suicidality subscales was consistent with previous research in community samples [58]. Moreover, these results demonstrate that trauma exposed individuals who report panic symptoms are at heightened risk for suicidal ideation and behaviors even when controlling for depressed mood and the number of types of traumatic events an individual has experienced. Our findings add to a growing body of research indicating that suicide is related to psychiatric conditions characterized by severe anxiety and agitation [37] as well as work suggesting that non-PD related panic is related to a variety of adverse outcomes following trauma exposure [9,11,36].

Although we did not investigate specific mechanisms, these results are consistent with positive feedback models of suicide suggesting that panic attacks amplify catastrophic cognitions [25]. According to the model set forth by Katz et al. [25], limbic–autonomic arousal escalates catastrophic cognitions in depressed individuals and leads to eventual suicidal ideation and attempts through a positive feedback loop. Our findings suggest that panic symptoms may contribute to suicidal ideation and behaviors in trauma exposed individuals through a similar process. Theoretical models of the relationship between panic and post-traumatic symptomology suggest that panic amplifies existing distress in trauma exposed individuals through the activation of trauma-relevant fear networks [22,23]. Taken together, it is plausible that panic amplifies catastrophic cognitions through trauma-relevant fear networks (such as amygdala–prefrontal cortex connectivity) to elevate suicidal ideation and behaviors.

Our results also indicate that the relationship between panic and suicidal ideation and behaviors is stronger among individuals with a PTSD diagnosis. Although trauma

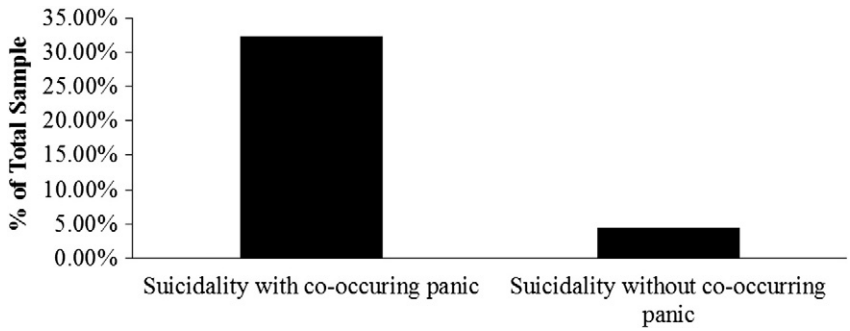

Fig. 1. Percentage of total sample endorsing suicidality with and without co-occurring panic. Panic = Inventory of Depression and Anxiety Symptoms Panic subscale. Suicidality = Inventory of Depression and Anxiety Symptoms Suicidality subscale.

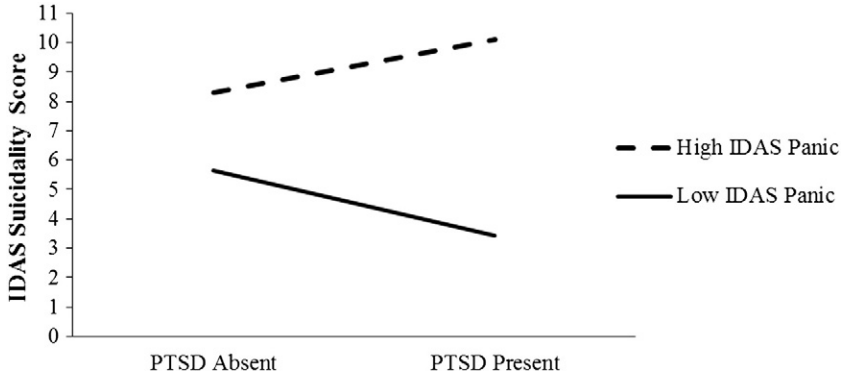

Fig. 2. Interaction of IDAS panic score and clinician verified PTSD diagnosis predicting IDAS suicidality score, controlling for IDAS dysphoria. High and low IDAS panic scores represent 1 SD above and below the mean, respectively. IDAS = Inventory of Depression and Anxiety Symptoms; PTSD = Posttraumatic Stress Disorder.

exposure is widespread, a significant minority of individuals develop PTSD [27]. There are a number of proposed risk factors that distinguish those who develop PTSD from those who do not develop PTSD [8]. The differences between those with and without PTSD are perhaps most salient in studies assessing fear reactivity using de novo conditioning and extinction paradigms. Relative to trauma exposed individuals without PTSD, those with PTSD have greater conditionability [21,38], heightened second-order conditioning [61], and deficits in fear extinction learning [29,33]. The greater fear reactivity observed among those with PTSD may escalate the positive feedback loop between panic and catastrophic cognitions, subsequently elevating suicidal ideation and behaviors.

The results of this study did not support a relationship between number of types of traumatic events experienced and suicidal ideation and behaviors when controlling for dysphoric mood and panic symptoms. The current study utilized a measure in which participants were asked to indicate the number of types of traumatic events they have experienced, whereas other studies (e.g., [51]) recorded the total number of times an individual has experienced a traumatic event. This difference in trauma history measurement may explain these discrepant findings. This pattern of findings suggests that the number of different types of traumatic events an individual has experienced may be pertinent information regarding cognitive styles [56] and subsequent development of PTSD symptoms [19] whereas the total number of times an individual has experienced any traumatic event is more predictive of suicidal ideation and behaviors [51].

Future research should further investigate the role of non-PD panic in suicidal ideation and behavior. Co-occurring panic has been shown to amplify symptom severity in psychiatric disorders such as Obsessive–Compulsive Disorder [20], and Hoarding Disorder [41] suggesting that panic may amplify general distress in individuals vulnerable to a variety of psychiatric disorders. Whether non-PD panic is related to suicidal ideation and behaviors among these populations is plausible, yet unconfirmed. Additionally, longitudinal investigations of neurophysiological functioning that has been associated with both suicidal ideation and behaviors and panic, such as frontal electroencephalographical (EEG) asymmetry [35,50,52] and Anterior Cingulate Cortex abnormalities [2,24], may provide further insight into the nature of this relationship by elucidating potential neurophysiological mechanisms. Future research of this sort may help elucidate the relationship between panic attacks and suicidal ideation and behaviors as well as foster the development of novel transdiagnostic treatments.

The current study has important clinical implications. First, this paper builds upon research supporting the clinical utility of the PA specifier applicable to all disorders in the DSM-5 (see [12] for a review). Specifically, assessing the presence of panic symptoms could be a useful diagnostic heuristic in determining risk for suicidal ideation and behaviors in addition to the assessment of PTSD diagnostic status and dysphoric mood. Second, the highly treatable nature of panic [46,47,54] suggests that the assessment and treatment of panic symptoms may serve as a beneficial clinical target to reduce suicidal ideation and behaviors among this high-risk sample. Treatments that ameliorate panic-related distress such as interoceptive exposure [48], CBT [54], and brief computerized treatments for panic-relevant cognitive vulnerability factors [45] may subsequently reduce suicidal ideation and behaviors.

As with any study, there are several limitations to consider. First, the trauma exposed sample was selected from a larger sample of community adults presenting for a smoking-cessation program. The use of this sample could limit generalizability to non-smoking trauma exposed samples. However, no research to date suggests that smoking would significantly alter the relationship between panic and suicidal ideation and behaviors. Second, these data are correlational in nature, precluding causal interpretations of these relationships. Third, the reliance on self-report measures may introduce a monomethod bias. Finally, only a measure of broad suicidal ideation and behaviors was

assessed. Future research should investigate unique influences of panic on suicidal ideation, plans, and attempts.

There are also several notable strengths to the current study. This investigation is the first to establish a link between non-PD related panic and suicidal ideation and behaviors among trauma exposed individuals. Second, these results are among the first to provide support for the clinical and research utility of the newly added PA specifier to the DSM-5 [1]. The present investigation suggests non-PD related panic as an important contributor to suicidal ideation and behaviors among this sample. As such, assessment for and treatment of panic may provide considerable clinical utility for suicide risk amelioration in trauma exposed individuals.

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