The Role of Anxiety Sensitivity in Mental Health Outcomes among Trauma-Exposed College Students and Young Adults during COVID-19

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THE ROLE OF ANXIETY SENSITIVITY IN MENTAL HEALTH OUTCOMES AMONG TRAUMA-EXPOSED COLLEGE STUDENTS AND YOUNG ADULTS DURING COVID-19

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ABSTRACT

Emerging literature has documented the substantial negative effects of the COVID-19 pandemic on the mental health of college students and young adults. Although extant work has shown that those with prior trauma exposure have poorer mental health outcomes during infectious disease outbreaks, broadly, substantially less work has focused on putative mechanisms underlying these relations during COVID-19. Therefore, the current study conducted a longitudinal analysis examining the mediating effect of one such vulnerability factor, anxiety sensitivity (AS; the fear of behaviors or sensations related to experiencing anxiety) on the association between baseline PTSD symptom severity and fear of COVID-19, worry about COVID-19, panic, social anxiety, general depression, and suicidality during COVID-19. Participants were 41 trauma-exposed college students and young adults (68.3% female, M_{age} = 25.39, *SD* = 6.66). Results indicated that the relationship between baseline PTSD symptom severity and fear of COVID-19 and panic was mediated by AS; however, the same was not true for worry about COVID-19, social anxiety, depression, or suicidality. The current study provides novel empirical evidence that AS is an important transdiagnostic vulnerability factor for trauma-exposed individuals that longitudinally predicts COVID-19 specific and general mental health facets, which may be exacerbated by the COVID-19 pandemic. Such findings provide additional evidence for the importance of targeting AS in the content of treatment for trauma, stress, and related disorders in the context of the COVID-19 pandemic.

Keywords: Anxiety sensitivity, COVID-19, fear and worry, college students, PTSD

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Introduction

The outbreak of the 2019 novel coronavirus (COVID-19) has had a devastating global impact, causing millions of infections and deaths (World Health Organization, 2021). With unemployment rates peaking at an unprecedented 14.7% in the United States in April 2020, millions of Americans have filed for unemployment. They now must adapt to a loss of income, loss of health insurance, and food insecurity (Falk et al., 2021). The 'lockdown' policies and economic burden have led to the neglect of physical and mental health (i.e., not refilling medications, missed appointments, canceled elective procedures; Zhang et al., 2020). Accordingly, one ensuing consequence of COVID-19 is an increase in psychological symptoms and disorders (Brooks et al., 2020; Chew et al., 2020; Zhang et al., 2020).

A substantial literature has documented the negative psychological impact of pandemics broadly (Brooks et al., 2020; Chew et al., 2020; PAHO/WHO, 2009; Qiu et al., 2020; Szcześniak et al., 2021), but less is known about the lingering and long-term mental health impact of COVID-19 specifically. For instance, meta-analytic work examining responses to past outbreaks of infectious diseases (i.e., H1N1 and Ebola) suggests that symptoms of anxiety, depression, and post-traumatic stress were elevated above and beyond experiences accounted for by pre-outbreak mental health symptoms or disorders (PAHO/WHO, 2009). These increases in symptoms were associated with sleep disturbance and resulted in a negative impact on interpersonal relations and school/work productivity (Brooks et al., 2020; Chew et al., 2020; Qiu et al., 2020). Evidence indicates that individuals are exhibiting elevated levels of anxiety and stress in response to COVID-19 (Brooks et al., 2020; Cao et al., 2020; Galea et al., 2020; Sambuco et al., 2020) and other work suggests that those with pre-existing mood and anxiety disorders may show the greatest stress response to

the outbreak (Asmundson et al., 2002; Zvolensky et al., 2020); yet, the scale of the psychological impact of COVID-19 is not fully known. Therefore, there remains a need to identify those at the *highest risk* of developing psychological symptoms in response to COVID-19.

One group that may be particularly vulnerable to COVID-19 specific changes are individuals who have experienced a prior traumatic event (i.e., physical abuse, sexual assault) (PAHO/WHO, 2009). For individuals with prior trauma histories, evidence suggests that the experience of multiple traumatic events may result in more severe psychological symptoms and disorders, including anxiety/depression (Byllesby et al., 2016; Jakob et al., 2017; Rajkumar, 2020). Indeed, trauma exposure is related to physiological changes, such as hypocortisolism, which can result in chronic stress or decreased immune function due to lack of regulation in the Hypothalamic-Pituitary-Adrenal (HPA) axis (Sherin & Nemeroff, 2011); these stress responses could place trauma-exposed individuals at risk for mental and physical illness in the context of COVID-19. Of those who meet criteria for post-traumatic stress disorder (PTSD), epidemiological evidence suggests that 90% will develop a comorbid psychological disorder in their lifetime (Sherin & Nemeroff, 2011). Protective factors such as social support networks, employment, and established routines are likely to be interrupted by policies implemented to prevent the spread of COVID-19, which in turn, may lead to exacerbation of anxiety/depression symptoms and disorders as well as negative coping mechanisms (Sherin & Nemeroff, 2011; Zvolensky et al., 2020; Zvolensky & Leventhal, 2016). Additionally, it is possible that some individuals may experience COVID-19 as a traumatic event, responding with post-traumatic stress-related symptoms (Asmundson et al., 2002; Szcześniak et al., 2021; Zvolensky et al., 2020). Therefore, trauma-exposed individuals

represent a high-risk and vulnerable group due to biopsychosocial vulnerabilities and may disproportionately experience the negative effects of the COVID-19 pandemic (Zvolensky et al., 2020).

Although research suggests a link between trauma exposure and infectious disease outbreaks generally (Brooks et al., 2020; Chew et al., 2020; Zhang et al., 2020), little work has focused on *mechanisms* underlying these relations in the context of the COVID-19 pandemic. Nascent work suggests transdiagnostic vulnerability factors, such as anxiety sensitivity, may confer heightened risk for greater worry about and fear of COVID-19 (Rogers et al., 2021; Warren et al., 2021). Anxiety sensitivity (AS), or the fear of behaviors or sensations related to experiencing anxiety (Reiss et al., 1986), plays an established role in the development and maintenance of PTSD and anxiety symptoms and disorders, especially among trauma-exposed individuals (Grant et al., 2008; Nichter et al., 2019). Previous research shows that in the context of stressful life events, AS is a strong predictor of panic and the presence of somatic symptoms (Hensley & Varela, 2008; Hensley-Maloney & Varela, 2009). AS is related to the interoceptive tendency to be more aware of bodily cues, which typically results in escalating anxiety and more bodily perturbation (Hensley & Varela, 2008; Zvolensky & Forsyth, 2002). Through repeated fear-oriented learning experience, AS may be associated with worry about COVID-19, resulting in worse psychological and physical outcomes among trauma-exposed individuals. Given the novelty of COVID-19, there is presently no work examining the role of AS in the relations between PTSD symptom severity and anxiety and depression symptoms among trauma-exposed college students and young adults. The experience of anxiety and depression have emerged among the most common reactions to COVID-19 (Brooks et al., 2020; Cao et al., 2020;

Galea et al., 2020; Sambuco et al., 2020), and therefore, there is a need to expand the understanding of how AS may serve as a key explanatory factor underlying the association between PTSD symptom severity and anxiety and depression-related outcomes.

Therefore, the primary aim of the present work was to elucidate if and how AS may relate to COVID-related worry and fear, as well as anxiety (panic and social anxiety), depression, and suicide in the context of the COVID-19 among trauma-exposed college students and young adults. Specifically, the purpose of the current study was to examine the role of AS in the relations between PTSD symptom severity and worry about COVID-19, fear of COVID-19, panic symptoms, social anxiety, general depression, and suicidality among trauma-exposed college students and young adults. It was hypothesized that greater levels of pre-COVID-19 AS would explain the association between pre-COVID-19 PTSD symptom severity and current worry about and fear of COVID-19 as well as mental health symptoms. In addition, it was hypothesized that this association would be particularly robust for this population given that trauma exposure has been associated with poorer levels of mental and physical health in general (Foa et al., 1997; Grant et al., 2008), and these symptoms are likely to be exacerbated in the context of a global pandemic.

Method

Participants

Participants were 41 college students and young adults (68.3% female, M_{age} = 25.39, *SD* = 6.66) from a large public university in the southern United States. Eligible participants were between the ages of 18 and 65, endorsed exposure to at least one traumatic event, and participated in a prior trauma-focused study conducted between February and November of 2018. Participants were excluded if they were unable to complete required self-report

surveys, lacked proficiency in English, or were unable to provide voluntary informed consent. Of the 843 who participated at time 1, 832 students were recontacted, 92 consented to participate in the follow-up study conducted between July and October of 2020, and 41 completed all measures of interest at both time points.

Most of the sample was White (36.6%) or Asian/Pacific Islander (36.6%), with 29.3% identifying as Hispanic/Latino, 9.8% Black/African American, 9.8% Native American/Alaska Native, and 7.3% other. In terms of education, 34.1% completed some college, 9.8% earned an associate's degree, 48.8% earned a bachelor's degree, and 2.4% earned a graduate degree. The median income bracket fell within the range of $15,000 to $24,999. The majority of the sample were never married (70.7%), 12.2% were married, 7.3% were engaged, 4.9% were living with a partner, 2.4% were widowed, and 2.4% were separated. In terms of trauma type, 85.4% experienced a natural disaster, 34.1% experienced a serious accident, 17.1% experienced sexual assault by a family member or someone they know, 12.2% experienced non-sexual assault by a family member or someone they know, 12.2% experienced sexual contact as a minor with someone 5 or more years older, 7.3% experienced a life threatening illness, 7.3% experienced torture, 4.9% experienced non-sexual assault by a stranger, 4.9% experienced imprisonment, 2.4% experienced sexual assault by a stranger, and 2.4% experienced military combat or a war zone.

Measures

Demographic Questionnaire Participants provided socio-demographic information, including age, gender, race/ethnicity, education level, income, and marital status.

Post-traumatic Diagnostic Scale (PDS) The PDS is a 49-item self-report measure to assess traumatic event exposure and PTSD symptom severity according to DSM-IV

diagnostic criteria (Foa et al., 1997). The measure yields a total symptom severity score as well as five subscales: intrusion, avoidance, changes in cognition and mood, arousal, and hyperreactivity. In the current study, the PDS demonstrated excellent internal consistency at time 1 (α = 0.97) and at time 2 (α = 0.95). The PDS total score at time 1 served as a predictor variable controlling for the effect of the PDS total score at time 2.

Anxiety Sensitivity Index - 3 (ASI-3) The ASI-3 is an 18-item measure to assess one's fear of the possible negative consequences associated with anxiety-related symptoms and sensations (Taylor et al., 2007). Respondents indicate their fear on a 5-point scale from 0 (*Very little*) to 4 (*Very much*). The ASI-3 includes a summative total score with higher scores indicating higher levels of AS. The measure has demonstrated strong predictive validity and internal consistency (Jardin et al., 2018; Taylor et al., 2007), including among trauma-exposed samples (Paltell et al., 2019). In the current study, the ASI-3 total score demonstrated excellent internal consistency at time 1 (α = 0.95) and at time 2 (α = 0.96). The ASI-3 at time 1 was used as a mediator and as a covariate at time 2.

COVID-19 Worry Index Informed by established measures of worry (Meyer et al., 1990), the COVID-19 Worry Index is a 15-item measure developed by the current research team to assess worry about contracting COVID-19, related symptoms, and associated health consequences. Respondents are asked to rate their worry about each item (e.g., "I worry that I am going to contract COVID-19.") as well as how much the worry interferes with their daily life functioning on a scale ranging from 1 (*Not at all*) to 7 (*A great deal*). As in prior work (Rogers et al., 2020; Shepherd et al., 2021), responses were summed to obtain a total score, with higher scores indicating greater COVID-19-related worry. The COVID-19 Worry Index has demonstrated strong construct validity and excellent internal consistency (Rogers et al.,

2020; Shepherd et al., 2021). The COVID-19 Worry Index demonstrated excellent internal consistency (α = 0.97) and was used as a criterion variable.

Fear of COVID-19 Scale The Fear of COVID-19 Scale is a 7-item measure developed by the present research team and is designed to assess the extent to which respondents experience anxiety-related symptoms in response to thinking about contracting COVID-19. Example items include "It makes me uncomfortable to think about coronavirus-19." and "When watching news and stories about coronavirus-19 on social media, I become nervous or anxious." Responses are rated on a 5-point Likert type scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Responses were summed for a total score, with higher scores indicating greater COVID-19-related fear. The Fear of COVID-19 Scale demonstrated excellent internal consistency (α = 0.91) and was used as a criterion variable.

Inventory of Depression and Anxiety Symptoms (IDAS) The IDAS is a 64-item self-report measure designed to assess symptom dimensions of major depression and anxiety disorders according to DSM-IV criteria (Watson et al., 2007). Respondents rate how much they have experienced each symptom over the past two weeks on a scale of 1 (*Not at all*) to 5 (*Extremely*). The IDAS includes specific symptom scales: Suicidality, Lassitude, Insomnia, Appetite Loss, Appetite Gain, Ill Temper, Well-Being, Panic, Social Anxiety, and Traumatic Intrusions. Additionally, it includes two broader subscales: Dysphoria and General Depression (including the 10 Dysphoria scale items, and two items each from the Suicidality, Lassitude, Insomnia, Appetite Loss, and Well-Being subscales). It has shown strong test-retest reliability as well as convergent and discriminant validity across populations (Watson et al., 2007, 2008). In the current study, the internal consistency of the General Depression (α = 0.94) and Panic subscales were excellent (α = 0.93), the Social Anxiety subscale

demonstrated adequate internal consistency (α = 0.62), and the Suicidality subscale demonstrated good internal consistency (α = 0.85). Each of these subscales measured at time 2 were used as criterion variables.

Procedure

A first wave of data was collected between February and November of 2018 from 843 college students as part of a trauma-focused study. Participants completed one online survey and were awarded course credit for their participation. For the current study, participants were recontacted between July and October of 2020 with the study information via phone and email. Each interested participant was emailed a link to the online survey. Once participants agreed to take part in the study, they were directed to the cover letter and provided informed, voluntary consent to participate in the study. Participants completed a battery of self-report measures via one online assessment. Participants were entered into a raffle for a chance to win one of eighteen $50 gift cards for completing the survey. Following data collection, eighteen participants were randomly selected to win a $50 Tango gift card via email. The present work was approved by the Institutional Review Board at the sponsoring institution.

Data Analytic Strategy

First, sample descriptive statistics and zero-order correlations among study variables were examined. Second, longitudinal mediation models were employed to examine the temporal associations between PTSD symptom severity at time 1 and fear of COVID-19, worry about COVID-19, panic, social anxiety, general depression, and suicidality through AS at time 1 in six separate models in SPSS version 27 using the PROCESS macro (Hayes, 2013). In each analysis, we controlled for AS and PTSD symptom severity at time 2.

Results

Bivariate Associations

See Table 1 for descriptive statistics and bivariate correlations. PTSD symptom severity at time 1 was significantly associated with general depression and panic at time 2 (*r*'s = 0.36 and 0.46, respectively), but not social anxiety, suicidality, worry about COVID-19, or fear of COVID-19. Additionally, AS at time 1 was significantly associated with PTSD at time 1 ($r = 0.69$) and all outcome variables at time 2 (*r's*= 0.41 - 0.73).

Indirect Effects

Fear of COVID-19

The overall regression model examining the relationship between PTSD symptom severity at time 1 through AS at time 1 on fear of COVID-19 at time 2 was significant. The total effect model was not significant and accounted for 38.10% of the variance ($b = -0.08$, $se = 0.07$, $p = 0.26$). The indirect effect of PTSD symptom severity at time 1 through AS at time 1 on fear of COVID-19 at time 2 was significant ($b = 0.11$, $se = 0.05$, *bootstrapped 95% CI* [0.008, 0.203], *CSE* = 0.24). After controlling for the effect of AS at time 1, there was a significant direct effect of PTSD symptom severity at time 1 on fear of COVID-19 at time 2 ($b = -0.18$, $se = 0.08$, $p = 0.03$).

Worry About COVID-19

The overall regression model examining the relationship between PTSD symptom severity at time 1 through AS at time 1 on worry about COVID-19 at time 2 was not significant. The total effect model was not significant and accounted for 40.89% of the variance ($b = -.09$, $se = 0.21$, $p = 0.67$). The indirect effect of PTSD symptom severity at time 1 through AS at time 1 on worry about COVID-19 at time 2 was not significant (*b* =

0.16, *se* = 0.15, *bootstrapped 95% CI* [-0.111, 0.482], *CSE* = 0.11). After controlling for the effect of AS at time 1, there was not a significant direct effect of PTSD symptom severity at time 1 on worry about COVID-19 at time 2 (*b* = -0.25, *se* = 0.27, *p* = 0.36).

Panic

The overall regression model examining the relationship between PTSD symptom severity at time 1 through AS at time 1 on panic at time 2 was significant. The total effect model was not significant and accounted for 66.31% of the variance (*b* = 0.05, *se* = 0.05, *p* = 0.24). The indirect effect of PTSD symptom severity at time 1 through AS at time 1 on panic at time 2 was significant (*b* = 0.08, *se* = 0.04, *bootstrapped 95% CI* [0.002, 0.161], *CSE* = 0.20). After controlling for the effect of AS at time 1, there was not a significant direct effect of PTSD symptom severity at time 1 on panic at time 2 (*b* = -0.03, *se* = 0.05, *p* = 0.61).

Social Anxiety

The overall regression model examining the relationship between PTSD symptom severity at time 1 through AS at time 1 on social anxiety at time 2 was not significant. The total effect model was not significant and accounted for 45.20% of the variance (*b* = -0.05, *se* = 0.05, *p* = 0.40). The indirect effect of PTSD symptom severity at time 1 through AS at time 1 on social anxiety at time 2 was not significant (*b* = 0.08, *se* = 0.05, *bootstrapped 95% CI* [-0.003, 0.198], *CSE* = 0.21). After controlling for the effect of AS at time 1, there was not a significant direct effect of PTSD symptom severity at time 1 on social anxiety at time 2 (*b* = -0.12, *se* = 0.06, *p* = 0.06).

General Depression

The overall regression model examining the relationship between PTSD symptom severity at time 1 through AS at time 1 on general depression at time 2 was not significant.

The total effect model was not significant and accounted for 55.23% of the variance (b = 0.08, se = 0.13, p = 0.56). The indirect effect of PTSD symptom severity at time 1 through AS at time 1 on general depression at time 2 was not significant (b = 0.07, se = 0.11, *bootstrapped 95% CI* [-0.113, 0.345], *CSE* = 0.07). After controlling for the effect of AS at time 1, there was not a significant direct effect of PTSD symptom severity at time 1 on general depression at time 2 (b = 0.005, se = 0.17, p = 0.98).

Suicidality

The overall regression model examining the relationship between PTSD symptom severity at time 1 through AS at time 1 on suicidality at time 2 was not significant. The total effect model was not significant and accounted for 33.15% of the variance (b = 0.01, se = 0.04, p = 0.82). The indirect effect of PTSD symptom severity at time 1 through AS at time 1 on suicidality at time 2 was not significant (b = 0.06, se = 0.05, *bootstrapped 95% CI* [-0.023, 0.161], *CSE* = 0.20). After controlling for the effect of AS at time 1, there was not a significant direct effect of PTSD symptom severity at time 1 on suicidality at time 2 (b = -0.05, se = 0.05, p = 0.38).

Discussion

Extant research has demonstrated that pandemics have a significant negative impact on mental health broadly (Brooks et al., 2020; Chew et al., 2020; Qiu et al., 2020), and may be especially true for those with pre-existing mental health-related symptoms and disorders (Newby et al., 2020). However, to date, little work has focused on mechanisms that may undergird the maintenance (and perhaps the exacerbation) of anxiety and depression-related symptoms in the context of COVID-19. Therefore, the purpose of the present study was to investigate the role of AS in the relationship between time 1 PTSD symptom severity and

time 2 COVID-19 related to fear and worry as well as anxiety and depression symptoms during COVID-19 among trauma-exposed college students and young adults. Results indicated that AS mediated the relations between time 1 PTSD symptom severity and time 2 panic and fear of COVID-19; however, the same was not true for worry about COVID-19, social anxiety, general depression, or suicidality. These results are in line with prior work, which has shown that AS is an explanatory mechanism underlying relations between PTSD symptom severity and panic and fear (Armstrong et al., 2021; Vujanovic et al., 2008) and extend the present literature by identifying the relevance of AS in terms of COVID-19 specific fear and panic in the context of the pandemic.

AS and PTSD symptoms are reciprocally predictive of each other over time, with PTSD serving as a key vulnerability factor for increased AS (Marshall et al., 2010). Accordingly, individuals with higher AS are likely to experience increased PTSD symptom severity in response to trauma exposure, and individuals with higher PTSD symptom severity are likely to develop higher AS (Marshall et al., 2010). AS may exacerbate PTSD symptoms such that those with elevated levels of AS pre-trauma exposure may have more intense reactions to traumatic events due to increased sensitization to fear and anxiety (Wald & Taylor, 2008). PTSD impacts physiological responses to stress and anxiety over time, theoretically leading to increased sensitivity to bodily signals manifesting as AS (Tsur et al., 2018). Importantly, elevated AS as a result of trauma exposure may lessen one's threshold for fear and anxiety. In turn, higher AS may lead to poorer mental health broadly in response to highly stressful and anxiety-provoking events (Grant et al., 2007; Vujanovic et al., 2008).

In the current study, PTSD symptom severity was related to fear of COVID-19 through AS, while the same was not true for worry about COVID-19. Fear refers to an

immediate emotional response to a threat (Adolphs, 2013), whereas worry refers to a prolonged state of distress in anticipation of a potential threat or anxiety-inducing event (Borkovec et al., 1983). Emerging work has demonstrated elevated levels of reported fear in response to COVID-19 (Fitzpatrick et al., 2020). Fear is an important functional response, motivating one to adaptively cope with or avoid the potential threat (Adolphs, 2013). Although speculative, in the context of COVID-19, fear may serve in an adaptive capacity to drive individuals to take protective measures such as handwashing, social distancing, or wearing masks (Fitzpatrick et al., 2020). However, findings from the present study suggest that for trauma-exposed college students and young adults, AS may heighten the fear response such that it reaches maladaptive levels and causes undue psychological stress. Worry, however, is a cognitive process that stems from fear with the goal of problem-solving (Borkovec et al., 1983). Though fear and worry are closely related, fear does not always lead to worry if one feels that they can mitigate the threat caused by the fear-inducing stimulus (Borkovec et al., 1983). Emerging work demonstrates the prevalence of worry about COVID-19 and its importance as a motivating factor in maladaptive behaviors (Rogers et al., 2020; Shepherd et al., 2021). However, in the present sample, it appears that fear of COVID-19 does not necessarily translate to subsequent worry as a result of AS.

AS has demonstrated robust relations with panic-related symptoms and disorders (Hensley-Maloney & Varela, 2009; Schmidt et al., 2006; Vujanovic et al., 2008). Notably, AS is a strong predictor of panic over time (Hensley-Maloney & Varela, 2009), and in the present work, AS at time 1 was a significant predictor of panic at time 2. One primary concern of AS is the fear of cardiorespiratory symptoms leading to panic (Eifert et al., 1999) and may be particularly relevant to COVID-19, being a known respiratory disease (CDC,

2020). Individuals with pre-existing heart or lung conditions are at higher risk for contracting COVID-19 and have an increased risk for more severe COVID-19 symptoms (CDC, 2020). AS can induce panic due to the fear of panic symptoms themselves and accentuate the panic response (McNally, 2002). In the current study, after controlling for AS, there was not a significant direct effect of PTSD symptom severity at time 1 on panic at time 2. Therefore, it appears as though AS plays an important explanatory role in predicting panic when trauma-exposed individuals experience panic or panic-like symptoms.

Although extant work has demonstrated relations between AS and social anxiety (Grant et al., 2007; Khakpoor et al., 2019), AS was not a significant predictor of social anxiety in the context of COVID-19 in the current study. This may be due to the specific types of fear and anxiety brought on by COVID-19. Social anxiety is primarily focused on the fear of negative evaluation from peers or biased information processing (Khakpoor et al., 2019), but these socially motivated fears of evaluation may be less relevant to fears present in response to COVID-19. Indeed, work has shown that compared to fear and panic, social anxiety is less related to AS (Knowles et al., 2019; Naragon-Gainey, 2010). Additionally, AS, specifically social concerns, is a predictor of social anxiety cross-sectionally but not longitudinally (Grant et al., 2007). Though social anxiety is related to AS through lower-order social AS (Grant et al., 2007), it is not related to the higher-order AS construct in the present work. In the context of COVID-19, AS may exacerbate the experience of fear or panic, but less so social anxiety. Among trauma-exposed individuals with and without PTSD, social anxiety is a frequent co-occurring condition, but panic disorder and generalized anxiety disorder are more prevalent (Knowles et al., 2019). Nevertheless, social anxiety was an important construct to examine due to its high comorbidity with PTSD and since the

pandemic has had a significant effect on people's social activities causing significantly decreased social interaction.

Finally, our results indicated that AS does not mediate the relationship between PTSD symptom severity and depression and suicidality. These findings are in line with literature on AS, which suggests that compared to panic and fear, depression is less related to AS (Grant et al., 2007; Naragon-Gainey, 2010). Although current literature shows that increased rates of depression are a common correlate of COVID-19, especially among college students (Newby et al., 2020; Xiong et al., 2020), AS is not an explanatory mechanism for the increased prevalence of these outcomes. One potential explanation for these results is overlap between depression and suicidality as the IDAS General Depression subscale includes the suicidality items, such that there was aggregated shared variance between the two subscales. Prior work has demonstrated the role of cognitive AS concerns in the association between PTSD and depression and suicidality (Mitchell et al., 2014; Norr et al., 2016). Thus, in the future, it may be valuable to investigate the role of lower-order cognitive AS rather than global AS, as global AS may not fully capture the impact of AS on depressive symptoms. Cognition is an especially important factor in depression contributing to negative thought patterns like rumination, and accordingly, fear of cognitive dyscontrol is a salient facet of AS that contributes to depression (Brown & Ryan, 2003; Chen et al., 2016; Cox et al., 2001). Furthermore, future research should examine the role of other transdiagnostic mechanisms more closely related to depression. Previous work has documented the role of certain vulnerability factors in the association between PTSD and depression, such as distress tolerance, emotion dysregulation, rumination, anhedonia, or negative affect, for example

(Byllesby et al., 2016; Contractor et al., 2018; Felton et al., 2019; Naguy et al., 2020; Post, 2014) which may be valuable to examine in the future.

Future research may focus on specific dimensions of PTSD related to panic and fear through AS. For instance, prior work has shown that PTSD symptoms such as hyperarousal and hypervigilance, in particular, are highly related to AS (Naragon-Gainey, 2010; Vujanovic et al., 2008; Wald & Taylor, 2008), and may contribute to an individual's experience of panic and fear. Hypervigilance may make individuals more susceptible to experiencing fear and panic as a result of an increased propensity to be attuned to the potential threats of COVID-19 exposure. Theoretically, hyperarousal results in increased sensory sensitivity and subsequently increased awareness of sensations related to anxiety, potentially making individuals with greater PTSD symptom severity more susceptible to higher AS (Vujanovic et al., 2008). Due to elevated AS amplifying the intensity and awareness of physical manifestations of anxiety (Zvolensky & Forsyth, 2002), trauma-exposed individuals may respond to these symptoms with panic and fear (Vujanovic et al., 2008). Previous research has shown the efficacy of interoceptive exposure targeting AS in trauma-exposed individuals (Taylor, 2003; Wald & Taylor, 2008), which suggests that integrating interoceptive exposure in clinical settings may be particularly helpful in regulating panic and fear-related to COVID-19.

Limitations to the present study should be noted. Importantly, the original study, which served as our time 1 data, was designed cross-sectionally. Although participants consented to be contacted for future studies, they did not make a commitment to any further participation, and many had since graduated and were unable to be contacted through their university email addresses. As a result, we had a very low response rate (11.06%) and a small

sample size (n = 41). The results of this study correspond with theoretical knowledge such that AS appears to be most related to panic and fear-like constructs, but future studies with a larger sample size may be able to detect other significant psychological outcomes which have been prevalent during COVID-19. Additionally, the COVID-19 related measures were created by our study team based on validated measures but have not been empirically validated themselves. Though this was necessary due to the novelty of COVID-19 and the timeline for data collection, future studies can improve upon this one by using validated measures. Further, the current study measured PTSD symptom severity with the PDS (Foa et al., 1997) according to the DSM-IV PTSD criteria rather than the PDS-5 according to the current DSM-5 criteria (Foa et al., 2016) to remain consistent with the measures used at time 1. Future work should utilize the PDS-5 to more accurately assess PTSD symptoms based on the current DSM-V criteria. Finally, 68.3% of the sample were female. Thus, the gender imbalance in the current study may limit the generalizability of these findings.

The present work builds upon that conducted before the COVID-19 outbreak and addresses a novel public health problem by providing novel insight into the role of cognitive-affective vulnerability factors (*pre-COVID-19*), which may lead to poorer mental health symptoms in response to COVID-19 among trauma-exposed college students and young adults. This is especially important as research shows that women, college students, and individuals under the age of 35 are at the highest risk for experiencing negative psychological and behavioral outcomes, such as symptoms of depression and anxiety, as a result of the COVID-19 outbreak, making this population especially important to study (Cao et al., 2020; Newby et al., 2020; Xiong et al., 2020). Clinically, this may be important in allowing further research to develop specialized treatments to address the needs of this population.

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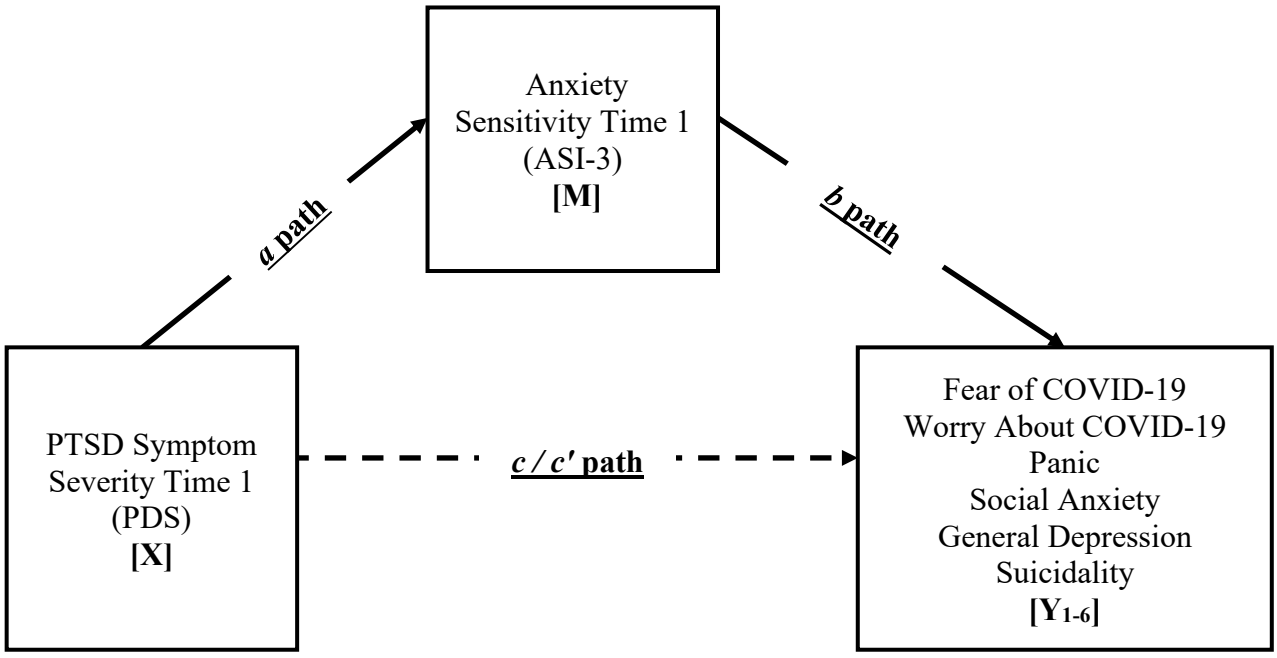
Figure 1. *Conceptual Model*



Note: PDS = Total PTSD symptom severity score as per the Post-traumatic Diagnostic Scale (Foa et al, 1997); ASI-3 = Total score as per the Anxiety Sensitivity Index-3 (Taylor et al., 2007); Fear of COVID-19 = Total sum score of the Fear of COVID-19 scale; Worry About COVID-19 = Total sum score from the COVID-19 Worry Index; Panic, Social Anxiety, General Depression, and Suicidality = Subscales from the Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); *a* path = Effect of X on M; *b* paths = Effect of M on Y; *c* paths = Effect of X on Y; *c'* paths = Effect of X on Y controlling for M. Six separate paths were conducted (Y_{1-6}) with the predictor (X). Covariates included PDS total score at time 2 and ASI-3 total score at time 2.

Table 1. *Descriptive statistics and bivariate correlations.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. ASI-3 (Time 2) [a]	-	.641**	.363*	.598**	.611**	.768**	.656**	.733**	.575**	.647**
2. PDS (Time 2) [a]		-	.491**	.402**	0.252	.680**	.501**	.549**	.367*	.584**
3. PDS (Time 1) [b]			-	0.096	0.114	.460**	0.183	.356*	0.235	.692**
4. Fear of COVID-19 [c]				-	.806**	.523**	.331*	.372*	.400**	.485**
5. Worry About COVID-19 [c]					-	.440**	.381*	.425**	.399**	.405**
6. Panic [c]						-	.739**	.768**	.743**	.733**
7. Social Anxiety [c]							-	.852**	.784**	.539**
8. General Depression [c]								-	.800**	.572**
9. Suicidality [c]									-	.521**
10. ASI-3 (Time 1) [d]										-
Mean/n	22.44	11.88	12.32	17.78	55.54	12.15	9.98	45.20	9.44	12.80
SD/%	18.38	13.82	15.31	6.77	22.48	6.33	5.78	15.85	4.42	12.64

Note. N=41; * $p < 0.05$; ** $p < 0.01$; [a] Covariate. [b] Predictor. [c] Criterion. [d] Indirect Variable; ASI-3 = Total score as per the Anxiety Sensitivity Index-3 (Taylor et al., 2007); PDS = Total PTSD symptom severity score as per the Post-traumatic Diagnostic Scale (Foa et al, 1997); Fear of COVID-19 = Total sum score of the Fear of COVID-19 scale; Worry About COVID-19 = Total sum score from the COVID-19 Worry Index; Panic, Social Anxiety, General Depression, and Suicidality = Subscales from the Inventory of Depression and Anxiety Symptoms (Watson et al., 2007).

Table 2. *Indirect effect of PTSD symptom severity on mental health outcomes via anxiety sensitivity.*

Y	Path	R^2	b	SE	t	p	CI (l)	CI (u)
1	PDS → ASI-3 (a)	0.66	0.42	0.09	4.61	<0.001	0.24	0.60
	ASI-3 → Fear of COVID-19 (b)	0.46	0.25	0.11	2.21	0.03	0.02	0.48
	PDS → Fear of COVID-19 (c')		-0.18	0.08	-2.30	0.03	-0.34	-0.02
	PDS → Fear of COVID-19 (c)	0.38	-0.08	0.07	-1.15	0.26	-0.21	0.06
	PDS → ASI-3 → Fear of COVID-19 (a*b)		0.11	0.05			0.008	0.20
2	ASI-3 → Worry about COVID-19 (b)	0.42	0.38	0.39	0.99	0.33	-0.40	1.17
	PDS → Worry about COVID-19 (c')		-0.25	0.27	-0.94	0.36	-0.80	0.29
	PDS → Worry about COVID-19 (c)	0.41	-0.09	0.21	-0.42	0.67	-0.52	0.34
	PDS → ASI-3→ Worry about COVID-19 (a*b)		0.16	0.15			-0.11	0.48
3	ASI-3 → Panic (b)	0.71	0.19	0.08	2.53	0.02	0.04	0.35
	PDS → Panic (c')		-0.03	0.05	-0.52	0.61	-0.14	0.08
	PDS → Panic (c)	0.66	0.05	0.05	1.19	0.24	-0.04	0.15
	PDS → ASI-3 → Panic (a*b)		0.08	0.04			0.002	0.16
4	ASI-3 → Social Anxiety (*b)*	0.51	0.19	0.09	2.02	0.05	-0.0005	0.37
	PDS → Social Anxiety (*c')*		-0.12	0.06	-1.93	0.06	-0.25	0.006
	PDS → Social Anxiety (*c)*	0.45	-0.05	0.05	-0.85	0.40	-0.15	0.06
	PDS → ASI-3→ Social Anxiety (*a*b)*		0.08	0.05			-0.003	0.20
5	ASI-3 → General Depression (*b)*	0.56	0.17	0.24	0.72	0.48	-0.31	0.66
	PDS → General Depression (*c')*		0.005	0.17	0.03	0.98	-0.33	0.34
	PDS → General Depression (*c)*	0.55	0.08	0.13	0.58	0.56	-0.19	0.34

	PDS → ASI-3 → General Depression (*a*b)*		0.07	0.11			-0.11	0.34
6	ASI-3 → Suicidality (*b)*	0.39	0.14	0.08	1.79	0.08	-0.02	0.30
	PDS → Suicidality (*c')*		-0.05	0.05	-0.89	0.38	-0.16	0.06
	PDS → Suicidality (*c)*	0.33	0.01	0.04	0.23	0.82	-0.08	0.10
	PDS → ASI-3 → Suicidality (*a*b)*		0.06	0.05			-0.02	0.16

Note. N for analyses is 41 cases. Path a is equal in all cases Y; therefore, it presented only once to avoid redundancies. The standard error and 95% CI for the indirect effects (*a*b*) are obtained through bootstrapping with 10,000 re-samples. *a* path = Effect of X on M; *b* paths = Effect of M on Y; *c'* paths = Effect of X on Y controlling for M; *c* paths = Effect of X on Y. PDS = Total PTSD symptom severity score as per the Post-traumatic Diagnostic Scale (Foa et al., 1997); ASI-3 = Total score as per the Anxiety Sensitivity Index-3 (Taylor et al., 2007); Fear of COVID-19 = Total sum score of the Fear of COVID-19 scale; Worry About COVID-19 = Total sum score from the COVID-19 Worry Index; Panic, Social Anxiety, General Depression, and Suicidality = Subscales from the Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); Covariates included PDS total score at time 2 and ASI-3 total score at time 2.