ORIGINAL ARTICLE

Anxiety Sensitivity Moderates the Impact of COVID-19 Perceived Stress on Anxiety and Functional Impairment

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Abstract

Background The COVID-19 pandemic has had a profound negative impact on mental health symptoms and daily life functioning across the United States and worldwide. Past work has revealed that perceived stress relates to poorer outcomes, however, little work to date has examined factors that may exacerbate these outcomes, and no work to date has examined this relation in terms of COVID-19. Anxiety sensitivity is a promising individual difference factor that has shown to be related to mental health and functional impairment. Anxiety Sensitivity is also a vulnerability factor related to heightened stress perception.

Method Therefore, the current study sought to examine the potential moderating role of anxiety sensitivity in the relation between COVID-19 specific perceived stress and global anxiety symptom severity, anxious arousal symptom severity, and functional impairment among 563 adults (58.1% male; $M_{age} = 38.3$ years; $SD = 12.15$).

Results Results indicated a statistically significant interaction between COVID-19 perceived stress and anxiety sensitivity with global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. Post-hoc analysis indicated that COVID-19 perceived stress was associated with an increased likelihood of clinically significant global anxiety symptom severity and anxious arousal symptom severity at higher levels of anxiety sensitivity.

Conclusions The current study provides support for the role of anxiety sensitivity in identifying individuals at risk for clinically significant global anxiety symptom severity and anxious arousal symptom severity.

Keywords Pandemic · COVID-19 · Mental health · Stress · Functional impairment

Introduction

In March 2020, the World Health Organization declared the outbreak of the novel coronavirus (COVID-19) a global health pandemic (Covid, C., & Team, R 2020). As of August 15th, 2020, the United States (U.S.) has seen over 5.5 million confirmed cases of COVID-19 and has reported over 170,000 deaths due to the virus (Engineering 2020). Unfortunately, this pandemic has negatively impacted not only those with the deadly virus, but also "non-cases" who experience fear and anxiety about becoming infected. For example, individuals' anxiety may be exacerbated by the uncertainty surrounding the pandemic, uncertainty regarding one's likelihood of contracting the virus, severity of symptoms if the virus is contracted, and how long social distancing precautions will be in place (Mertens et al. 2020; Pfefferbaum and North 2020; Rajkumar 2020; Yao et al. 2020), ultimately impacting overall daily functioning (Park et al. 2020). To date, close to 45% of U.S. adults have reported that their psychological functioning has been negatively impacted during the COVID-19 pandemic (Panchal et al. 2020) with rates of clinical anxiety rising 12% compared to what is typically reported (Bureau 2020; Gallagher et al. in press). Overall, past work suggests that global health epidemics have a detrimental impact on mental health and

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functioning (Brooks et al. 2020; Rajkumar 2020). An important next step is to examine potential underlying individual difference factors that may explain the dramatic increase in rates of anxiety related disorders and functional impairment due to the COVID-19 pandemic.

Individuals mental health and functioning may be differentially impacted by the pandemic based on their perceived stress experienced (Limcaoco et al. 2020). Broadly, perceived stress is defined as the extent to which an individual construes life events as overwhelming, erratic, or uncontrollable (Cohen et al. 1983). Regarding COVID-19 specifically, perceived stress emphasizes the degree to which an individual believes they have control over unexpected or difficult events or emotions that arise due to the pandemic (i.e., unemployment, illness, negative affect). Past work suggests that perceived stress is related to poorer mental health functioning (VanKim and Nelson 2013) and functional impairment (Besser and Zeigler-Hill 2014). In terms of COVID-19, it is significantly related to greater anxiety symptoms (Limcaoco et al. 2020). Although research on past health epidemics have cited both increases in stress and mental and physical health symptoms (Brooks et al. 2020; Rajkumar 2020), little work has explored the potential factors that may impact the association between perceived stress due to COVID-19 with global anxiety symptom severity, anxious arousal symptom severity (panic-like symptoms), and functional impairment.

There may be individual difference factors that further intensify the relation between COVID-19 perceived stress and global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. Past work has identified anxiety sensitivity, defined as the fear or concern related to the negative consequences associated with anxiety relevant sensations (Reiss and McNally 1985), as a transdiagnostic factor related to global anxiety symptom severity (Allan et al. 2014; Baek et al. 2019; Naragon-Gainey 2010) anxious arousal symptom severity (Behenck et al. 2020; Isyanov and Calamari 2004; McNally 2002; Schmidt et al. 1997), functional impairment (Storch et al. 2014), and perceived stress (Bardeen et al. 2013; Isyanov and Calamari 2004; Zvolensky et al. 2002). Indeed, anxiety sensitivity has shown to be a vulnerability factor for heightened stress perception as anxiety sensitivity is directly related to the evaluation of an event and its significance (Zvolensky et al. 2002). Drawing from such work, anxiety sensitivity may exacerbate the intensity of COVID-19 perceived stress, resulting in increased global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. However, no work to date has studied how anxiety sensitivity may interact with COVID-19 perceived stress in terms of these factors.

The COVID-19 pandemic has generated many novel stressors, and has indirectly eliminated many effective coping mechanisms (i.e. going to the gym, socializing with friends, visiting loved ones, etc.; Fauci et al. 2020; Pfefferbaum and North 2020). Therefore, individuals are likely to interpret their current situation as uncontrollable or overwhelming. Anxiety sensitivity may heighten global increases in COVID-19 perceived stress as suggested in past work (Zvolensky et al. 2002), and in the absence of effective stress management strategies, these individuals may experience increased global anxiety symptom severity, anxious arousal symptom severity, and functional impairment (i.e., impairment at work due to preoccupation or stress related to COVID-19). Heightened anxiety sensitivity may further restrict available stress management tools, such as avoiding physical activity, as fears of anxiety related sensations become more salient (i.e., "shortness of breath may mean I have COVID-19"). In turn, because high anxiety sensitivity is related to poorer outcomes, these individuals may experience greater global anxiety symptom severity, anxious arousal symptom severity, and functional impairment.

The purpose of the present study was to examine if anxiety sensitivity moderates the relationship between COVID-19 perceived stress and anxiety, anxious arousal symptom severity, and functional impairment. It was hypothesized that the relations between COVID-19 perceived stress with global anxiety symptom severity, anxious arousal symptom severity, and functional impairment would be stronger at increasing levels of anxiety sensitivity. In addition, it was hypothesized that both anxiety sensitivity and COVID-19 perceived stress would uniquely, and significantly relate to anxiety symptom severity, anxious arousal symptom severity, and functional impairment.

Methods

Participants

Participants included 563 adults (58.1% male; $M_{age} = 38.3$ years; $SD = 12.15$) that were recruited through Amazon's MTurk online platform system. The percentage of the sample that received results confirming a diagnosis of COVID-19 by a public health official was 15.8%. The employment status of participants was as follows: 76.7% working now; 8.0% only temporarily laid off, sick leave or maternity; 3.9% looking for work, unemployed; 3.4% keeping house; 3.2% retired; 1.4% unemployed and not looking for work; 1.2% disabled, permanently or temporarily; and 2.1% other. Most of the sample was White (70.2%). The remainder of the sample identified as African American/Black (13.7%), Hispanic/Latino (6.2%), Asian/Pacific Islander (4.1%), Native American (2.8%), Biracial/Multiracial (2.8%), and other (0.2%).

Measures

Demographics Questionnaire

A Demographics Questionnaire was utilized to describe the sample. The questionnaire collected information regarding participants' age, gender, race, and ethnicity. Participants' reported age and gender were also used as covariates in the current study.

Anxiety Sensitivity Index-3 (ASI-3)

The Anxiety Sensitivity Index-3 (ASI-3; Taylor et al. 2007) is an 18-item self-report measure of the fear of the consequences associated with anxiety related symptoms. Participants rated items related to fears of physical, cognitive, and social consequences due to anxiety-related symptoms on a 5-point Likert-type scale ranging from 0 (*very little*) to 4 (*very much*). As this is the first study to examine the role of anxiety sensitivity in terms of mental health and perceived stress during the ongoing COVID-19 pandemic, the total score was used rather than the subscales in order to establish the relevance of examining ASI as an individual difference factor in the current model. In past work, the ASI-3 has demonstrated strong psychometric properties (Taylor et al. 2007). The ASI-3 total score was used as an independent variable and demonstrated excellent internal consistency ($\alpha = .96$) in the current study.

Perceived Stress Scale Due to COVID-19 (PSS COVID-19

Perceived stress as it relates to the COVID-19 pandemic was measures with a 10-item measure adapted from the Perceived Stress Scale-10 item version (PSS-10; Cohen and Williamson 1988). Participants were asked to rate the extent to which they perceived they experienced stress related to the COVID-19 pandemic on a 5-point Likert scale ranging from 0 (*never*) to 4 (*very often*). In the current study, this measure was used as an independent variable and demonstrated good internal consistency ($\alpha = .83$).

Overall Anxiety Severity and Impairment Scale (OASIS)

The Overall Anxiety Severity and Impairment Scale (OASIS; Norman et al. 2006) is a 5-item self-report measure of past-week anxiety symptoms. Items are rated on a 5-point Likert-type scale ranging from 0 to 4. In the current study, the total score demonstrated excellent internal consistency ($\alpha = .91$). The OASIS total score was used as a criterion variable in the current study.

Panic Disorder Severity Scale (PDSS)

The Panic Disorder Severity Scale (PDSS; Shear et al. 1997) is a 7-item self-report measure of anxious arousal symptom severity. Respondents were asked to rate each item from 0 to 4. The PDSS had demonstrated acceptable psychometric properties in past work (Wuyek et al. 2011). In the current sample, the PDSS total score demonstrated excellent internal consistency ($\alpha = .96$). In the current study, the PDSS total score was used as a criterion variable.

Work and Social Adjustment Scale (WSAS)

The Work and Social Adjustment Scale (WSAS; Mundt et al. 2002) is a self-report measure of work- and social-related functional impairment. Items are rated on a 9-point Likert scale ranging from 0 (*not at all*) to 8 (*very severely*). The WSAS has exhibited good psychometric properties in past work (Mundt et al. 2002; Pedersen et al. 2017). The WSAS was used as a criterion variable and demonstrated excellent internal consistency ($\alpha = .97$) in the current study.

Procedure

Amazon's MTurk online platform system was utilized to recruit and screen potential participants for inclusion. Extant work has documented the value of this methodological approach (e.g., demographic diversity of samples) relative to other approaches (e.g., undergraduate samples; Behrend et al. 2011; Buhrmester et al. 2018; Burnham et al. 2018). Interested individuals were redirected to Qualtrics, a reliable and valid online survey management system. Participants who provided informed consent were then given the opportunity to complete the entirety of the survey. To ensure the validity of the data, several measures were taken. To be eligible for the study, workers were required to have at least a 95% approval rating (i.e. 95% of prior completed HITs were approved) based on their performance of at least 100 prior HITS. In addition, participants had to pass an attention check by correctly answering at least 3 out of 4 questions (e.g. "Respond to this question by writing the word 'apple' in the blank", "select 'true' for this question".), which were established a priori. Following completion of the survey, participants were compensated through their MTurk worker account. Data was collected between March 23, 2020 and May 28, 2020. The study protocol was approved by the Institutional Review Board where the study took place.

Analytic Strategy

Analyses were conducted with SPSS version 25. First, descriptive statistics zero-order correlations among study variables were examined. Next, to understand the

incremental predictive value of COVID-19 perceived stress, anxiety sensitivity, and their interaction, three separate three-step hierarchical regression analyses were conducted for the following criterion variables: (1) global anxiety symptom severity (OASIS) (2) anxious arousal symptom severity (PDSS), and (3) functional impairment (WSAS). Step 1 of the model included covariates of age and gender (0 = male, 1 = female). In step 2, COVID-19 perceived stress and anxiety sensitivity were simultaneously added to the model. In step 3, the interaction between perceived stress and anxiety sensitivity was added to the model. Planned post-hoc simple-slope analyses were conducted with the PROCESS macro (Hayes 2013) to evaluate the relationship between COVID-19 perceived stress with global anxiety symptom severity, anxious arousal symptom severity, and functional impairment at high and low levels of anxiety sensitivity (± 1 standard deviation from the mean).

Results

Descriptive statistics and zero-order correlations are presented in Table 1. Anxiety sensitivity was positively correlated with COVID-19 perceived stress, global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. COVID-19 perceived stress was positively associated with global anxiety symptom severity, anxious arousal symptom severity, and functional impairment.

Regression Analyses

For the model with global anxiety symptom severity, step 1 of the model with covariates only was statistically significant ($R^2 = .02$, $F(2, 560) = 6.81$, $p = .001$); age was a significant individual predictor that was negatively associated with anxiety. In step 2 with the addition of COVID-19 perceived stress and anxiety sensitivity added to the model, there was a statistically significant increase in variance

accounted for ($\Delta R^2 = .46$, $F(2, 558) = 247.29$, $p < .001$) with main effects for COVID-19 perceived stress and anxiety sensitivity; see Table 2. In step 3, the interaction term was added and accounted for a statistically significant increase in R^2 ($\Delta R^2 = .01$, $F(1, 557) = 4.48$, $p = .035$). Post hoc simple slope analysis revealed that COVID-19 perceived stress was related to greater levels of global anxiety symptom severity, among those with both higher ($b = .33$, $SE = .05$, $p < .001$) and lower ($b = .20$, $SE = .03$, $p < .001$) levels of anxiety sensitivity (see Fig. 1).

In the model with anxious arousal symptom severity, step 1 with covariates only was statistically significant ($R^2 = .05$, $F(2, 560) = 14.55$, $p < .001$). Examining the individual predictors revealed that age was a statistically significant predictor of lower anxious arousal symptom severity. In step 2, with COVID-19 perceived stress and anxiety sensitivity added to the model, there was a statistically significant increase in R^2 ($\Delta R^2 = .46$, $F(2, 558) = 262.44$, $p < .001$); main effects were evident for COVID-19 perceived stress and anxiety sensitivity; see Table 2. With the addition of the interaction term in step 3, there was a statistically significant increase in R^2 ($\Delta R^2 = .02$, $F(1, 557) = 21.75$, $p < .001$). Simple slope analysis revealed that COVID-19 perceived stress was related to greater levels of anxious arousal symptom severity for individuals with higher ($b = .39$, $SE = .07$, $p < .001$) but not lower ($b = .02$, $SE = .04$, $p = .631$) levels of anxiety sensitivity (see Fig. 1).

In the model with functional impairment, step 1 with covariates only was statistically significant ($R^2 = .04$, $F(2, 560) = 10.13$, $p < .001$). Evaluating the individual predictors in this model revealed that age was a significant predictor of lower functional impairment. In step 2 of the model, with the addition of COVID-19 perceived stress and anxiety sensitivity, there was a statistically significant increase in R^2 ($\Delta R^2 = .48$, $F(2, 558) = 269.89$, $p < .001$); main effects were evidenced for COVID-19 perceived stress and anxiety sensitivity; see Table 2. With the addition of the interaction term in step 3, there was

Table 1 Descriptive statistics and correlations

Variable	Mean/n (SD/%)	1	2	3	4	5	6
1. Age	38.26 (12.15)	–					
2. Gender	327 (58.1%)	.198***	–				
3. PSS COVID-19	16.57 (7.53)	– .173***	.016	–			
4. ASI-3	27.72 (18.75)	– .200***	– .049	.614***	–		
5. OASIS	6.09 (4.96)	– .137**	.042	.613***	.630***	–	
6. PDSS	5.51 (6.92)	– .221***	– .069	.512***	.702***	.734***	–
7. WSAS	11.13 (13.02)	– .176***	– .097*	.485***	.708***	.579***	.695***

Gender % listed as males (Coded: 0 = male, 1 = female), *PSS COVID-19* Perceived Stress Scale due to COVID-19; *ASI-3* Anxiety Sensitivity Index (Taylor et al. 2007), *OASIS* Overall Anxiety Severity and Impairment Scale (Norman et al. 2006), *PDSS* Panic Disorder Severity Scale (Shear et al. 1997); *WSAS* Work and Social Adjustment Scale (Mundt et al. 2002)

***$p < .001$, **$p < .01$, *$p < .05$

Table 2 Main and interactive effects

Step		b	SE	β	t	p	CI (l)	CI (u)	sr^2
OASIS									
1	Age	−0.06	0.02	−0.15	−3.55	<.001	−0.10	−0.03	.02
	Gender	0.73	0.43	0.07	1.70	.090	−0.11	1.57	.01
2	Age	0.00	0.01	0.00	−0.11	.911	−0.03	0.02	.00
	Gender	0.58	0.31	0.06	1.85	.064	−0.03	1.19	.00
	PSS COVID-19	0.24	0.03	0.36	9.25	<.001	0.19	0.29	.08
	ASI-3	0.11	0.01	0.41	10.58	<.001	0.09	0.13	.10
3	Age	0.00	0.01	−0.01	−0.18	.854	−0.03	0.02	.00
	Gender	0.63	0.31	0.06	2.00	.046	0.01	1.24	.00
	PSS COVID-19	0.18	0.04	0.28	5.15	<.001	0.11	0.25	.02
	ASI-3	0.06	0.03	0.21	2.03	.043	0.00	0.11	.00
	PSS COVID-19*ASI-3	0.00	0.00	0.27	2.12	.035	0.00	0.01	.01
PDSS									
1	Age	−0.12	0.02	−0.22	−5.13	<.001	−0.17	−0.08	.04
	Gender	−0.37	0.59	−0.03	−0.62	.534	−1.52	0.79	.00
2	Age	−0.04	0.02	−0.07	−2.31	.021	−0.08	−0.01	.00
	Gender	−0.38	0.42	−0.03	−0.89	.375	−1.21	0.46	.00
	PSS COVID-19	0.12	0.03	0.13	3.33	.001	0.05	0.18	.01
	ASI-3	0.22	0.01	0.61	16.09	<.001	0.20	0.25	.23
3	Age	−0.04	0.02	−0.08	−2.51	.012	−0.08	−0.01	.01
	Gender	−0.24	0.42	−0.02	−0.58	.565	−1.06	0.58	.00
	PSS COVID-19	−0.04	0.05	−0.04	−0.84	.401	−0.13	0.05	.00
	ASI-3	0.07	0.04	0.18	1.85	.065	0.00	0.14	.00
	PSS COVID-19*ASI-3	0.01	0.00	0.56	4.66	<.001	0.00	0.01	.02
WSAS									
1	Age	−0.17	0.05	−0.16	−3.84	<.001	−0.26	−0.09	.03
	Gender	−1.72	1.12	−0.07	−1.54	.124	−3.92	0.47	.00
2	Age	−0.02	0.03	−0.02	−0.59	.555	−0.08	0.05	.00
	Gender	−1.67	0.80	−0.06	−2.09	.037	−3.25	−0.10	.00
	PSS COVID-19	0.14	0.07	0.08	2.21	.028	0.02	0.27	.00
	ASI-3	0.45	0.03	0.65	17.14	<.001	0.40	0.50	.26
3	Age	−0.02	0.03	−0.02	−0.70	.486	−0.09	0.04	.00
	Gender	−1.51	0.80	−0.06	−1.90	.058	−3.07	0.05	.00
	PSS COVID-19	−0.04	0.09	−0.03	−0.48	.632	−0.22	0.13	.00
	ASI-3	0.26	0.07	0.38	3.76	<.001	0.12	0.40	.01
	PSS COVID-19*ASI-3	0.01	0.00	0.36	2.96	.003	0.00	0.02	.01

N for analyses is 563 cases. Gender: % listed as males (Coded: 0 = male, 1 = female)

PSS COVID-19 Perceived Stress Scale due to COVID-19, *ASI-3* Anxiety Sensitivity Index (Taylor et al. 2007), *OASIS* Overall Anxiety Severity and Impairment Scale (Norman et al. 2006), *PDSS* Panic Disorder Severity Scale (Shear et al. 1997), *WSAS* Work and Social Adjustment Scale (Mundt et al. 2002)

a statistically significant increase in R^2 ($\Delta R^2 = .01$, $F(1, 557) = 8.73$, $p = .003$). Post-hoc simple slope analysis demonstrated that COVID-19 perceived stress was related to greater levels of functional impairment for individuals with higher ($b = .47$, $SE = .13$, $p < .001$) but not lower ($b = .03$, $SE = .08$, $p = .714$) levels of anxiety sensitivity (see Fig. 1).

Discussion

The purpose of the current study was to examine anxiety sensitivity as a moderating factor in the relation between COVID-19 perceived stress with global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. Results were consistent

Fig. 1 Interaction of Perceived Stress Due to COVID-19 and Anxiety Sensitivity: Associations with Global Anxiety Symptom Severity, Anxious Arousal Symptom Severity and Functional mpairment. *Note.* ** Significant at $p < 0.001$; Effects of Perceived Stress due to COVID-19 (PSS COVID-19) on Global Anxiety Symptom Severity (OASIS; top) Anxious Arousal Symptom Severity (PDSS; middle) and Functional Impairment (WSAS; bottom) at high (dashed line) and low (solid line) values of Anxiety Sensitivity (ASI-3)
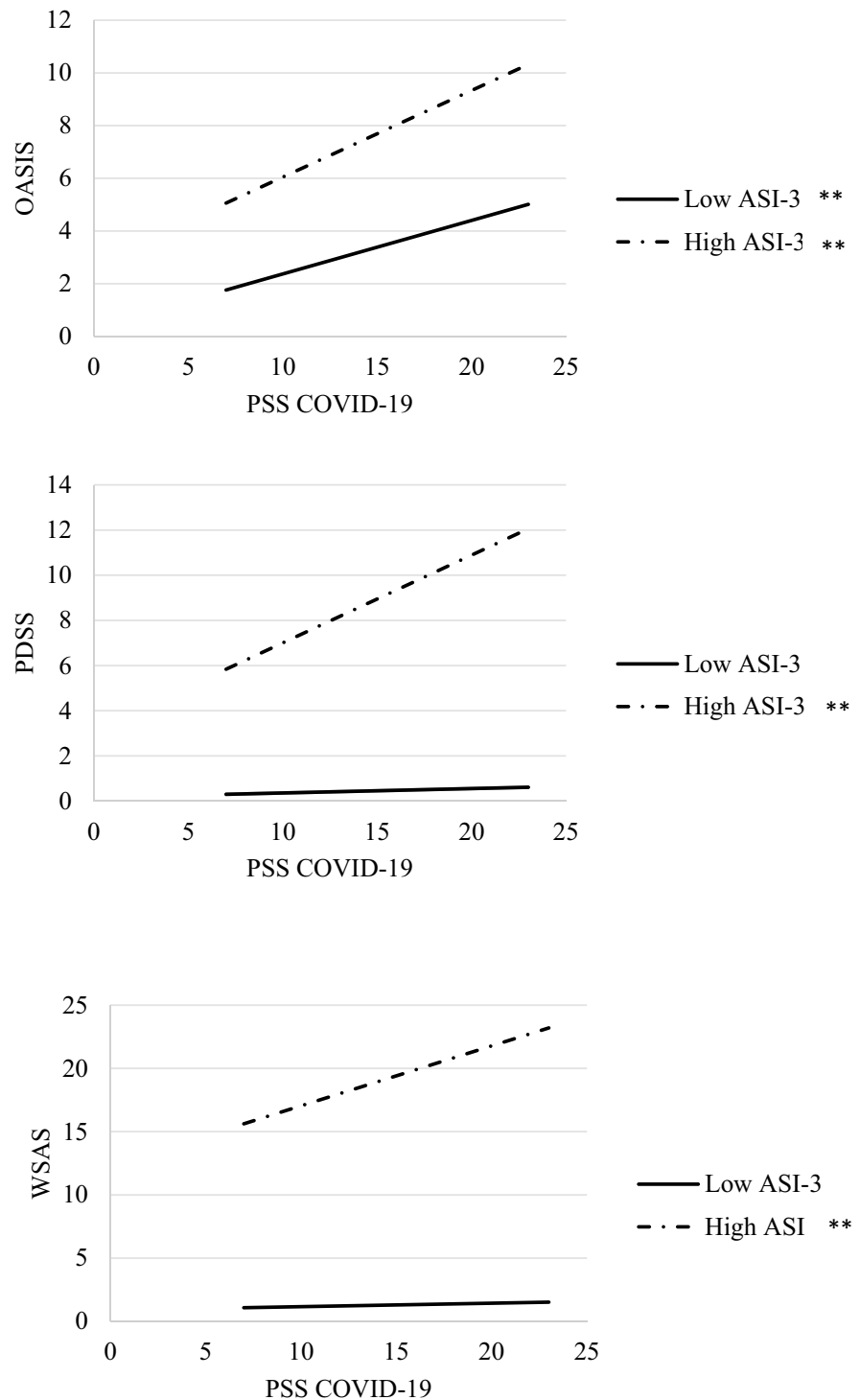
with predictions, such that the interaction of COVID-19 perceived stress and anxiety sensitivity significantly predicted global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. Planned post hoc simple slope analyses indicated that the relation between COVID-19 perceived stress and global anxiety symptom severity was significant at both higher and lower levels of anxiety sensitivity. For anxious arousal symptom severity and functional impairment, post hoc analyses indicated the relationship between COVID-19 perceived stress was related to greater levels of anxious arousal symptom severity and functional impairment for those with higher

anxiety sensitivity, not lower levels of anxiety sensitivity. All results were observed over and above the effects accounted for by age and gender.

The current results provide empirical evidence that anxiety sensitivity may be an important factor in better understanding the impact of COVID-19 perceived stress on global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. Theoretically, during the COVID-19 pandemic, individuals are experiencing many novel stressors, contributing to an increase in perceived stress. As individuals begin to experience their situation as uncontrollable or overwhelming, anxiety symptoms may develop or increase. As adaptive methods for managing stress and anxiety are unavailable due to social distancing measures and COVID-19 related mandates, these symptoms may become overwhelming and may be interpreted as threatening or maladaptive, further exacerbating perceived stress. As such, an individual is at an increased risk for experiencing mental health symptoms, and a decline in overall functioning.

As the pandemic continues to progress, it is important to consider the current results in terms of their clinical implications. Specifically, it may be important to fully understand the novel stressors an individual may be facing because of the ongoing pandemic. Further, assessing for and targeting anxiety sensitivity in a clinical context may serve to increase the capacity to handle ongoing stressors, and improve mental health and overall functioning. As COVID-19 perceived stress and anxiety sensitivity may exist in a reciprocal framework, targeting both concurrently may lead to better outcomes. Indeed, past work indicates that mindfulness and meditation can reduce perceived stress and improve anxiety sensitivity symptoms (Lane et al. 2007; McCracken and Keogh 2009). There is also value in integrating other anxiety sensitivity interventions, including physical activity (Smits et al. 2008, 2016), to promote the use of adaptive coping mechanisms.

There are some limitations to the current study. First, an online survey method was employed to collect all data included in the current study and therefore the noted relations between variables are influenced by the possibility of shared method variance. Future work would benefit from employing a multi-method assessment approach to reduce such variance. Second, the data were cross-sectional. Therefore, it is impossible to establish temporal relations between study variables. Future work should employ a longitudinal design to establish the temporal nature of the proposed model. Third, most of the sample reported their race as white. Future work will benefit from recruiting a more diverse sample in order to determine if the proposed model generalizes to other ethnic and racial groups. Fourth, the participants in the current sample were not treatment seeking adults. Thus, no actual diagnoses were made, and results

can only be interpreted based on symptom scores. Future work will benefit from working with a clinical population to determine if the current results generalize to individuals with mental health disorders.

Together, the current study provides initial support for the moderating role of anxiety sensitivity in the relation between COVID-19 perceived stress with global anxiety symptom severity, anxious arousal symptom severity, and functional impairment. These findings suggest that greater anxiety sensitivity, in the context of COVID-19 perceived stress, may relate to greater global anxiety symptom severity, anxious arousal symptom severity, and functional impairment.

Compliance with Ethical Standards

Informed Consent and Animal Rights Informed consent was obtained from all individual participants included in the study. No animal research was conducted.

Conflicts of Interest Kara Manning, Natasha D. Eades, Brooke Y. Kauffman, Laura J. Long, Angela L. Richardson, Lorra Garey, Michael J. Zvolensky, and Matthew W. Gallagher declare that they have no conflicts of interest.

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