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Anxiety Sensitivity Mediates Gender Differences in Post-Concussive Symptoms in a Clinical Sample

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Abstract

Traumatic brain injury (TBI) is both prevalent and potentially disabling. Extant literature has demonstrated women to report greater post-concussive symptoms (PCS) compared to men, highlighting the necessity of investigations into malleable, gender-linked risk factors for PCS that hold promise for reducing this gender disparity. Anxiety Sensitivity (AS) and Distress Tolerance (DT) are gender-linked risk factors that may be related to PCS. Despite a breadth of research supporting elevated AS and reduced DT in women, no study to date has investigated whether AS and DT mediate gender differences in PCS. The current sample was composed of 59 participants selected from a larger study based on their report of a past TBI. Findings indicated that AS, but not DT, significantly mediated gender differences in PCS. The present results suggest that AS is a cognitive risk factor that can partially account for the gender disparity in the expression of PCS. AS may influence an individual's interpretation of PCS as dangerous, thereby amplifying the perception of PCS severity. This suggests that efforts to reduce the burden of TBI may benefit from targeting AS in prevention and treatment paradigms, especially among women.

Keywords

Cognitive risk factors; traumatic brain injury; post-concussive symptoms; gender

1. Introduction

Traumatic Brain Injury (TBI) is an important health concern warranting further attention. Each year, 1.4 million Americans seek medical attention for a TBI, with 1.1 million receiving emergency department treatment, 235,000 being hospitalized, and 50,000 people dying as a result of their injury (Langlois et al., 2006). In addition, a substantial number of brain injured individuals do not present for treatment (Setnik and Bazarian, 2007). Coronado et al. (2012) estimated that, including treatment seeking and non-treatment seeking individuals, 3.5 million Americans sustained a TBI in 2009 alone. Moreover, TBI often results in a broad range of disability including both acute and chronic personal, familial, and occupational impairment (Langlois et al., 2006). This is partially related to a myriad of potentially chronic TBI-related post-concussive symptoms (PCS), including memory loss, attentional control impairment, and difficulty concentrating (Ryan and Warden, 2003).

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It appears that women report elevated PCS compared to men (Colvin et al., 2009; Dick, 2009; Farace and Alves, 2000). Farace and Alves (2000) conducted a meta-analysis of gender differences in TBI outcomes and demonstrated that men were more likely to receive a TBI, but women reported greater PCS following a TBI. In concert with these findings, a review of sport-related TBIs found that males were more likely to receive a TBI but females reported greater PCS (Dick, 2009). These findings, coupled with the demonstrated distress and impairment associated with TBI and PCS (Langlois et al., 2006; Ryan and Warden, 2003) underscore the elevated TBI-related dysfunction experienced by female patients. Despite this evidence, little is known regarding factors influencing the gender difference in self-reported PCS. Therefore, it is critical to evaluate gender-linked factors associated with PCS, particularly factors with demonstrated malleability that may serve as future treatment targets to mitigate this discrepancy.

Some evidence suggests that PCS may be amplified by psychological factors (Bryant and Harvey, 1999; Cicerone and Kalmar, 1995; Garden and Sullivan, 2010; Hoge et al., 2008; Iverson, 2006; Schneiderman et al., 2008). Research suggests that brain injured individuals with comorbid Major Depressive Disorder (MDD; Cicerone and Kalmar, 1995; Garden and Sullivan, 2010; Iverson, 2006) or post-traumatic stress disorder (PTSD; Bryant and Harvey, 1999; Hoge et al., 2008; Schneiderman et al., 2008) report greater PCS when compared to psychologically healthy brain injured individuals. Given research suggesting that cognitive risk factors (i.e., individual differences in interpretations that place an individual at risk for psychopathology) contribute to MDD and PTSD (Leyro et al., 2010; Naragon-Gainey, 2010; Olatunji and Wolitzky-Taylor, 2009; Taylor, 2003), it is plausible that gender-linked cognitive risk factors may partially explain gender differences in PCS. Two risk factors that may elucidate gender differences in PCS include Anxiety Sensitivity (AS; Reiss and McNally, 1985) and Distress Tolerance (DT; Leyro et al., 2010).

AS, commonly referred to as the “fear of fear,” is a risk factor characterized by a tendency to interpret benign arousal-related sensations as indicative of harm or danger (Reiss and McNally, 1985). For instance, an individual with high AS may interpret sensations of cognitive dyscontrol as indicative of harm rather than as a benign symptom of anxious arousal. A breadth of literature has demonstrated higher AS scores among women in both nonclinical (Deacon et al., 2003; Stewart et al., 1997; Zvolensky et al., 2001) and clinical samples (Schmidt and Koselka, 2000). Among undergraduate students, Deacon et al. (2003) found females to have significantly higher AS scores in one sample and marginally higher AS in another sample. Schmidt and Koselka (2000) investigated gender differences in AS among those with a panic disorder diagnosis and found women to have higher AS when compared to men. Moreover, this gender difference has been shown to begin in childhood and adolescence and continue through adulthood (Armstrong and Khawaja, 2002; Walsh et al., 2004).

In the context of TBI, high AS may exacerbate distress associated with PCS through the perception of these symptoms as indicative of harm or danger. An individual with high AS may interpret PCS-related symptoms in an exaggerated or catastrophic way (e.g., difficulties concentrating may be misinterpreted as being indicative of mental illness or catastrophic injury-related brain damage). The perception of PCS as catastrophically dangerous or

harmful may then amplify the perception of PCS severity, resulting in greater distress and subsequently greater PCS through a positive feedback loop (Bryant and Harvey, 1999; Coronado et al., 2012; Hoge et al., 2008; Iverson, 2006; Karzmark et al., 1995; Schneiderman et al., 2008; Stewart et al., 1997). Consistent with this, two studies of TBI patients on emergency units indicated that AS was significantly associated with self-reported PCS (Wood et al., 2011; Wood et al., 2014).

DT is another risk factor that may partially account for gender differences in PCS. DT has been conceptualized as an individual difference variable reflective of the capacity to tolerate aversive emotions/sensations, and has been assessed via self-report and behaviorally via persistence on discomfort/stress-inducing tasks (Leyro et al., 2010). Like AS, gender differences have been observed in DT, with females reporting lower DT than males (Gratz et al., 2011; Simons and Gaher, 2005). Although research on DT and PCS is lacking, low DT may exacerbate PCS via greater sensitivity to distressing sensations and emotions associated with PCS. Individuals with low DT may find PCS to be more intolerable when compared to individuals with high DT, resulting in elevated distress and associated salience of these symptoms. Finally, recent literature suggests that DT and AS are related subfactors of an overarching affect sensitivity/tolerance factor (Allan et al., 2015), and so it is important to determine if any observed relationships between AS/DT and PCS are common or specific.

The current study sought to address gaps in the extant TBI literature by examining if AS, a gender-linked cognitive risk factor, mediates the effect of gender on PCS when controlling for MDD and PTSD diagnoses. Based on previous findings, we predicted that AS would significantly mediate the effect of gender on PCS, such that women would report greater AS and subsequently report greater PCS. We also explored if DT significantly mediated the effect of gender on PCS. Based on results of related work with DT (Gratz et al., 2011; Simons and Gaher, 2005), we also predicted that DT would significantly mediate the effect of gender on PCS.

2. Methods

2.1. Participants

Participants included 59 individuals selected from a larger investigation examining the effects of a brief, computerized intervention designed to reduce AS (Schmidt et al., 2014). All data were collected at baseline prior to randomization and intervention. To be eligible, participants had to be 18 years or older and speak English. Participants were also over-sampled for self-reported AS at or above the community mean (Taylor et al., 2007), though not all participants reported elevations. Exclusionary criteria for the parent study included a significant medical illness that would prevent completion of interoceptive exercises included in the brief intervention (i.e., respiratory disorder, cardiovascular disease, uncontrolled hypertension). Participants were also excluded if they reported current or past psychotic spectrum disorders, current bipolar spectrum disorders not stabilized on medications, or significant suicidal intent requiring immediate hospitalization. No participants in the present sample endorsed a history of psychotic and/or bipolar spectrum disorders. Participants for the current study were selected based on their indication of a history of TBI. The sample was roughly evenly distributed by gender (females = 30, 50.8%). The majority of participants

identified as White (67.8%) followed by African-American (22.0%), Hispanic/Latino (1.7%), and Other (e.g., biracial; 8.5%). Age ranged from 18 to 87 (M = 42.10, SD = 16.34).

2.2. Procedure

Individuals meeting initial eligibility criteria completed a baseline battery of self-report questionnaires and a semi-structured diagnostic interview for the DSM-IV-TR (SCID/NP; First et al., 1994) prior to randomization to treatment or control groups. The study was approved by the university's Institutional Review Board and informed consent was obtained from all participants prior to the collection of data.

2.3. Measures

2.3.1. Anxiety Sensitivity Index – 3 (ASI-3)—The ASI-3 (Taylor et al., 2007) is an 18-item self-report measure used to assess an individual's tendency to interpret benign anxiety-related arousal symptoms as potentially harmful or dangerous. The ASI-3 was adapted from the original ASI (Reiss and McNally, 1985) to improve its psychometrics. Respondents indicate the extent to which each item reflects their typical experience on a 5-point Likert scale ranging from 0 (*very little*) to 4 (*very much*). Previous research has demonstrated the ASI-3 to have strong psychometrics, such as good to excellent internal consistency, factor stability, test-retest reliability, and convergent, discriminant, and predictive validity (Farris et al., 2015; Taylor et al., 2007). In the current study, the ASI-3 demonstrated excellent internal reliability (α = 0.95).

2.3.2. Distress Tolerance Scale (DTS)—The DTS (Simons and Gaher, 2005) is a 15-item self-report measure used to assess individual differences in in the ability to experience and withstand negative psychological states. Respondents are asked to indicate the extent to which they agree with statements regarding times they experienced negative psychological states on a 5-point Likert type scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). Lower scores on the DTS reflect greater difficulty tolerating negative psychological states. In the current study, the DTS demonstrated excellent internal reliability (α = 0.94).

2.3.3. Neurobehavioral Symptom Inventory (NSI)—The NSI (Cicerone and Kalmar, 1995) is a 22-item self-report measure used to assess an individual's experience of PCS. The NSI is composed of four subscales: vestibular symptoms, somatic symptoms, cognitive symptoms, and affective symptoms. Respondents indicate the extent to which each item reflects their typical experience in the past 2 weeks on a 5-point Likert scale ranging from 0 (None) to 4 (Very Severe). Previous research has demonstrated the NSI to have strong psychometrics (Cicerone and Kalmar, 1995; King et al., 2012). For instance, King et al. (2012) found the NSI total score to have excellent internal consistency (α = 0.95) and that all subfactors were highly correlated with the total score (r = 0.88 to 0.93). King et al. (2012) also demonstrated that the NSI differentiated those with and without a TBI history. In the current study, the NSI demonstrated excellent internal consistency (α = 0.95).

2.3.4. Traumatic Brain Injury Questionnaire (TBIQ)—The TBIQ (Diamond et al., 2007) is a 4-item questionnaire used to assess for history of traumatic brain injury. The TBIQ was adapted for civilian use from a TBI measure originally intended for use with

military populations (Brief Traumatic Brain Injury Screen; Schwab et al., 2006). The Brief Traumatic Brain Injury Screen (BTBIS) and TBIQ have both shown good sensitivity and high specificity for TBI history when compared to TBI history verified by clinical interview and has been successfully used to identify TBI history in a growing number of studies (Diamond et al., 2007; Matthews et al., 2011; Matthews et al., 2012; Richardson et al., 2014; Shu et al., 2014). In the current study, the TBIQ was used to select participants who reported a history of TBI. In addition, individual differences in the duration of loss of consciousness was used as a covariate in all analyses to account for difference in TBI severity.

2.4 Structured Clinical Interview for DSM-IV – Non-patient Edition (SCID/NP)

The SCID/NP is a psychometrically sound semi-structured interview commonly used to assess for DSM-IV psychiatric diagnoses (First et al., 1994). Trained doctoral level therapists administered the SCID/NP to all participants and all diagnoses were reviewed by a licensed clinical psychologist. A random sample of approximately 15% of these SCID/NP interviews were evaluated for reliability and resulted in high interrater agreement (e.g., over 80% with a kappa of 0.77). In the current study, the SCID/NP was utilized to assess for MDD and PTSD diagnoses.

2.5. Data Analytic Plan

Descriptive statistics were first computed for all variables. The PROCESS macro for SPSS (Hayes, 2012) was used to create a bias-corrected bootstrap parallel mediation model with 5,000 random bootstrap samples (with replacement) to test for significant indirect pathways from gender to PCS through AS and DTS. MDD diagnosis and PTSD diagnosis were included as covariates in all analyses. Bootstrap distributions were used to create 95% confidence intervals of the estimates. Although it is now generally agreed that a significant indirect path, from the independent variable to the dependent variable through the mediator, is the only requirement necessary to demonstrate mediation (Preacher and Hayes, 2008; Zhao et al., 2010), direct effects of gender on ASI-3 and DTS were also computed.

3. Results

3.1. Preliminary Analyses

Descriptive statistics and correlations between all variables used in the present analyses are provided in Table 1. The mean number of diagnoses was 1.95 ($SD = 1.65$). Further, an independent samples t-test revealed that gender did not differ on the number of current diagnoses received ($t(57) = -1.19$, $p = 0.24$). The most common primary diagnoses were as follows: No diagnoses (n = 14), PTSD (n = 10), MDD (n = 10), Social Anxiety Disorder (n = 10), other (n = 11). With regard to TBI severity, 22 individuals reported some alteration of consciousness but no loss of consciousness, 19 reported losing consciousness for less than 1 minute, 12 reported losing consciousness for between 1 and 20 minutes, and 6 reported losing consciousness for greater than 20 minutes. An independent samples t-test indicated a non-significant gender difference in TBI severity ($t(57) = 1.05$, $p = 0.30$). The common mechanism of injury was falling (n = 36), followed by vehicular accident (n = 31).

AS total scores in the present study ranged from 0 to 65 ($M = 32.59$, $SD = 18.01$). Of note, these values are consistent with AS total scores observed in clinical samples in previous research (Schmidt & Koselka, 2000). DT total scores ranged from 1.04 to 4.83 ($M = 2.76$, $SD = 1.00$), and NSI total scores ranged from 1 to 73 ($M = 30.44$, $SD = 18.51$). Examination of the raw data revealed no cases of outliers, skew, or kurtosis. Accordingly, no transformations were made to the data. Gender was significantly correlated with ASI-3 and NSI. In addition, bivariate correlations revealed NSI to be significantly associated with ASI-3 but not with DTS.

3.2. Direct effects of gender on ASI-3, DTS, and NSI

Gender (male = 0; female = 1) significantly predicted ASI-3 total scores ($B = 16.82$, 95% CI [9.76, 23.88]) but not DTS total scores ($B = -0.11$, 95% CI [−0.57, 0.35]) when accounting for MDD and PTSD diagnoses. Gender significantly predicted NSI total scores ($B = 19.46$, 95% CI [11.93, 26.99]) when accounting for MDD and PTSD diagnoses.

3.3. Mediation Analyses

The overall model composed of gender, ASI-3, MDD diagnosis, PTSD diagnosis, and NSI was statistically significant ($F(4, 54) = 27.03$, $p < 0.001$, $R^2 = 0.67$). Values for the paths from gender to ASI-3 ($B = 17.09$, 95% CI [8.93, 25.26]), ASI-3 to NSI ($B = 0.58$, 95% CI [0.39, 0.78]), and the indirect effect (gender to NSI through ASI-3) were computed. As predicted, the direct effect between gender and NSI was significant ($B = 9.43$, 95% CI [2.69, 16.17]) and there was a significant indirect effect from gender to NSI through ASI-3 ($B = 10.03$, 95% CI [5.16, 17.27]).[1]

Using DTS, the overall model was statistically significant ($F(4, 52) = 11.76$, $p < 0.001$, $R^2 = 0.48$). Values for the paths from gender to DTS ($B = -0.11$, 95% CI [−0.66, 0.44]), DTS to NSI ($B = -4.09$, 95% CI [−7.85, −0.32]), and the indirect effect (gender to NSI through DTS) were computed. Against prediction, there was not a significant indirect effect from gender to NSI through DTS ($B = 0.44$, 95% CI [−1.48, 4.20]).[2]

4. Discussion

The findings from the current study highlight the role of psychological risk factors underlying reported gender differences in PCS among a clinical sample. Specifically, the current study demonstrated a significant indirect effect of gender on PCS through AS when controlling for MDD and PTSD diagnoses among those with a range of TBI severity. These findings are consistent with previous work demonstrating women to have greater AS (Schmidt and Koselka, 2000) and PCS (Colvin et al., 2009; Dick, 2009; Farace and Alves, 2000) compared to men. The present findings are also consistent with extant research associating AS and PCS among those with a TBI history (Wood et al., 2011; Wood et al.,

[1]Mediation models were also conducted to assess the specificity of ASI-3 as a mediator of each NSI subfactor (i.e., vestibular, somatic, cognitive, and affective symptoms). However, results demonstrated that ASI-3 significantly mediated gender differences in all NSI subscales. Due to the lack of specificity, the subscale mediation models were not reported or discussed in the current manuscript.

[2]AS and DT mediation models were also conducted with loss of consciousness duration, an indicator of TBI severity (e.g., Malec et al., 2007), as a covariate. However, the observed pattern of results remained when including this covariate. Therefore, in the interest of parsimony, loss of consciousness duration was not included in the present manuscript.

2014). Interestingly, the observed relationship between AS and PCS in the current study (r = 0.76) is similar to the correlation in one prior study (r = 0.61; Wood et al., 2014) but is considerably larger than the relationship found in an earlier study (r = 0.33; Wood et al., 2011). The current study may have observed a larger effect size due to the clinical nature of the sample, which has been shown to elevate PCS (Bryant and Harvey, 1999; Cicerone and Kalmar, 1995; Garden and Sullivan, 2010; Hoge et al., 2008; Iverson, 2006; Schneiderman et al., 2008). However, the inconsistent magnitude of the relation between AS and PCS warrants further evaluation in future studies comparing this effect size in clinical and non-clinical populations, as well as with regard to TBI severity and time since the injury.

It is plausible that elevations in AS are positively associated with the interpretation of PCS-related sensations (e.g., cognitive dyscontrol) as more dangerous or potentially harmful. Thus, self-reported PCS symptom severity may be amplified through the interpretation of these symptoms as dangerous or harmful, as well as the distress that may accompany such an interpretation, among clinical samples (Karzmark et al., 1995; Wood et al., 2011; Wood et al., 2014). Therefore, greater PCS reported by women may be in fact related to differences in the interpretation of these symptoms and the associated distress, and not due solely to organic, injury-related gender differences. However, the statistical mediation observed in the current study warrants further research utilizing prospective study designs to further evaluate the causal relationships between AS and PCS.

In contrast to our hypothesis, DT did not significantly mediate the effect of gender on PCS. DT and AS are considered distinct, yet related, psychological risk factors, with DT indexing an individual's perceived ability to tolerate negative emotionality, as opposed to AS, which assesses an individual's tendency to interpret bodily sensations in a negative way (Allan et al., 2015). It appears that the interpretation of PCS as dangerous or potentially harmful, and not the interpretation of one's own ability to tolerate distressing symptoms, is related to greater PCS observed among women. The belief that one cannot tolerate distressing emotions held by individuals with low DT may lead to PCS-related impairment through the avoidance of activities that may exacerbate PCS, but DT itself does not appear to contribute to the elevated self-reported PCS observed among women. Contrary to prior literature (Gratz et al., 2011; Simons and Gaher, 2005), the current study did not find a significant bivariate relationship between DT and gender though the mean DT did appear to be lower for women than for males. It is possible that the current study lacked power to detect gender differences in DT that previous research has demonstrated to be smaller than gender differences in AS (Schmidt and Koselka, 2000; Simons and Gaher, 2005).

Our study provides new perspectives into the genesis of PCS gender discrepancies by demonstrating that a psychological vulnerability may influence gender differences in PCS reports. The present study reveals that AS may be an important mechanism through which gender influences PCS. Therefore, it is plausible, although speculative, that AS directed interventions may mitigate the observed gender discrepancy in self-reported PCS by ameliorating AS, a vulnerability for elevated PCS that appears to adversely impact women. Computerized interventions have demonstrated significant reductions in AS after just a single, 45-minute session (Schmidt et al., 2014). Such brief interventions hold promise for TBI rehabilitation, though further work utilizing longitudinal designs is needed to determine

whether AS reductions relate to PCS reductions, or if AS interventions may be an effective preventative measure against the development of PCS. In addition to the relief of personal burden among those suffering from PCS, accessibility of these interventions at locations providing emergency medical services may also serve to reduce societal burden of TBI-related functional impairment.

Several limitations of the current investigation should be noted. First, though our analyses allowed us to test AS as a statistical mediator of gender differences in PCS, longitudinal data will be required to test the temporal mediation of this relationship. Future research should evaluate the temporal relationship between gender differences in AS and gender differences in PCS to ensure the proposed direction of this relationship. Moreover, future research would benefit from assessing AS prior to a TBI to examine the presence of a causal relationship between AS and PCS. A larger sample size will also benefit future research in order to more accurately observe the relationships between gender, AS, and PCS.

Another notable limitation is the measure of TBI history employed in this study (i.e., the TBIQ; Diamond et al., 2007) provides little information about the nature, severity, and time-since-injury in the current TBI sample, all of which may potentially influence the experience of PCS. In particular, data regarding the time-since-injury is an important predictor of PCS severity, as data show that PCS typically reduces over time (Cicerone, & Kalmar, 1995; Røe, Sveen, Alvsåker, & Bautz-Holter, 2009). Therefore, the present study is unable to determine if elevations in AS are related to PCS in the acute stage of TBI, or if elevations in AS predict PCS only during longer follow-ups. The present findings, which are preliminary in nature, pose this important question in need of further investigation. Further, the available data suggest a relatively mild TBI severity, though the lack of formal TBI diagnoses limits conclusions regarding the relationships between gender, AS, and PCS among those with differing levels of TBI severity. Though the absence of these data limits interpretations of these data with regard to subsamples of TBI (i.e., those with recent TBIs vs. persistent symptoms), past research demonstrating convergence of self-reported TBIs using the TBIQ (civilian or military) with interview-based diagnosis of TBI (Diamond et al., 2007; Matthews et al., 2011; Matthews et al., 2012; Richardson et al., 2014; Shu et al., 2014) lends confidence to the preliminary conclusions of the current study that AS plays a role gender differences in PCS. Future research should seek to extend these findings by examining the effects TBI severity and time-since-injury on the relation between gender, AS, and PCS.

Despite these limitations, our data provide initial evidence that AS is an important risk factor for PCS, and contributes to the observed gender discrepancy in self-reported PCS. Notably, this effect was specific to AS, but not a related psychological risk factor, DT. Future research should utilize clinical interviews that provide a more comprehensive assessment of TBI history, including number of TBIs, chronology, and severity. Ideally, this would also include longitudinal, naturalistic analyses of the relationships between AS and PCS. Finally, future research should evaluate the effect of computerized AS interventions on PCS and the mitigation of the gender discrepancy.

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Table 1

	Mean (SD) or %							
Measure	**Male**	**Female**	**1**	**2**	**3**	**4**	**5**	**6**
1. ASI 3 Total	24.72 (16.77)	40.20 (15.99)	--					
2. DTS Total	2.82 (1.07)	2.71 (0.92)	−0.18	--				
3. NSI Total	21.48 (14.55)	39.10 (17.98)	0.76**	−0.19	--			
4. Gender	--	--	0.43**	−0.06	0.48**	--		
5. MDD (% positive)	41.40	26.70	0.26*	0.08	0.33*	−0.16	--	
6. PTSD (% positive)	31.00	33.30	0.19	0.15	0.32*	0.02	0.27*	--

Note: N = 59. ASI = Anxiety Sensitivity Index. DTS = Distress Tolerance Scale. NSI = Neurobehavioral Symptom Inventory. Gender coding: Male = 0; female = 1. MDD = Major Depressive Disorder diagnosis. PTSD = Post-traumatic Stress Disorder diagnosis.

* $p < 0.05$

** $p < 0.01$

Table 2

Mediation models of gender predicting post-concussive symptoms through AS and DT

	Post-concussive Symptoms		
Models	***B***	***LL***	***UL***
Anxiety Sensitivity			
Gender	**9.43**	**2.69**	**16.17**
AS	**0.59**	**0.39**	**0.78**
Gender-AS Mediation	**10.03**	**5.16**	**17.27**
Distress Tolerance			
Gender	**18.94**	**11.43**	**26.45**
DT	**−4.09**	**−7.85**	**−0.32**
Gender-DT Mediation	0.44	−1.48	4.20

LL = lower limit of 95% confidence interval; UL = upper limit of 95% confidence interval; AS = Anxiety Sensitivity; DT = Distress Tolerance; Gender-AS Mediation = mediation pathway from gender to post-concussive symptoms through AS; Gender-DT Mediation = mediation pathway from gender to post-concussive symptoms through DT. Significant effects (those whose confidence interval does not include zero) are shown in bold type. Covariates included MDD diagnosis and PTSD diagnosis.