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The Explanatory Role of Fatigue Severity in the Relation between COVID-19 Perceived Stress and Depression, Anxiety, and Panic Severity

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Abstract

The COVID-19 pandemic has had an adverse effect on anxiety and depression symptoms and disorders in the United States and worldwide. As such, there is considerable interest in better understanding the relationship between COVID-19 and anxiety and depressive disorders. Although individual differences in perceived stress have shown to be related to anxiety and depression in non-COVID-19 work, research has not examined potential factors underlying this relation in the context of COVID-19. Fatigue severity may be a promising mechanistic construct for perceived stress and anxiety and depression relations, as some work has found that perceived stress may predict elevated fatigue symptoms. As such, the current study sought to examine the potential explanatory role of fatigue severity in the relation between COVID-19 specific perceived stress and depression, anxiety, and panic symptoms among 563 adults (41.9% female, M_{age} = 38.26 years, SD = 12.15). Results suggested that COVID-19 perceived stress, via fatigue severity, significantly predicted depression, anxiety, and panic symptoms. These results provide initial empirical support for the role of fatigue severity in the relation between COVID-19 perceived stress and depression, anxiety, and panic symptoms. Future work would benefit from using longitudinal data to evaluate the current model.

Keywords

Pandemic; COVID-19; Mental Health; Fatigue; Stress; Affect

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Introduction

The outbreak of the novel coronavirus (COVID-19) was declared a global health pandemic by the World Health Organization in March 2020 (Covid & Team, 2020). As of October 23rd, 2020, the United States (U.S.) has seen over 8.46 million confirmed cases of COVID-19 and has reported over 220,000 deaths due to the virus (Engineering, 2020). To mitigate the spread of the virus, the U.S. has recommended that individuals engage in social distancing, which includes home quarantining, telecommuting to work, closing schools, and avoiding large social gatherings (Fauci et al., 2020; Pfefferbaum & North, 2020). Although social distancing measures have demonstrated efficacy in slowing the spread of the virus (Matrajt & Leung, 2020), such precautions have had widespread economic, social, and psychological impacts (Pfefferbaum & North, 2020).

COVID-19 has generated an epidemic of panic, anxiety, and depression in the general population related to the disease and its impact on society at large (Rajkumar, 2020; Yao et al., 2020). Indeed, approximately 45% of individuals in the U.S. have reported that their mental health has been negatively affected during the COVID-19 pandemic (Panchal et al., 2020), and rates of mental health problems are elevated compared to what is typically seen in the general population with rates of clinical depression increasing by 24% and rates of clinical anxiety increasing by 12% (Bureau, 2020; Gallagher et al., 2020). These findings are consistent with past research suggesting that widespread health epidemics have an overall negative impact on mental health functioning (Brooks et al., 2020; Rajkumar, 2020). In part, the rise in negative affective symptoms may be a consequence of stressors inherent to the virus, such as fear of contracting the illness, lack of sufficient information regarding the virus and its spread, and worry about the safety of loved ones (Brooks et al., 2020; Pfefferbaum & North, 2020). In addition, changes in daily routine associated with the pandemic and financial or resource-related concerns can also contribute to stress associated with COVID-19 (Park et al., 2020).

Perceived stress reflects the extent to which an individual interprets the events in their life as uncontrollable, unpredictable, or overwhelming (Cohen et al., 1983). In terms of COVID-19 specifically, it underscores the extent to which an individual feels they have control over difficult or unanticipated events or emotions that arise due to the pandemic (i.e. job loss, illness, anger). The current pandemic has been characterized as a period of global increase in perceived stress compared to what is typically observed in the general population (Limcaoco et al., 2020). Perceived stress is related to poorer mental health functioning (VanKim & Nelson, 2013), functional impairment (Besser & Zeigler-Hill, 2014), and high mortality rates (Limcaoco et al., 2020). Specifically, in terms of the pandemic, perceived stress has shown to be significantly related to greater anxiety symptoms (Limcaoco et al., 2020) and greater negative affect (Whitehead, 2020). Although past work on other global health epidemics have cited both increases in stress and mental health symptoms (Brooks et al., 2020; Rajkumar, 2020), few studies have explored the potential link between stress and mental health functioning specifically in terms of an ongoing health crisis.

When considering the impact of perceived stress specific to COVID-19 on mental health outcomes, it is clinically important to recognize potential explanatory variables that may be

involved in these relations. For example, as cognitive resources to manage present stressors become depleted and traditional methods of stress management are unavailable (i.e., social support, vacations, etc.), physical and mental fatigue may develop. Fatigue severity is a risk factor for poor mental health outcomes and is defined as an overwhelming sense of tiredness, lack of energy and a feeling of exhaustion that contributes to impaired physical and/or cognitive functioning (Shen et al., 2006). Fatigue severity is related to greater perceived stress (Kocalevent et al., 2011), as well as increased depression, anxiety, and substance use (Manning et al., 2019; Manning et al., 2020; Manning et al., 2019). Further, it is hypothesized that fatigue symptoms may arise in the context of ongoing tension or stress (Kocalevent et al., 2011). As such, it is probable that rates of fatigue severity would increase in the wake of a health pandemic and may partially account for the relation between COVID-19 specific perceived stress and depressive and anxiety symptoms. However, no work to date has examined whether this is the case amid COVID-19.

Most individuals are experiencing many novel stressors due to COVID-19 (Park et al., 2020), and due to recommended safety precautions (Van Bavel et al., 2020), are limited in their capacity to effectively cope (e.g., visiting loved ones or socializing with friends). Thus, individuals may be more likely to perceive their situation as overwhelming or out of control (i.e., increased perceived stress). Without proper strategies to manage increases in perceived stress due to COVID-19, increased fatigue severity is apt to be experienced, further limiting resources needed to effectively cope with the ongoing crisis (i.e., avoidance of physical activity due to reduced energy stores). In turn, poorer mental health functioning, such as increasing depression, anxiety, or panic related symptoms, may develop. Thus, this theorized model supports the idea that fatigue severity may, in part, link the association between COVID-19 specific perceived stress and depression and anxiety symptoms.

The purpose of the present study was to test the potential explanatory role of fatigue severity in the relation between perceived stress due to COVID-19 and mental health functioning, above and beyond the effects of age, gender, race, and perceived health. Perceived health was selected as a covariate in order to control for any potential confounding effects of physical health on COVID-19 related concerns. It was hypothesized that COVID-19 perceived stress, via fatigue severity, would significantly predict greater depression, anxiety, and panic symptoms.

Methods

Participants

Participants for the current study included 563 adults (41.9% female, M_{age} = 38.26 years, SD = 12.15). Participants were eligible to participate in the current study if they: 1) were 18 years or older, 2) currently lived in the United States, 3) had completed at least 100 Human Intelligence Tasks (HITS), and 4) had an approval rate of at least 95%. Participants were excluded if they did not complete the full survey or failed to answer at least 3 out of 4 validity questions correctly (e.g. “Respond to this question by writing the word ‘apple’ in the blank”).

Most of the sample self-identified as Caucasian/White (70.1%). The remainder of the sample identified as follows: 13.6% African American/Black, 6.2% Hispanic/Latinx, 4.2% Asian/Pacific Islander, 2.8% Native American/American Indian, 2.8% Biracial or multiracial, and 0.2% other. In terms of education level, 0.2% reported less than a high school education, 9.9% reported a high school education or equivalent, 17.0% reported some college, 11.3% received an associate's degree, 43.7% received a bachelor's degree, 15.9% received a master's degree,1.4% received a professional degree, and 0.5% received a doctoral degree.

Measures

Demographic Questionnaire.—A demographic questionnaire was employed to obtain demographic information from the sample, including age, sex, race, and ethnicity. The variables age, gender (coded as 0 = male, 1 = female), and race (coded as 0 = not white and 1 = Caucasian/white) were also utilized as covariates in the current study.

Self-Perceived Health.—Perceived health was measured by a single item (i.e. "In general, how would you say your health is?") taken from the 20-item Short Form Health Survey (Ware Jr et al., 1996). This item was rated on a 5-point Likert-type scale ranging from 1 (*excellent*) to 5 (*poor*). Item responses were transformed into a scale from 0 to 100 with higher scores indicative of greater perceived health (Ware Jr et al., 1996). This item was utilized as a covariate in the current study.

Brief Fatigue Inventory.—The Brief Fatigue Inventory (BFI; Mendoza et al., 1999) is a 9-item measure that assesses severity of fatigue and impairment over the past 24 hours. The first 3 items assess fatigue severity and are rated on an 11 point Likert-type scale ranging from 0 (no fatigue) to 10 (fatigue as bad as you can imagine), and the final 6 items assess fatigue related impairment and are also rated on an 11-point Likert-type scale ranging from 0 (does not interfere) to 10 (completely interferes). A total score is generated from taking the average of all 9 items. The total score was used in the current study as a mediator and it demonstrated excellent internal consistency (α = .97).

Perceived Stress Scale-Modified.—The 10 item Perceived Stress Scale (PSS; Cohen et al., 1983) was adapted for the current study to assess perceived stress due to COVID-19 (example item, "In the last week, how often have you felt nervous and stressed due to the coronavirus?"). Responses to the items were recorded on a 5-point Likert scale ranging from 0 (never) to 4 (very often). The total score was used as a predictor variable and demonstrated good reliability (α = .83).

Overall Depression Severity and Impairment Scale.—The Overall Depression Severity and Impairment Scale (ODSIS; Bentley et al., 2014) is a 5-item measure that assesses depression symptoms over the past week. Items are rated on a 5-point Likert-type scale ranging from 0 to 4. The total score demonstrated excellent internal consistency (α = .94) and was utilized as a criterion variable in the current study.

Overall Anxiety Severity and Impairment Scale.—The Overall Anxiety Severity and Impairment Scale (OASIS; Norman et al., 2006) is a 5-item measure that assesses anxiety

symptoms over the past week. Items are rated on a 5-point Likert-type scale ranging from 0 to 4. The total score demonstrated excellent internal consistency (α = .93) and was utilized as a criterion variable in the current study.

Panic Disorder Severity Scale.—The Panic Disorder Severity Scale (PDSS; Shear et al., 1997) is a 7 item measure that assesses panic symptoms and frequency of panic attacks over the past week. Items are rated on a 5-point Likert-type scale ranging from 0 to 4. A total score is calculated by averaging all 7 items. In the current study, the total score was used as a criterion variable and demonstrated excellent internal consistency (α = .96).

Procedure

American adults were recruited using Amazon Mechanical Turk (MTURK), an online data collection platform that has been shown to be an effective method of obtaining reliable and valid data (Thomas & Clifford, 2017). The survey was advertised as a study on mental health and the coronavirus pandemic, and data collection occurred from March 27, 2020 to May 5, 2020. All individuals who met initial eligibility criteria could complete the survey. Incomplete responders or responders that failed to correctly answer 3 out of the 4 validity questions were excluded (N=38) to give the final sample size of 563. The study protocol was approved by the Institutional Review Board at the sponsoring institution.

Analytic Strategy

Analyses were conducted in SPSS version 25.0. First, bi-variate correlations among study variables were examined. Next, mediation analyses were conducted using the PROCESS macro (Hayes, 2013) for SPSS to compute the indirect associations of COVID-19 perceived stress (X) via fatigue severity (M) with the following criterion variables: depression (Y1), anxiety (Y2), and panic symptoms (Y3). In addition, competing models were run to test the indirect associations of fatigue severity (X) via COVID-19 perceived stress (M) with depression (Y1), anxiety (Y2), and panic symptoms (Y3). All models controlled for age, gender, race, and perceived health (Afifi, 2007; Al-Windi, 2005; Charles et al., 2001; George & Lynch, 2003; Wu et al., 2002). Both direct and total effects for each model were reported. To test the statistical significance of the indirect effects, bootstrapping with 10,000 bootstrap re-samplings was conducted. Bootstrapping estimates the sampling distribution of an estimator based on re-sampling with replacement from the data set, which creates an empirically generated sampling distribution (Hayes, 2013). A bootstrapped 95% confidence interval that does not include zero indicates a statistically significant indirect effect (Preacher & Hayes, 2008b). Completely standardized indirect effects are reported as indices of effect size and can be interpreted as a one-unit change in the standardized predictor on the standardized outcome through the mediator (Preacher & Hayes, 2008a). Effect sizes can be interpreted as small (.14) medium (.39), and large (.59; Lachowicz et al., 2018).

Results

Descriptive Statistics

Bivariate correlations are presented in Table 1. Fatigue severity was significantly correlated with COVID-19 perceived stress (r = .57, p<.001), anxiety (r = .67, p<.001), depression

(r = .70, p<.001), and panic symptoms (r = .66, p<.001). COVID-19 perceived stress was significantly correlated with anxiety (r = .61, p<.001), depression (r = .56, p<.001), and panic symptoms (r = .51, p<.001). The observed correlations indicate strong, positive relations between the studied variables.

Primary Analyses[1]

In relation to depression, there was a significant total effect of COVID-19 perceived stress (see Table 2; b=0.36, p<.001, 95%CI [0.32, 0.41]). In addition, there was a significant indirect effect of COVID-19 perceived stress, through fatigue severity, for depression (ab=0.21, SE= 0.02, 95%CI [0.17, 0.25]), completely standardized indirect effect (β=.31). After accounting for indirect effects of the mediator, the direct effect of COVID-19 perceived stress on depression remained significant (b=0.16, p<.001, 95%CI [0.11, 0.20]).

In relation to anxiety, there was a significant total effect of COVID-19 perceived stress (see Table 2; b=0.39, p<.001, 95%CI [0.35, 0.44]). In addition, there was a significant indirect effect of COVID-19 perceived stress, through fatigue severity, for anxiety (ab =0.17, SE= 0.02, 95%CI [0.14, 0.21]), completely standardized indirect effect (β=.26). After accounting for indirect effects of the mediator, the direct effect of COVID-19 perceived stress on anxiety remained significant (b=0.22, p<.001, 95%CI [0.17, 0.27]).

Regarding panic symptoms, there was a significant total effect of COVID-19 perceived stress (see Table 2; b=0.06, p<.001, 95%CI [0.06, 0.07]). In addition, there was a significant indirect effect of COVID-19 perceived stress, through fatigue severity, for panic symptoms (ab=0.04, SE= 0.004, 95%CI [0.03, 0.05]), completely standardized indirect effect (β=.30). After accounting for indirect effects of the mediator, the direct effect of COVID-19 perceived stress on panic symptoms remained significant (b=0.03, p<.001, 95%CI [0.02, 0.04]).

Reverse Models

In relation to depression, there was a significant total effect of fatigue severity (b=1.26, p<.001, 95%CI [1.15, 1.37]). In addition, there was a significant indirect effect of fatigue severity, through COVID-19 perceived stress, for depression (ab =0.24, SE= 0.04, 95%CI [0.16, 0.31]), completely standardized indirect effect (β=.13). After accounting for indirect effects of the mediator, the direct effect of fatigue severity on depression remained significant (b=1.02, p<.001, 95%CI [0.89, 1.15]).

Regarding anxiety, there was a significant total effect of fatigue severity (b=1.18, p<.001, 95%CI [1.07, 1.30]). In addition, there was a significant indirect effect of fatigue severity, through COVID-19 perceived stress, for anxiety (ab =0.33, SE= 0.04, 95%CI [0.25, 0.41]), completely standardized indirect effect (β=.19). After accounting for indirect effects of

[1]Additional analyses were run to examine the effects for those that identified their race as African American/Black (n=77). The results indicated significant indirect effects for depression (ab =0.22, 95%CI [0.12, 0.39]), completely standardized indirect effect (β=.30), anxiety (ab =0.23, 95%CI [0.12, 0.42]), completely standardized indirect effect (β=.30), and panic symptom severity (ab =0.06, 95%CI [0.04, 0.10]), completely standardized indirect effect (β0=.37).

the mediator, the direct effect of fatigue severity on anxiety remained significant (*b*=0.85, *p*<.001, 95%CI [0.73, 0.98]).

For panic symptoms, there was a significant total effect of fatigue severity (*b*=0.23, *p*<.001, 95%CI [0.21, 0.25]). In addition, there was a significant indirect effect of fatigue severity, through COVID-19 perceived stress, for panic symptoms (*ab* =0.04, SE= 0.01, 95%CI [0.02, 0.05]), completely standardized indirect effect (*β*=.11). After accounting for indirect effects of the mediator, the direct effect of fatigue severity on panic symptoms remained significant (*b*=0.19, *p*<.001, 95%CI [0.17, 0.22]).

Discussion

The purpose of the current investigation was to determine the explanatory role of fatigue severity in the relation between COVID-19-perceived stress and depression, anxiety, and panic symptoms. Results were generally consistent with predictions, such that COVID-19 perceived stress significantly predicted greater depression, anxiety, and panic symptoms through fatigue severity. These results were observed over and above the variance accounted for by age, gender, race, and perceived health. Such findings extend emerging work on the COVID-19 pandemic by highlighting the relevance of fatigue severity as a potential explanatory variable in the relation between perceived stress and mental health symptoms (Limcaoco et al., 2020; Whitehead, 2020). Yet, results from the reverse models indicated that a bi-directional relation may exist between COVID-19 specific perceived stress and fatigue severity. Specifically, fatigue severity may relate to greater COVID-19 perceived stress, which in turn is related to greater depression, anxiety, and panic symptoms. It is important to note, however, that the observed effect sizes were greater in all three of the hypothesized models (estimates ranged from .26-.31) compared to the reverse models (estimates ranged from .11-.19). Thus, there may be a relatively greater degree of validity to fatigue severity as an explanatory variable in the current investigation. This is also consistent with past work suggesting that greater fatigue may be the result of ongoing stress or tension (Kocalevent et al., 2011).

Theoretically, due to the ongoing pandemic, an individual may experience an increase in perceived stress, and as cognitive resources to manage stressors become depleted and adaptive methods of managing stress are unavailable (i.e., social support, vacations, etc.), greater fatigue severity may be experienced. Yet, as the data indicate a potential reciprocal relationship between COVID-19 perceived stress and fatigue severity, it may be the case that individuals with greater fatigue severity are more susceptible to perceiving their current situation as stressful and uncontrollable. Fatigue and perceived stress may therefore bidirectionally reinforce one anoter and together causeindividuals to experience greater depression, anxiety, and panic symptoms. More work is needed to fully explicate the relations between COVID-19 specific perceived stress and fatigue severity.

It is important to note that exploratory analyses for those that identified their race as African American/Black also yielded significant indirect effects with medium effect sizes. Work to date on COVID-19 suggests that African Americans/Blacks are disporprotianately affected by this virus (Zvolensky et al., in press). As compared to Caucasians/Whites, they are

more likely to get COVID-19 and are more likely to die from the virus (Yancy, 2020). These disproportiante rates are likely due to lack of access to quality health care, social determinants such as high housing density, and the absence of privelge that does not allow for the ability to work safely from home, along with other systemic racial biases (Yancy, 2020). Therefore, it is unsurprising that this population would also experience significant COVID-19 perceived stress and poorer mental health outcomes via severe fatigue. The sample size for the exploratory analyses was small (n=77); therefore, future work would benefit from investigating the current model among a larger sample size, and extending the current results to other racial/ethnic groups.

Clinically, the current investigation may serve to inform the development of intervention strategies for individuals experiencing an increase in mental health symptoms. It may be beneficial to understand and address the difficulties an individual may be facing, such as job loss or social isolation, in a clinical context. Providing positive coping skills, such as meditation, may reduce perceived stress, making circumstance feel more controllable (Lane et al., 2007). As such, reducing perceived stress may improve fatigue symptoms, however, as a bidirectional relation may exist, there may be merit in integrating fatigue based interventions, such as physical activity (Edmonds et al., 2004; Powell et al., 2001), or cognitive-behavioral therapy (Price & Couper, 1998). Instilling healthy coping mechanisms has the potential to reduce the mental health burden associated with the COVID-19 pandemic.

There are limitations to the current study that warrant discussion. First, the data were cross-sectional, thus no temporal relations between study variables can be established. Future work would benefit from employing prospective or longitudinal designs to fully explicate the directionality of the proposed model. Second, all the data were collected via an online survey and therefore the observed relations are subjected to shared method variance. Future work should implement a multi-method assessment approach to account for this issue. Third, most of the sample identified their race as Caucasian/White. Future work is needed to determine whether the proposed model generalizes to more diverse populations. Fourth, an a priori power analysis was not conducted specifically for the current model. Therefore, it is not fully clear the specific sample size needed to detect all effects. Future research could conduct an a priori power analysis in efforts to replicate and extend the current work.

Overall, the current study provides novel support for the mechanistic role of fatigue severity in the relation between COVID-19 perceived stress and depression, anxiety, and panic symptoms. More work is needed to fully understand the mental health implications of the ongoing health pandemic and future work would benefit from employing a longitudinal design to explicate the temporal nature of the studied variables.

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Table 1.

Bivariate Correlations and Descriptive Statistics.

	1.	2.	3.	4.	5.	6.	7.	8.	Mean (SD) or % [N]
1. Gender (Female)	1								41.9% [236]
2. Age	.19***	1							38.26 (12.15)
3. Race (White)	.12***	.29***	1						70.1% (396)
4. Perceived Health	−.21	−.22***	−.11*	1					66.22 (24.18)
5. Fatigue Severity	.02	−.15***	−.16***	−.09*	1				3.31 (2.77)
6. Perceived Stress	.02	−.17***	−.09*	−.06	.57***	1			16.59 (7.53)
7. Depression	.03	−.14**	−.08	−.13**	.70***	.56***	1		4.85 (5.09)
8. Anxiety	−.05	−.14**	−.08	−.10*	.67***	.61***	.80***	1	6.10 (4.96)
9. Panic Symptoms	−.06	−.22***	−.18***	.07	.66***	.51***	.72***	.74***	0.79 (0.99)

Note.

* $p<.05$

** $p<.01$

*** $p<.001$.

Sex coded 0=Male, 1=Female; Race coded 0= Not White and 1=Caucasian/White; Perceived Health= 20-item Short Form Health Survey (Ware Jr et al., 1996); Fatigue Severity=Brief Fatigue Inventory (BFI; Mendoza et al., 1999); Perceived Stress= Perceived Stress Scale-Modified for COVID-19 (PSS; Cohen et al., 1983); Depression= Overall Depression Severity and Impairment Scale (ODSIS; Bentley et al., 2014); Anxiety= Overall Anxiety Severity and Impairment Scale; Panic Symptoms= Panic Disorder Severity Scale(PDSS; Shear et al., 1997).

Table 2.

Total, direct, and indirect effects of perceived stress on depression, anxiety, and panic symptoms via fatigue severity.

Y	Model	b	SE	t	*p*	LLCI	ULCI
1	PSS→Fatigue (a)	0.20	0.01	15.56	<0.001	0.18	0.23
	Fatigue→Depression (b)	1.02	0.07	15.49	<0.001	0.89	1.15
	PSS→Depression (c)	0.36	0.02	15.08	<0.001	0.32	0.41
	PSS→Depression (c')	0.16	0.02	6.51	<0.001	0.11	0.20
	PSS→Depression (ab)	0.21	0.02			0.17	0.25
2	Fatigue→Anxiety (b)	0.85	0.06	13.30	<0.001	0.73	0.98
	PSS→Anxiety (c)	0.39	0.02	17.49	<0.001	0.35	0.44
	PSS→Anxiety (c')	0.22	0.02	9.42	<0.001	0.17	0.27
	PSS→Anxiety (ab)	0.17	0.02			0.14	0.21
3	Fatigue→Panic (b)	0.19	0.01	14.42	<0.001	0.17	0.22
	PSS→Panic (c)	0.06	0.005	13.55	<0.001	0.06	0.07
	PSS→Panic (c')	0.03	0.005	5.30	<0.001	0.02	0.04
	PSS→Panic (ab)	0.04	0.004			0.03	0.05

Note. →= association; a =Association of X with M; b = association of M with Y; c = Total association of X with Y; c' = Direct association of X with Y controlling for M; ab= indirect effects of X on Y; Path a is equal in all models; therefore, it presented only in model 1. LLCI=Lower Level Confidence Interval; ULCI=Upper Level Confidence Interval; Fatigue=Brief Fatigue Inventory (BFI; Mendoza et al., 1999); PSS= Perceived Stress Scale-Modified for COVID-19 (PSS; Cohen et al., 1983); Depression= Overall Depression Severity and Impairment Scale (ODSIS; Bentley et al., 2014); Anxiety= Overall Anxiety Severity and Impairment Scale (OASIS; Norman et al., 2006); Panic= Panic Disorder Severity Scale (PDSS; Shear et al., 1997).