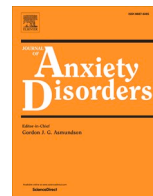




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How does COVID stress vary across the anxiety-related disorders? Assessing factorial invariance and changes in COVID Stress Scale scores during the pandemic

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ABSTRACT

Background: No studies have examined whether levels of COVID stress vary across anxiety-related disorders. Likewise, no studies have assessed structural invariance of the COVID Stress Scales (CSS) across clinical diagnoses. We sought to address these issues in the present study. Given the dynamic nature of pandemics, we also assessed whether COVID stress changed from the first to third wave in those with clinical diagnoses and those with no mental health conditions.

Method: Data were collected during COVID-19 from two independent samples of adults assessed about a year apart (early-mid in 2020, N = 6854; and early-mid 2021, N = 5812) recruited from Canada and the United States through an online survey. Participants provided demographic information, indicated the presence of current (i.e., past-year) anxiety-related or mood disorder, and completed the CSS.

Results: The five CSS were reliable (internally consistent), and the five-factor structure was stable across samples. Scores tended to be highest in people with anxiety-related or mood disorders, particularly panic disorder. As expected, scores fluctuated over time, being higher during the early phases of the pandemic when threat was greatest and lower during the later phases, when vaccines were deployed and the COVID-19 threat was reduced.

Conclusion: The findings add to the growing number of studies supporting the psychometric properties of the CSS. The results encourage further investigations into the utility of the scales, such as their ability to detect treatment-related changes in COVID-19-related distress. The scales also show promise for studies of future pandemics or outbreaks because the CSS can be modified, with minor wording changes, to assess distress associated with all kinds of disease outbreaks.

1. Introduction

Over the course of the COVID-19 pandemic there has been a progressive deterioration in mental health (Center for Disease Control and Prevention, 2021; World Health Organization, 2021). Mental health impacts are related, at least in part, to pandemic mitigation strategies such as lockdown mandates to work from home, and a host of other pandemic-related stressors (Taylor, 2022). COVID stress—measured by the COVID Stress Scales (CSS; Taylor et al., 2020a)—is a cross-cultural construct anchored by danger and contamination fears at its core, with connections to worry over adverse socioeconomic consequences, xenophobia, traumatic stress symptoms, as well as checking and

reassurance seeking (Khosravani, Asmundson, Taylor, Bastan, & Ardestani, 2021; Khosravani, Ardestani, & Bastan, 2021; Milic et al., 2021; Taylor et al., 2020b). COVID stress is also associated with panic buying, excessive avoidance of public places, maladaptive coping attempts, and compliance levels with public health recommendations (Taylor et al., 2020b; Taylor, Paluszek, Rachor, McKay, & Asmundson, 2020).

While many people are resilient to stressors associated with lockdown (Prati & Mancini, 2021) and to COVID stress more generally (Asmundson, Paluszek, & Taylor, 2021), a substantial minority have been significantly affected. Data from population-representative samples have shown that, despite some waxing and waning over the course

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of the COVID-19 pandemic, approximately 40% of the general population in Canada and the United States have reported moderate to severe COVID stress (Taylor et al., 2020b), with an additional 13% reporting severe and disabling COVID stress (Asmundson & Taylor, 2020). There is evidence that COVID-related stressors may more negatively impact people with pre-existing mental health disorders. For example, those with anxiety-related disorders (i.e., anxiety disorders, posttraumatic stress disorder, obsessive-compulsive disorder) have reported greater fears about danger and contamination, socioeconomic consequences, xenophobia, and traumatic stress symptoms than those with a mood disorder or no mental health disorder (Asmundson et al., 2020). Likewise, German adults with an anxiety disorder were found to have significantly higher COVID-related fear levels than those with depressive disorders (Bendau et al., 2021).

Despite the rapidly growing number of studies that have examined the impact of COVID-19 on anxiety-related disorders (Winkler et al., 2020; Wu et al., 2021) and their treatment (Shafran, Rachman, Whittal, Radomsky, & Coughtrey, 2021; Sheu, McKay, & Storch, 2020), no studies have assessed whether the CSS have a stable structure (i.e., structural invariance) regardless of clinical status or whether levels of COVID stress vary across anxiety-related disorders. Such studies are necessary to determine whether the CSS can be applied transdiagnostically and to inform the extent to which we need to focus on modifying disorder-specific treatments as opposed to developing transdiagnostic treatments that target COVID stress.

The purposes of the present study were (1) to evaluate structural invariance of the CSS across clinical status, and (2) to assess the CSS total and scale scores across individuals with specific anxiety-related disorder diagnoses relative to mood disorders and community groups. To accomplish these goals, we conducted a multi-group confirmatory factor analysis (CFA) to assess structural invariance of the CSS and between-group comparisons using data collected towards the end of the third wave of the pandemic in Canada and the United States (i.e., Spring 2021). Given that development of the CSS was based on data early in the pandemic, the unique data from later waves of infection were used for these CFAs. Given the dynamic nature of pandemics (Asmundson & Taylor, 2020; Bendau et al., 2021), a third purpose was to determine whether estimates of COVID stress changed from the first wave early in the pandemic through to the tail end of the third wave. To do so, we conducted a two-sample replication, wherein the aforementioned CSS data collected in Spring 2021 were compared to the data collected at the outset of the pandemic (i.e., early Spring 2020).

2. Method

2.1. Sample and data collection procedures

As part of our ongoing COVID Stress Study, data were collected from Canada and the United States via an online self-report survey delivered in English by Qualtrics, a commercial survey sampling and administration company. This study used data from two independent samples, the first (hereafter Sample 1) collected shortly after the onset of the pandemic (March 21–April 1, 2020) and the second (hereafter Sample 2) collected towards the end of the third wave in North America (March 24–May 4, 2021). The study was approved by the University of Regina Research Ethics Board (2020–043), and all respondents provided informed consent before participation. A comprehensive description of sampling methods used in the COVID Stress Study is provided elsewhere (see Taylor et al., 2020a; Taylor et al., 2020b; Taylor, Rachor, & Asmundson, 2022).

Sample 1 initially comprised 6854 adults aged 18–94 years ($M = 49.8$ years, $SD = 16.2$). Sample 2 included 5812 adults aged 18–92 years ($M = 49.3$ years, $SD = 17.1$). Respondents in both samples self-reported whether they had pre-existing current mental health diagnoses within the past year. If respondents indicated a current mental health diagnosis, they were asked to provide their primary diagnosis. As we have

previously reported (Asmundson et al., 2020), evidence indicates that self-reported diagnoses of mental disorders are an adequate indicator of mental health status (Mawani & Gilmour, 2010; Sanchez-Villegas et al., 2008). Of the 1227 respondents (12.8%) in Sample 1 who reported a current mental health diagnosis, 649 reported a current primary anxiety-related disorder, and 226 reported a current mood disorder. Of the 1411 respondents (19.1%) in Sample 2 who reported a current mental health diagnosis, 657 reported a current primary anxiety-related diagnosis, and 454 reported a current mood disorder. Separation anxiety, agoraphobia, specific phobia, hoarding disorder, and adjustment disorder were not included due to the limited number of participants in each sample reporting these as a primary diagnosis. Random samples of 300 respondents without a mental health condition were drawn from each independent sample to compare to respondents with anxiety-related and mood disorders.

2.2. Measures

Respondents provided demographic information, including their country of residence, age, sex, ethnicity, employment status, educational level, and household income. Participants also responded to several self-report measures, as described below. Respondents in Sample 1 were instructed to respond as they would have before the COVID-19 outbreak, whereas those in Sample 2 received the standard instructions for each self-report measure.

2.2.1. COVID Stress Scales (CSS; Taylor et al., 2020a)

The CSS were developed to measure past-week COVID-related stress. The CSS are comprised of 36 items distributed over five scales: (1) danger and contamination fears (DAN), (2) fears about socioeconomic consequences (SEC), (3) xenophobia (XEN), (4) compulsive checking and reassurance seeking (CHE), and (5) traumatic stress symptoms (TSS). Each scale contains six items, excluding DAN, which has 12 items. Items within DAN, SEC, and XEN are scored on a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). The CHE and TSS items are scored on a 5-point Likert scale ranging from 0 (never) to 4 (almost always). High scores on the CSS indicate greater levels of COVID-related stress. The CSS has demonstrated good-to-excellent internal consistencies (Taylor et al., 2020a) and has been shown to have excellent validity and cross-cultural stability (Abbady et al., 2021; Khosravani & Asmundson, 2021; Milic et al., 2021; Muta et al., 2020; Rajbhandari et al., 2021; Taylor et al., 2020a). For the current study, McDonald's omega ranged from good to excellent in Sample 1 for the individual scales ($\omega = 0.82$ to $\omega = 0.94$) and was excellent for the total score ($\omega = 0.96$). For Sample 2, McDonald's omegas were excellent for the individual scales ($\omega = 0.89$ to $\omega = 0.94$) and the total scale ($\omega = 0.97$).

2.2.2. COVID-19 Disability Scale (CDS; modified from Sheehan et al., 1996)

The CDS is a 3-item measure of functional impairments associated with COVID-related stress in work or school, social life, and leisurely activities in the past week. Items are rated on a 5-point scale ranging from 0 (not at all) to 4 (extremely). The CDS also asks respondents to indicate how many days in the past week they were unable to carry out typical daily responsibilities and have been unproductive due to COVID stress. Higher scores on the CDS indicate greater levels of functional impairment.

2.2.3. Patient Health Questionnaire – 4-Item (PHQ-4; Kroenke, Spitzer, Williams, & Löwe, 2009)

The PHQ-4 measures current anxiety and depression, with four items assessing how often respondents have been bothered by symptoms related to anxiety and depression in the past week. Items are scored on a 4-point Likert scale, ranging from 0 (not at all) to 3 (nearly every day). Current anxiety and depression are each measured using two items, and higher scores on these items indicate greater levels of anxiety or

depression. The PHQ-4 has been validated for clinical and non-clinical samples (Kroenke et al., 2009; Löwe et al., 2010). The PHQ-4 was administered to Sample 1. The PHQ-9 (Kroenke, Spitzer, & Williams, 2001), a measure of depressive symptoms, and the Generalized Anxiety Disorder Scale 7-Item (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006), a measure of anxiety symptoms, were administered to Sample 2. The four items comprising the PHQ-4 that are contained within the PHQ-9 and GAD-7 were scored for Sample 2 for the purposes of this study. McDonald's omega for the PHQ-4 was excellent for the current study in Sample 1 ($\omega = .90$) and Sample 2 ($\omega = .89$).

2.3. Statistical procedures

To assess structural invariance of the CSS across groups (i.e., anxiety-related disorder, mood disorder, no mental health condition), multiple group CFAs were conducted. Given that development of the CSS was based on data from Sample 1, the unique data from Sample 2 were used for these CFAs. CFAs were completed with the *lavaan* package (Rosseel, 2012) in R (R Core Team, 2021) within *Jamovi version 2.2* using 12 items for DAN and 6 items each for SEC, XEN, TSS, and CHE (The Jamovi Project, 2021). Factor loadings were the same across groups, with entry of the same order of items for each scale (see Supplement Figure 1). Goodness-of-fit was determined based on an evaluation of the root-mean-square error of approximation (RMSEA), standardized square residual (SRMR), and comparative fit index (CFI) with reference to empirically informed cut-off values that minimize the potential for error (Hu & Bentler, 1998, 1999). Good fit was determined by $CFI \geq 0.90$, whereas excellent fit was denoted by $RMSEA \leq 0.06$, $SRMR \leq 0.08$, and $CFI \geq 0.95$. Follow-up reliability analyses were conducted with the *psych* package (Revelle, 2019) in R (R Core Team, 2021) within *Jamovi version 2.2* (The Jamovi Project, 2021) to examine McDonald's omega. Reported correlations were assessed for each of the scales (i.e., DAN, SEC, XEN, TSS, and CHE) using Cohen's (1988) indices for effect sizes of small ($r = 0.10$), moderate ($r = .30$), and large ($r = 0.50$).

Differences between groups (i.e., anxiety-related disorder, mood disorder, and no mental health condition) and between specific anxiety-related diagnoses on demographic variables were assessed independently for Samples 1 and 2 using analyses of variance (ANOVA) for continuous variables (i.e., age, PHQ-4) and χ^2 analyses for discrete measures (e.g., ethnicity, employment). ANOVAs were conducted to compare CSS total and scale score means between respondents with mood disorders and no mental health conditions groups and specific anxiety-related diagnoses. As several analyses were conducted, the alpha level was set at .01 instead of .05. This adjustment corrects for inflated Type I error, without excessive inflation of the probability of Type II error with more stringent corrections (e.g., a Bonferroni correction; Frane, 2015).

3. Results

3.1. Sample characteristics and group differences

Details regarding demographic characteristics, PHQ-4 scores, and CDS scores at each time point of data collection are reported in Table 1. Sample 1 ($N = 1175$)¹ was primarily female (60.4%) and White (73.6%), with a mean age of 43.5 years ($SD = 14.7$). Most respondents had completed full or partial college education (75.1%), and most were employed full- or part-time (57.0%). Sample 2 ($N = 1411$) was primarily female (65.1%) and White (68.8%), with a mean age of 44.3 years ($SD = 16.3$). Most respondents had completed full or partial college education

¹ Sample sizes differ from those reported in the Method section, as only those subsamples of individuals reporting anxiety-related or mood disorders were drawn from the broader samples of individuals reporting a current mental health diagnosis.

(78.3%), and most were employed full- or part-time (56.8%).

Among Sample 1, individuals with anxiety-related disorders, mood disorders, and no mental health conditions differed significantly in terms of age ($F(2, 1172) = 35.58, p < .001, \eta^2 = .06$), sex ($X^2(2) = 29.69, p < .001, V = 0.16$), ethnicity, ($X^2(2) = 27.43, p < .001, V = 0.15$), and levels of education ($X^2(2) = 18.02, p < .001, V = 0.12$), but did not significantly differ in terms of employment status ($X^2(2) = 2.31, p = .315, V = 0.25$). Among Sample 2, groups differed significantly in terms of age ($F(2, 1408) = 58.02, p < .001, \eta^2 = .08$), sex ($X^2(2) = 38.26, p < .001, V = 0.17$), and employment status ($X^2(2) = 18.90, p < .001, V = 0.12$), but did not significantly differ in terms of ethnicity, ($X^2(2) = 0.78, p = .677, V = 0.02$), or levels of education ($X^2(2) = 0.46, p = .795, V = 0.02$).

As expected, groups from both Samples 1 and 2 differed significantly in levels of current anxiety ($F(2, 1172) = 65.84, p < .001, \eta^2 = .10$, and $F(2, 1408) = 58.02, p < .001, \eta^2 = .16$, respectively) and depression ($F(2, 1172) = 75.25, p < .001, \eta^2 = .11$, and $F(2, 1408) = 96.34, p < .001, \eta^2 = .12$, respectively) as indicated by PHQ-4 subscale scores. Respondents with anxiety-related and mood disorders reported significantly higher levels of current anxiety than the respondents without a mental health condition, and those with anxiety-related disorders reported significantly greater levels of anxiety than the mood disorder respondents ($ps < 0.001$). Both the anxiety-related and mood disorder groups reported significantly higher levels of depression than those without a mental health condition ($ps < 0.001$), but did not significantly differ from one another. Among Sample 2, both those with anxiety-related and mood disorders, with the exception of obsessive-compulsive disorder, reported significantly higher levels of COVID-19-related functional impairments than those with no mental health conditions ($X^2(2) = 39.96, p < .001, V = 0.17$), but did not significantly differ from one another.

3.2. Confirmatory factor analysis

The CSS 5-factor model (Taylor et al., 2020a) was tested with CFAs across each of the groups using data from Sample 2. In the anxiety-related disorder group, the goodness-of-fit indices indicated good model fit, with $RMSEA = 0.0829$ (90% CI: 0.0801–0.0857), $SRMR = 0.0531$, and $CFI = 0.877$. In the mood disorder group, there was also evidence of good model fit, with $RMSEA = 0.0865$ (90% CI: 0.0831–0.0899), $SRMR = 0.0545$, and $CFI = 0.858$. Finally, the community group demonstrated good to excellent model fit, with $RMSEA = 0.0849$ (90% CI: 0.0805–0.0892), $SRMR = 0.0482$, and $CFI = 0.975$. Unstandardized path coefficients and covariances indicated a factor model that fit well to the data, demonstrating factorial invariance across anxiety-related (Supplement Tables 1 and 2), mood-related (Supplement Table 3 and 4), and no mental health conditions (Supplement Tables 5 and 6) groups.

3.3. Reliability Analysis

Based on the findings of the CFAs, follow-up reliability analyses were performed by summing items of individual scales of the CSS. Table 2 presents McDonald's omegas coefficients for each scale within each group. All scales had excellent reliability for each group.

3.4. ANOVA results

Means and standard deviations for the CSS scale and total scores across the anxiety-related, mood disorder, and no mental health conditions groups in both Samples 1 and 2 are reported in Table 3. Given differences in sample sizes across groups, homogeneity of variance was an important consideration to avoid inflation of Type I error (Tabachnik & Fidell, 2013). To determine whether the assumption of homogeneity was violated, F_{Max} (i.e., the ratio between the variance of the largest and the smallest sample size) was calculated (Tabachnik & Fidell, 2013). F_{Max} values were less than two across all dependent variables; however,

Table 1
Sample characteristics across anxiety-related disorders, mood disorders, and no mental health conditions groups.

Variable	PD	GAD	SAD	OCD	PTSD	Anxiety due to Medical Condition	Mood Disorder	No Condition
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
<i>Time 1</i>	n = 54	n = 357	n = 94	n = 35	n = 76	n = 33	n = 226	n = 300
Age	44.03 (13.70)	40.01 (13.20)	38.63 (12.80)	37.80 (14.55)	43.43 (12.40)	46.64 (13.75)	43.64 (14.45)	49.20 (16.01)
Sex								
Male	20 (37.0%)	103 (28.9%)	41 (43.6%)	15 (42.9%)	26 (34.2%)	17 (51.5%)	85 (37.6%)	158 (52.7%)
Female	34 (63.0%)	254 (71.1%)	53 (56.4%)	20 (57.1%)	50 (65.8%)	16 (48.5%)	141 (62.4%)	142 (47.3%)
Ethnicity								
White	44 (81.5%)	274 (76.8%)	72 (76.6%)	25 (71.4%)	58 (76.3%)	30 (90.9%)	170 (78.7%)	192 (64.0%)
Non-White	9 (16.7%)	72 (20.2%)	21 (22.3%)	9 (25.7%)	17 (22.4%)	3 (9.1%)	46 (21.3%)	108 (36.0%)
Education								
Partial College or Higher	34 (64.2%)	260 (72.8%)	56 (59.6%)	27 (77.1%)	64 (84.2%)	23 (69.7%)	164 (73.5%)	254 (84.7%)
High School or Less	19 (35.8%)	93 (26.1%)	38 (40.4%)	8 (22.9%)	11 (14.5%)	10 (30.3%)	59 (26.5%)	46 (15.3%)
Employment								
Employed	22 (40.7%)	220 (61.6%)	52 (55.3%)	24 (68.6%)	30 (39.5%)	17 (60.7%)	116 (56.3%)	189 (63.0%)
Unemployed	28 (51.9%)	117 (32.8%)	34 (36.2%)	8 (22.9%)	38 (50.0%)	11 (39.3%)	90 (43.7%)	111 (37.0%)
PHQ-Anx	3.52 (2.23)	3.36 (2.05)	3.10 (1.97)	3.57 (2.15)	3.32 (2.20)	3.00 (2.00)	2.71 (2.07)	1.72 (1.80)
PHQ-Dep	3.17 (2.07)	2.72 (2.01)	3.12 (1.98)	3.17 (2.24)	3.20 (2.24)	2.30 (1.93)	2.74 (2.08)	1.22 (1.70)
<i>Time 2</i>	n = 70	n = 289	n = 102	n = 22	n = 148	n = 26	n = 454	n = 300
Age	40.04 (15.17)	39.60 (14.44)	34.74 (12.96)	35.48 (12.66)	44.78 (14.71)	49.31 (16.53)	45.18 (16.43)	51.95 (16.24)
Sex								
Male	21 (30.0%)	62 (21.5%)	41 (39.8%)	10 (43.5%)	44 (29.7%)	12 (46.2%)	154 (33.9%)	148 (49.3%)
Female	49 (70.0%)	226 (78.2%)	61 (59.2%)	13 (56.5%)	104 (70.3%)	14 (53.8%)	300 (66.1%)	152 (50.7%)
Ethnicity								
White	51 (72.9%)	206 (71.3%)	58 (56.3%)	12 (52.2%)	94 (63.5%)	16 (66.7%)	313 (74.2%)	222 (74.0%)
Non-White	14 (20.0%)	59 (20.4%)	37 (35.9%)	10 (43.5%)	43 (29.1%)	8 (33.3%)	109 (25.8%)	78 (26.0%)
Education								
Partial College or Higher	51 (72.9%)	230 (79.6%)	70 (68.0%)	18 (78.3%)	126 (85.1%)	15 (57.7%)	360 (79.6%)	236 (78.7%)
High School or Less	19 (27.1%)	56 (19.4%)	33 (32.0%)	5 (21.7%)	21 (14.2%)	11 (4.3%)	92 (20.4%)	64 (21.3%)
Employment								
Employed	44 (62.9%)	190 (65.7%)	69 (67.0%)	16 (69.6%)	78 (52.7%)	12 (48.0%)	229 (51.2%)	164 (54.7%)
Unemployed	25 (35.7%)	93 (32.2%)	32 (31.1%)	6 (26.1%)	64 (43.2%)	13 (52.0%)	218 (48.8%)	136 (45.3%)
PHQ-Anx	3.61 (2.02)	3.01 (1.97)	3.25 (1.86)	3.13 (1.98)	3.18 (1.94)	3.31 (1.85)	2.46 (1.93)	1.04 (1.40)
PHQ-Dep	2.94 (1.98)	2.30 (1.89)	3.12 (1.95)	2.52 (1.81)	3.06 (1.98)	3.00 (1.70)	2.93 (2.02)	1.10 (1.51)
CDS								
Not Disabled	33 (47.1%)	184 (63.7%)	62 (60.8%)	14 (63.6%)	81 (54.7%)	13 (50.0%)	276 (60.8%)	238 (79.3%)
Disabled	37 (52.9%)	105 (36.3%)	40 (39.2%)	8 (36.4%)	67 (45.3%)	13 (50.0%)	178 (39.2%)	62 (20.7%)

Note. PHQ-Anx = Patient Health Questionnaire-4-Item – Anxiety Scale; PHQ-Dep = Patient Health Questionnaire 4-Item – Depression Scale; CDS = COVID-19 Disability Scale; PD = panic disorder; GAD = generalized anxiety disorder; SAD = social anxiety disorder; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder.

Table 2
Reliability (internal consistency): McDonald’s omega.

COVID Stress Scales	Anxiety-Related Disorders	Mood-Related Disorders	No Condition
COVID Danger and Contamination	0.945	0.940	0.947
COVID Socioeconomic Consequences	0.946	0.931	0.953
COVID Xenophobia	0.941	0.943	0.943
COVID Traumatic Stress	0.942	0.926	0.933
COVID Compulsive Checking	0.893	0.884	0.903

Note. McDonald’s omegas are only for Sample 2 groupings.

the larger variance was associated with the smaller sample size, partially violating assumptions. The use of a more stringent alpha of .01 in the current study corrects for and minimizes the impact of a lack of homogeneity of variance (Tabachnick & Fidell, 2013).

Across both Samples 1 and 2, all models including CSS total and scale scores were statistically significant ($ps < 0.01$). Post-hoc tests determined that within both samples, the panic disorder group reported significantly higher overall COVID stress, as indicated by CSS total scores, than those in the mood disorder ($M_{diff} = 16.70$, 99% CI = [0.37,

33.03], $p = .007$, and $M_{diff} = 16.75$, 99% CI = [3.56, 29.93], $p < .001$, respectively) and no mental health conditions ($M_{diff} = 22.02$, 99% CI = [6.08, 37.96], $p < .001$, and $M_{diff} = 16.27$, 99% CI = [2.65, 29.89], $p = .001$, respectively) groups, while the only other significant difference identified was among Sample 2, where those with panic disorder reported significantly higher overall levels of COVID stress than those with generalized anxiety disorder ($M_{diff} = 14.34$, 99% CI = [0.67, 28.01], $p = .005$). Significant differences across groups on DAN included those with panic disorder reporting greater DAN than those with no mental health conditions in Samples 1 and 2 ($M_{diff} = 6.42$, 99% CI = [0.09, 12.75], $p = .008$, and $M_{diff} = 5.97$, 99% CI = [0.28, 11.68], $p < .005$, respectively) and greater DAN than the mood disorder group in Sample 2, but not Sample 1 ($M_{diff} = 5.79$, 99% CI = [0.28, 11.31], $p = .005$, and $M_{diff} = 4.40$, 99% CI = [-2.09, 10.89], $p < .351$, respectively). Additionally, those in with generalized anxiety disorder reported greater DAN than those with no mental health conditions in Sample 1 ($M_{diff} = 3.61$, 99% CI = [0.25, 6.96], $p = .003$), but not Sample 2, and those with social anxiety disorder reported greater DAN those with no mental health conditions in Sample 1 ($M_{diff} = 5.19$, 99% CI = [0.13, 10.26], $p = .007$), but not Sample 2. The only significant difference that emerged in relation to SEC was that the panic disorder group reported significantly higher scores than those with no mental health conditions in Sample 1 ($M_{diff} = 4.46$, 99% CI = [1.04, 7.88], $p < .001$), but not Sample 2. The panic disorder group also reported significantly higher XEN scores than

Table 3

CSS total and scale scores across anxiety-related disorders, mood disorders, and no mental health condition groups.

Variable	PD M (SD)	GAD M (SD)	SAD M (SD)	OCD M (SD)	PTSD M (SD)	Anxiety due to Medical Condition M (SD)	Mood Disorder M (SD)	No Condition M (SD)
Time 1								
DAN	24.52 (14.43)	21.71 (11.91)	23.30 (12.97)	24.91 (13.11)	23.25 (12.40)	20.84 (12.30)	20.11 (11.77)	18.10 (11.07)
SEC	11.87 (7.71)	9.07 (6.28)	10.04 (6.80)	10.71 (7.02)	10.28 (6.70)	10.52 (7.04)	8.67 (6.55)	7.41 (6.07)
XEN	9.63 (8.26)	6.13 (6.04)	8.55 (7.62)	8.63 (7.91)	7.08 (7.26)	8.61 (7.64)	5.93 (6.61)	6.28 (6.31)
CHE	8.76 (6.47)	7.82 (5.21)	7.85 (6.16)	7.63 (5.98)	8.42 (4.72)	8.03 (5.26)	7.00 (5.58)	6.16 (4.89)
TSS	9.17 (7.62)	6.84 (6.27)	6.70 (7.19)	7.57 (6.48)	7.88 (6.98)	5.33 (5.19)	5.53 (6.26)	3.97 (5.18)
CSS-Total	63.94 (38.51)	51.57 (28.58)	56.45 (34.42)	59.46 (34.18)	56.91 (29.98)	53.33 (30.78)	47.25 (30.63)	41.92 (27.78)
Time 2								
DAN	22.11 (14.13)	17.60 (11.79)	19.17 (12.10)	19.04 (12.25)	19.53 (13.06)	20.12 (14.91)	16.32 (11.20)	16.14 (12.02)
SEC	7.69 (8.25)	4.79 (5.90)	6.24 (7.52)	5.91 (6.71)	6.19 (6.69)	8.23 (8.19)	4.80 (5.78)	4.92 (6.39)
XEN	7.07 (8.00)	4.27 (5.74)	5.55 (6.68)	6.13 (7.69)	5.62 (7.07)	5.85 (6.55)	4.39 (6.07)	6.06 (6.78)
CHE	6.70 (6.31)	4.81 (4.97)	6.02 (6.32)	7.96 (6.53)	5.80 (5.92)	6.69 (7.39)	4.41 (5.16)	4.40 (5.39)
TSS	6.87 (6.66)	4.75 (5.33)	5.18 (6.60)	4.74 (5.93)	5.45 (5.90)	5.50 (6.69)	4.06 (5.02)	2.76 (4.43)
CSS-Total	50.55 (36.86)	36.21 (25.76)	42.17 (32.58)	43.78 (30.19)	42.60 (29.96)	46.38 (37.26)	33.81 (26.52)	34.28 (28.51)

Note. DAN = COVID Stress Scales – Danger and Contamination Fears; SEC = COVID Stress Scales – Fears About Socioeconomic Consequences; XEN = COVID Stress Scales – Xenophobia; CHE = COVID Stress Scales – Compulsive Checking and Reassurance Seeking; TSS = COVID Stress Scales – Traumatic Stress Symptoms; CSS-Total = COVID Stress Scales – Total Score; PD = panic disorder; GAD = generalized anxiety disorder; SAD = social anxiety disorder; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder.

those with in the generalized anxiety disorder ($M_{diff} = 3.50$, 99% CI = [0.02, 6.98], $p = .009$) and mood disorder ($M_{diff} = 3.70$, 99% CI = [0.09, 7.31], $p = .007$) groups in Sample 1, but not Sample 2.

In relation to TSS scores, the panic disorder group reported significantly higher scores than those in the mood disorder ($M_{diff} = 3.64$, 99% CI = [0.28, 6.99], $p = .003$, and $M_{diff} = 2.81$, 99% CI = [0.36, 5.26], $p = .001$, respectively), and no mental health conditions ($M_{diff} = 5.19$, 99% CI = [1.92, 8.47], $p < .001$, and $M_{diff} = 4.11$, 99% CI = [1.58, 6.65], $p < .001$, respectively) groups in both Samples 1 and 2. Additionally, those in the generalized anxiety disorder ($M_{diff} = 2.87$, 99% CI = [1.13, 4.60], $p < .001$, $M_{diff} = 1.99$, 99% CI = [0.41, 3.56], $p < .001$, respectively), social anxiety disorder ($M_{diff} = 2.73$, 99% CI = [0.11, 5.35], $p = .006$, $M_{diff} = 2.48$, 99% CI = [0.29, 4.66], $p = .002$, respectively), and post-traumatic stress disorder ($M_{diff} = 3.91$, 99% CI = [1.06, 6.75], $p < .001$, $M_{diff} = 2.69$, 99% CI = [0.78, 4.61], $p < .001$, respectively) groups reported greater TSS than the no mental health conditions group in both Samples 1 and 2. The only significant difference identified in relation to CHE was that those in the generalized anxiety disorder group reported greater CHE than the no mental health conditions group in Sample 1 ($M_{diff} = 1.67$, 99% CI = [0.17, 3.17], $p = .002$), but not Sample 2.

4. Discussion

The current study was designed to determine whether the CSS have a consistent structure across clinical diagnoses, as well as to compare CSS total and scale scores across the anxiety-related disorders and relative to those with mood disorders or no mental health conditions. Results of CFA indicated that the 5-factor CSS model assessing DAN, SEC, XEN, TSS, and CHE had good to excellent fit to the data from Sample 2. Multiple CFAs illustrated stability of the CSS across anxiety-related disorder, mood disorder, and community groups. Excellent reliability was also observed across the CSS.

Individuals with anxiety-related or mood disorders reported greater levels of anxiety and depression over the course of the pandemic in comparison to those with no mental health conditions. COVID stress did not generally differ across the specific anxiety-related diagnoses and the mood disorder groups, although some significant differences were identified. Those with anxiety-related disorders reported greater COVID stress than those with no mental health conditions on various facets of the CSS; however, this finding was more consistent in Sample 1 (i.e., during earlier waves of the pandemic), suggesting that COVID stress responses may have stabilized in those with anxiety-related disorders as the pandemic progressed. Early in the pandemic, individuals with panic disorder experienced greater levels of overall COVID stress and TSS in

comparison to those with a mood disorder and with no mental health conditions as well as higher SEC compared to those with no mental health condition and higher XEN compared to those with a mood disorder. Over the course of the pandemic, those with panic disorder continued to report greater levels of overall COVID stress and TSS relative to the other groups as well as higher DAN compared to those with a mood disorder. Several other significant between group differences also emerged for TSS; specifically, individuals with generalized anxiety disorder, social anxiety disorder, and posttraumatic stress disorder reported greater levels of TSS in comparison to those with no mental health conditions in both Samples 1 and 2.

An important difference identified from Samples 1 to 2 (i.e., earlier to later in the pandemic) was that the the higher CSS total and scale scores observed in those with specific anxiety-related disorders, with some notable exceptions, diminished to some degree over time. This suggests that CSS total and scale scores may have become more comparable across anxiety-related disorders to those with no mental health conditions in later waves of the pandemic. However, elevated scores on TSS across anxiety-related disorders were observed at both time periods, suggesting that traumatic stress responses may have remained elevated, particularly in those with generalized anxiety disorder, social anxiety disorder, and posttraumatic stress disorder.

Limitations of the current study include reliance on a two-sample replication (i.e., cross-sectional data), self-report measures, and unmeasured comorbidities. Cross-sectional data were collected on two independent samples at two time points over the course of the pandemic and, as such, the groups differed in a number of ways beyond experiencing COVID-19 at different points in time. Also, as in our previous study (Asmundson et al., 2020), diagnostic status relied on self-report; however, this method been shown to sufficiently reflect diagnosis (Mawani & Gilmour, 2010; Sanchez-Villegas et al., 2008).

4.1. Conclusion

The CSS is a brief, multi-faceted assessment of COVID-19-related distress. The present study adds to the growing body of research supporting the psychometric properties of the CSS. Scores fluctuated over the course of the pandemic, being higher in the early phases (early-mid 2020) and lower in later phases (early-mid 2021) when vaccines were deployed, less severe variants of the SARS-CoV-2 coronavirus were predominant, and the COVID-19 threat was reduced. The fluctuation in CSS scores is expected given that COVID-19-related distress is conceptualized as an adjustment reaction to pandemic-related stressors (Taylor, 2022). Scores tended to be highest in people with panic disorder, which

is not surprising given that health anxiety (i.e., fear of dying during panic attacks) is a cardinal feature of the disorder. Additionally, people with generalized anxiety disorder, social anxiety disorder, and post-traumatic stress disorder reported greater TSS throughout the pandemic. Further research is needed to determine whether the scales are sensitive to treatment effects, such as cognitive-behavioral therapies used to treat COVID-19-related distress. The CSS was designed so that it can be readily adapted to other pandemics or disease outbreaks, with minor wording substitutions (e.g., replacing “coronavirus” with “Zika virus”). The merits of the CSS in other pandemics or disease outbreaks remains to be investigated. Such work is important in determining how pandemic-related distress varies across a range of variables, including disease characteristics, emotional disorders, and pandemic mitigation strategies such as vaccination and social distancing.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.janxdis.2022.102554](https://doi.org/10.1016/j.janxdis.2022.102554).

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