

RESEARCH ARTICLE

Psychometric properties of a brief version of the COVID-19 Stress Scales (CSS-B) in young adult undergraduates

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Abstract

We extracted items to create a brief version of the COVID-19 Stress Scale (i.e., CSS-B) and examined its psychometric properties in young adults. A sample of 1318 first- and second-year undergraduates from five Canadian universities (mean [SD] age = 19.27 [1.35] years; 77.6% women) completed an online cross-sectional survey that included the CSS-B as well as validated measures of anxiety and depression. The 18-item CSS-B fit well on both a 5-factor and a hierarchical model indicating that the five CSS-B dimensions may be factors of the same over-arching construct. The CSS-B factor structure displayed lower-order and higher-order configural and metric invariance across sites but not scalar invariance indicating that the intercepts/means were not consistent across sites. The CSS dimensions were positively related to measures of general anxiety and depression but not so strongly as to indicate that they are measuring the same construct. The CSS-B scale is a valid measure of COVID-19 stress among young adults. It is recommended that this shorter version of the scale be considered for use in longer surveys to avoid participant fatigue.

KEYWORDS

anxiety, coronavirus, COVID-19, fear, mental well-being, pandemic, psychometrics, reliability, stress, validity

1 | INTRODUCTION

The COVID-19 pandemic environment, including social distancing and lockdown, have widely and negatively impacted mental health (Ahmed et al., 2020; Tang et al., 2020; Zajacova et al., 2020). A systematic review found that the prevalence of symptoms of anxiety, depression, post-traumatic stress disorder (PTSD), psychological distress, and stress increased during the COVID-19 pandemic in multiple countries (Xiong et al., 2020). During the COVID-19 pandemic, various measures have been rapidly developed in attempts to measure the specific impact of the pandemic on anxiety, stress, and fear (e.g., CAS; Lee, 2020; C-19ASS; Nikčević & Spada, 2020).

The COVID-19 Stress Scales (CSS; Taylor et al., 2020b) is one such measure that was originally developed using a general sample of

adults from Canada and the USA (initial EFA done with the Canadian sample and CFA with the American sample; Taylor et al., 2020b). The CSS measures the multidimensional construct of COVID-19-related distress or COVID Stress Syndrome (Taylor et al., 2021). The five COVID Stress Syndrome dimensions are: (1) COVID danger and contamination fears (i.e., fear of contracting the virus), (2) COVID fears about economic consequences (e.g., supply chain disruptions), (3) COVID xenophobia (i.e., fear that the virus is being spread by 'foreigners'), (4) COVID compulsive checking and reassurance seeking (e.g., seeing information on the pandemic online), and (5) COVID traumatic stress symptoms (including intrusive thoughts and nightmares; Taylor et al., 2021). The measure contains 36 items that map onto the COVID Stress Syndrome's five dimensions (Taylor et al., 2020b). The five factor structure demonstrated acceptable fit

and each subscale showed good internal consistency (i.e., Cronbach's $\alpha > 0.80$; Taylor et al., 2020b). The five dimensions are all positively correlated with one another with relatively strong correlations (i.e., 0.41–0.73; Taylor et al., 2020b). As such, Taylor et al. (2020a) deemed a total sum score of the entire scale as a useful measure of overall pandemic-related distress in addition to the specific subscale scores.

The CSS has since been translated into at least three languages (i.e., Arabic; Abbady et al., 2021; Mahamid et al., 2021; Persian; Khosravani et al., 2021; Turkish; Demirgöz Bal et al., 2021). The scale's original 5-factor structure has been shown to hold in a general sample of Palestinian adults with a narrower age range than the original scale development sample (Mahamid et al., 2021), a Persian sample with anxiety disorders and obsessive-compulsive disorders (Khosravani et al., 2021), and Egyptian and Saudi university students (17–36 years old; Abbady et al., 2021).

Research to date has shown that the CSS dimensions are positively related to general anxiety, depression, and stress/distress (Khosravani et al., 2021; Mahamid et al., 2021; Taylor et al., 2020b). The CSS dimensions were also positively related to other COVID-19 distress measures, specifically Ahorsu et al.'s (2020) Fear of Coronavirus-19 Scale (FCV-19S; Khosravani et al., 2021; Mahamid et al., 2021) and Arpacı et al.'s (2020) COVID-19 Phobia Scale (C19P-S; Khosravani et al., 2021). Total CSS scores have been linked to negative thoughts and emotions during social isolation (e.g., stressed, bored, sad, lonely) and coping behaviours during social isolation (e.g., online shopping, increased eating, increased alcohol consumption, seeking medical help online; Taylor et al., 2020a). Taylor et al. (2020b) also found that CSS dimensions were positively linked to retrospective ratings of obsessive-compulsive checking and contamination symptoms pre-pandemic. Similarly, Khosravani et al. (2021) found that the CSS was related to measures of obsessive-compulsive disorder (OCD) symptoms and anxiety disorder symptoms in a sample of those with OCD or anxiety disorders.

Young adults have experienced considerable stressors since the onset of the pandemic including disruptions to education and employment opportunities, as well as key rites of passage, such as graduation. In fact, COVID stress (as measured via overall CSS) positively predicted future career anxiety in a sample of final year college students (Rahmadani & Sahrani, 2021). Many mental health issues onset during young adulthood (e.g., depression; Klein et al., 2013) and the pandemic has enhanced this vulnerability (Lopez-Nunez et al., 2021; Qian & Yahara, 2020). A review of risk factors for psychological symptoms during the pandemic revealed that young adulthood and student status were two important risks (Xiong et al., 2020). As a result, assessing COVID-19 related distress among this group is particularly important.

While the 36-item CSS is clearly a psychometrically sound measure that contains appropriate coverage of the various domains of distress involved in the conceptualization of the COVID Stress Syndrome, it does have one important disadvantage. Specifically, its relatively long length makes it unfeasible for use in shorter surveys. If a shorter version could be developed that continued to tap the five main domains of the COVID Stress Syndrome in young adult

undergraduates, it could be readily incorporated into university student surveys. This would allow for tracking of the reduction or maintenance of students' pandemic-related distress over time, and permit comparison of distress levels across institutions in regions with differing infection rates and restrictiveness of containment strategies.

We developed a brief version of the original CSS ("the Brief CSS" or "CSS-B") and then examined its psychometric properties (structural validity, internal consistency, convergent validity in terms of its association with general mental health measures) in a multi-site sample of young adult university students. As Taylor et al. (2020a) stated that a total sum score could be used for the full scale, a lower-order and higher-order (hierarchical) model will be tested. Further, given the considerable variability in infection rates and public health protocols across provinces and municipalities, we also assessed whether the CSS psychometric properties hold across five Canadian post-secondary institutions.

2 | METHOD

2.1 | Participants

One thousand three hundred and 18 participants from five Canadian universities completed an online cross-sectional survey. Sites 1 and 2 are located in Nova Scotia. Site 3 is in Ontario, Site 4 in British Columbia, and Site 5 in Quebec. All study sites are in major cities except for Site 2. The majority of participants were female (79.4%), while 20.5% were male (0.2% did not respond). Similarly, the majority of participants identified as a woman (77.6%), while 20.1% identified as a man, 0.2% as trans, 1.5% as non-binary, and 0.3% as other (0.3% did not respond). They were recruited through multiple means including direct email, social media advertisements, and through the SONA participant recruitment system. Data was collected between February and April 2021. It was required that participants be in either their first or second year of undergraduate study and be 18–25 years of age. Participants were compensated with either bonus points towards one of their psychology courses or through Amazon gift cards. Participation was entirely voluntary and was not a requirement for any course or programme of study. Participants' mean age was 19.27 years ($SD = 1.35$). The majority of participants were full-time students (86.5%) and White (66.9%). There was an approximately even split between first (53.4%) and second (46.6%) year of study. Participants were in various programs of study including science (32.2%), arts (20.8%), and business/commerce (10.1%).

2.2 | Measures and procedure

Following informed consent, participants answered questions related to their general mental well-being, behaviours and experiences during the COVID-19 pandemic, and demographic questions. Research Ethics Board (REB) approval was received from each university study site.

Distress during the pandemic (in the last 30 days) was measured using 18 of the 36 items from the COVID-19 Stress Scales (CSS; Taylor et al., 2020b). The CSS measured five factors: (1) COVID danger and contamination fears, (2) COVID fears about economic consequences, (3) COVID xenophobia, (4) COVID compulsive checking and reassurance seeking, and (5) COVID traumatic stress symptoms. Participants were asked to report about the various kinds of worries they experienced related to COVID-19 since returning to class in the winter term. The full scale uses 6 items per factor (except for COVID danger and contamination fears which has 12 items) while the current study used the top 3 items (6 for COVID danger and contamination fears) that showed the strongest loadings on each factor in the Taylor et al. (2020b) factor analytic solution of the original CSS. For details on what items were used, see CFA factor loadings in Table 2. As with the original CSS, response options ranged from 0 (not at all) to 4 (extremely).

Participants' general mental well-being was assessed through two measures: the 7-item Generalized Anxiety Disorder scale (GAD-7; Spitzer et al., 2007) and the 9-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). The GAD measures (generalized) anxiety while the PHQ measures depression. Participants were asked to rate how often they were bothered by each of the symptoms in the last 30 days on a scale from 1 (not at all) to 4 (nearly every day). Items were summed to yield total scores for the GAD and PHQ. The current study yielded Cronbach's alphas of 0.90 for the GAD and 0.89 for the PHQ.

3 | RESULTS

3.1 | CSS-B reliability

The current study yielded acceptable to good Cronbach's alphas of 0.88 (danger/contamination fears), 0.89 (economic fears), 0.79 (xenophobia), 0.77 (checking/reassurance seeking), and 0.88 (traumatic stress symptoms), for each of the five subscales. The overall CSS scale yielded a Cronbach's alpha of 0.90.

3.1.1 | Confirmatory factor analysis

Confirmatory factor analysis (CFA) was conducted to confirm the scale's factor structure. All model tests were based on the covariance matrix and used ML estimation as implemented in Mplus 7.4. A 1-factor model (i.e., all 18 items loading on a single factor), 5-factor model (i.e., COVID danger and contamination fears, COVID fears about economic consequences, COVID xenophobia, COVID compulsive checking and reassurance seeking, and COVID traumatic stress symptoms), and a hierarchical model (i.e., items loading onto 5 factors which then all load onto one higher order factor) were tested. Comparative fit index (CFI) and Tucker-Lewis index (TLI) values greater than 0.95 are considered good fit to the data (Hu &

Bentler, 1999) and 0.90 indicates adequate model fit. The recommended cutoffs for the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR) should be less than 0.08 (Kelloway, 2015). Chi-squared and degrees of freedom are reported but comparative model fit were made using the difference in other fit indices as chi-squared difference test are impacted by large sample sizes where even small differences can become significant (Alavi et al., 2020; Putnick & Bornstein, 2016). As such, the criteria used for determining differences in model fit will be as follows: models will be deemed significantly different if $\Delta CFI > 0.01$, $\Delta RMSEA > 0.015$, and $\Delta SRMR > 0.03$ (Putnick & Bornstein, 2016).

The fit indices for the CSS-B suggested that the model with the best fit is the 5-factor or hierarchical model (see Table 1). The 5-factor model fit substantially better than the 1-factor model ($\chi^2_{difference}(10) = 4561.93$, $p < 0.001$; $\Delta CFI = 0.352$; $\Delta RMSEA = 0.101$; $\Delta SRMR = 0.056$). Similarly, the hierarchical model fit substantially better than the 1-factor model ($\chi^2_{difference}(10) = 4506.39$, $p < 0.001$; $\Delta CFI = 0.348$; $\Delta RMSEA = 0.10$; $\Delta SRMR = 0.051$). However, the fit for the 5-factor model and hierarchical model were not significantly different ($\Delta CFI = 0.002$; $\Delta RMSEA = 0.001$; $\Delta SRMR = 0.005$). Both the 5-factor and hierarchical models provided adequate model fit. The CFI and TLI are both above 0.90. The RMSEA and SRMR were both less than 0.08. While model fit is slightly higher for the more parsimonious 5-factor model, invariance testing (below) was done on the hierarchical model as Taylor et al. (2020a) reported that a total sum score was accepted. All factor loadings for the hierarchical model were greater than 0.50 (see Table 2).

3.1.2 | Group invariance

As data were collected across Canadian universities in multiple provinces, CSS scores may have differed across groups. Table 3 provides the means and standard deviations across sites. Measurement invariance tests were conducted across sites using Mplus 7.4 (MLR estimation) following Rudnev et al. (2018). The invariance models were conducted in the following order: configural invariance, metric invariance of the first order (or lower-order) factors, metric invariance of the first- and second-order factors (i.e., lower and higher-order), and scalar invariance of the first order factors and scalar invariance of the first- and second-order factors. Invariance was determined by comparing changes in the comparative fit index (CFI) between successive models. A change of less than or equal to 0.01 is considered evidence of invariance (Zimprich et al., 2012). Note that if the CFI was greater than 0.01 and the model did not show invariance, the subsequent model was not conducted. As a confirmation, changes in RMSEA and SRMR were also examined using the thresholds as used in the ΔCFA (i.e., $\Delta RMSEA < 0.015$, and $\Delta SRMR < 0.03$ as evidence for invariance; Putnick & Bornstein, 2016).

As shown in Table 4, the configural invariance by site model provided an adequate fit to the data indicating that the factor

structure fit well for all five sites. The first order metric model did not fit better than the configural model ($\Delta RMSEA = 0.003$; $\Delta SRMR = 0.005$), demonstrating metric invariance by site at the first order. Similarly, the higher-order metric model did not fit better than the first order metric model ($\Delta RMSEA = 0.000$; $\Delta SRMR = 0.011$), demonstrating metric invariance by site at the higher order. The first-order scalar model fit worse than the higher-order metric model ($\Delta RMSEA = 0.015$; $\Delta SRMR = 0.128$), indicating that the scale's intercepts are not invariant (i.e., not the same) across sites.

TABLE 1 COVID-19 Stress Scales (CSS) CFA model comparisons

Model	χ^2	df	CFI	TLI	RMSEA	SRMR
1 factor	5587.82	135	0.578	0.523	0.175	0.108
5 factors	1025.89	125	0.930	0.915	0.074	0.052
Hierarchical	1081.43	130	0.926	0.913	0.075	0.057

Note: $N = 1317$.

Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker-Lewis index.

3.1.3 | Group differences

A MANOVA was conducted to determine if there were significant group differences in CSS dimensions by site. There was a significant multivariate main effect for study site on CSS dimensions ($F(20, 4339) = 11.11, p < 0.001, \eta^2 = 0.04$). In fact, the main effect of study site was significant for all five dimensions: COVID danger and contamination fears ($F(4, 1312) = 27.42, p < 0.001, \eta^2 = 0.08$), COVID fears about economic consequences ($F(4, 1312) = 19.54, p < 0.001, \eta^2 = 0.06$), COVID xenophobia ($F(4, 1312) = 15.02, p < 0.001, \eta^2 = 0.04$), COVID compulsive checking and reassurance seeking ($F(4, 1312) = 4.39, p < 0.01, \eta^2 = 0.01$), and COVID traumatic stress symptoms ($F(4, 1312) = 11.83, p < 0.001, \eta^2 = 0.04$).

Tukey's HSD post hoc tests were conducted to examine individual site differences. Danger and contamination fears were higher in Site 3 than any other site ($S1 SE = 0.08, p < 0.001$; $S2 SE = 0.08, p < 0.001$; $S4 SE = 0.09, p < 0.001$; $S5 SE = 0.11, p < 0.01$). Danger and contamination fears were lower in Site 2 than any other site ($S1 SE = 0.07, p < 0.001$; $S3 SE = 0.08, p < 0.001$; $S4 SE = 0.08, p < 0.01$; $S5 SE = 0.10, p < 0.001$). Economic fears were higher in Site 3 than any other site ($S1 SE = 0.07, p < 0.001$; $S2 SE = 0.07, p < 0.001$; $S4$

TABLE 2 Confirmatory factor analysis factor loadings of the CSS hierarchical model

Items	Factor				
	1	2	3	4	5
1. I am worried about catching the virus	0.74				
2. I am worried that I can't keep my family safe from the virus	0.65				
3. I am worried that our healthcare system won't be able to protect my loved ones	0.57				
19. I am worried that if I touched something in a public space (e.g., a handrail or door handle), I would catch the virus	0.82				
20. I am worried that if someone coughed or sneezed on me, I would catch the virus	0.78				
21. I am worried that people around me will infect me with the virus	0.86				
7. I am worried about grocery stores running out of food		0.88			
8. I am worried that grocery stores will close down		0.89			
9. I am worried about grocery stores running out of cleaning or disinfectant supplies		0.80			
13. I am worried that foreigners are spreading the virus in my country			0.76		
14. If I went to a restaurant that specialized in foreign foods, I would be worried about catching the virus			0.66		
15. I am worried about coming into contact with foreigners because they might have the virus			0.87		
25. I had trouble concentrating because I kept thinking about the virus				0.77	
26. Disturbing mental images about the virus popped into my head against my will				0.74	
27. I had trouble sleeping because I worried about the virus				0.68	
31. I searched the internet for treatments for COVID-19					0.83
32. I watched YouTube videos about COVID-19					0.85
33. I asked health professionals (e.g., doctors, pharmacists) for advice about COVID-19					0.86
Factors on overall CSS hierarchical	0.69	0.67	0.53	0.71	0.81

Note: $N = 1317$. For full CSS with all 36 items see Taylor et al. (2020b).

TABLE 3 Means and standard deviations by site

N	Site 1 320		Site 2 395		Site 3 229		Site 4 246		Site 5 127	
	M	SD	M	SD	M	SD	M	SD	M	SD
Total CSS	16.21	10.73	13.93	10.30	23.27	14.61	17.05	11.26	16.50	10.05
COVID danger and contamination fears	10.51	5.65	8.55	5.46	13.51	6.59	10.22	5.62	11.08	5.65
COVID fears about economic consequences	1.24	2.01	1.20	2.12	2.64	3.23	1.61	2.58	0.66	1.80
COVID xenophobia	1.15	1.94	1.24	1.93	2.31	3.34	1.82	2.36	2.47	2.58
COVID compulsive checking and reassurance seeking	2.26	2.83	1.98	2.50	2.72	3.01	2.36	2.72	1.65	2.19
COVID traumatic stress symptoms	1.05	2.21	0.97	2.00	2.10	3.18	1.04	2.22	0.64	1.34

Note: 0–4 scale, 18 items, 3 items per factor except COVID danger and contamination fears which has 6 items.

TABLE 4 COVID-19 Stress Scales - Brief (CSS-B) measurement invariance by site

Model	Compared model	χ^2	df	CFI	Δ CFI	TLI	RMSEA	SRMR
Configural invariance	--	1460.22	650	0.91	--	0.90	0.07	0.07
Metric invariance of the first order factors	Config.	1505.72	702	0.91	0.001	0.91	0.07	0.07
Metric invariance of the first- and second-order factors	Metric 1	1531.28	718	0.91	0.001	0.91	0.07	0.08
Scalar invariance of the first order factors	Metric 2	2130.78	775	0.85	0.059	0.86	0.08	0.21

Note: $N = 1317$.

Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker-Lewis index.

$SE = 0.07, p < 0.001$; $S5 SE = 0.09, p < 0.001$). Additionally, economic fears were higher in Site 4 than Site 5 ($SE = 0.09, p < 0.01$). COVID-related xenophobia was lower in Site 1 than most other sites ($S3 SE = 0.07, p < 0.001$; $S4 SE = 0.07, p < 0.01$; $S5 SE = 0.08, p < 0.001$) and in Site 2 than most other sites ($S3 SE = 0.07, p < 0.001$; $S4 SE = 0.06, p < 0.05$; $S5 SE = 0.08, p < 0.001$). Compulsive checking and reassurance seeking was higher in Site 3 than in Site 2 ($SE = 0.07, p < 0.01$) and Site 5 ($SE = 0.10, p < 0.01$). COVID traumatic stress symptoms were higher in Site 3 than any other site ($S1 SE = 0.07, p < 0.001$; $S2 SE = 0.06, p < 0.001$; $S4 SE = 0.07, p < 0.001$; $S5 SE = 0.09, p < 0.001$).

3.2 | CSS-B validity

As shown in Table 5, all five CSS dimensions are positively correlated with one another and with both measures of general anxiety and depression. Disattenuated correlations are a way to control for measurement error and are calculated using the raw Pearson correlation coefficients divided by the square root of the product of the scales' Cronbach's alphas (Hancock, 1997; Kenny, 2011). Even after controlling for measurement error, the correlations between CSS, anxiety, and depression show that these three constructs are related but different. Additionally, the disattenuated correlation between COVID danger and contamination fears and the total CSS sum score is almost 1.0 and is higher than the correlation between the total score and any of the other dimensions. This indicates that this dimension appears to contribute to the total score more than the

other dimensions. This makes sense as this dimension contains more items and, in this sample, has a higher mean than the other dimensions.

4 | DISCUSSION

The current study found that the five dimensions of the brief CSS fit adequately on a higher-order model. This is consistent with Taylor et al.'s (2020a) decision to assess the full CSS scale as a total score. Furthermore, our fit indices are similar to Taylor et al.'s (2020b) original CFA 5-factor lower-order findings (i.e., $RMSEA = 0.05$, $SRMR = 0.04$, $CFI = 0.93$ in their US sample).

While reported CSS dimensions may have differed across university sites, the measure's structure held across sites. Specifically, the scale had metric invariance at the higher order, but did not have scalar invariance. This indicates that factor loadings held across sites but the intercepts (or factor means) did not. This is likely due to the differences in the amount of COVID-19 cases in the provinces/cities of the university sites. Infection rates by province during the time of data collection (i.e., between February and April 2021) were highest in Ontario (number of cases = 270,180–520,774) and Quebec (263,473–366,394), lowest in Nova Scotia (1581–2427) and mid-level in British Columbia (67,937–141,729; Public Health Agency of Canada, n.d.). Consistent with infection rates, Site 2 (located in Nova Scotia, along with Site 1, though in a less populated city than Site 1) participants reported lower danger and contamination fears and COVID-related xenophobia than sites in other provinces. In a similar

TABLE 5 Correlations between study variables

	M	SD	CSS F1	CSS F2	CSS F3	CSS F4	CSS F5	CSS TOT	GAD	PHQ
COVID danger and contamination fears (CSS F1)	10.45	6.00								
COVID fears about economic consequences (CSS F2)	1.48	2.46	0.46** (0.52)							
COVID xenophobia (CSS F3)	1.63	2.43	0.38** (0.46)	0.40** (0.48)						
COVID compulsive checking and reassurance seeking (CSS F4)	2.21	2.70	0.37** (0.45)	0.38** (0.46)	0.27** (0.35)					
COVID traumatic stress symptoms (CSS F5)	1.17	2.33	0.50** (0.57)	0.48** (0.55)	0.34** (0.41)	0.52** (0.63)				
CSS total score (CSS TOT)	16.94	11.82	0.86** (0.97)	0.70** (0.79)	0.61** (0.72)	0.65** (0.78)	0.73** (0.82)			
GAD	16.85	5.75	0.31** (0.35)	0.20** (0.22)	0.12** (0.14)	0.15** (0.18)	0.29** (0.32)	0.31** (0.34)		
PHQ	22.11	7.16	0.26** (0.29)	0.22** (0.25)	0.08* (0.10)	0.14** (0.17)	0.28** (0.32)	0.28** (0.31)	0.73** (0.82)	

Note: $N = 1287$; all variables calculated as summed scores; first value = uncorrected correlation, value in brackets = disattenuated correlation; * $p < 0.01$, ** $p < 0.001$.

vein, COVID traumatic stress symptoms were higher in Site 3 (located in Toronto, Ontario) than any other site. Infection numbers in participants' locations likely impacted provincial restrictions and students' COVID-19 stress. Considering that infection rates and accompanying restrictions differed by study site, a lack of scalar invariance as shown in the current study should be expected.

Like others (e.g., Mahamid et al., 2021; Taylor et al., 2020b), the current study found that the CSS dimensions and overall CSS total score were positively related to anxiety and depression. That said, the CSS is measuring something distinct from general anxiety and depression. The disattenuated correlations (i.e., correlation coefficients corrected for measurement error) were significant but not overly strong, indicating that the CSS-B is measuring something correlated with, but separate from, general mental health symptoms.

The current study showed that the shortened CSS measure is still reliable and valid. Furthermore, its psychometric properties held in a sample of young adult university students, a population that is especially vulnerable during the pandemic (Xiong et al., 2020). We were also able to show that the CSS-B dimensions differed by study site, indicating that infection rates and public health policies/restrictions influence COVID-related distress.

5 | LIMITATIONS AND FUTURE RESEARCH

While the results demonstrate the scale properties of the CSS-B, the current study did not include the full CSS. We were unable to directly compare the reliability and validity of the CSS-B to the original CSS. Future research should ensure that the CSS-B captures the full domain of the COVID Stress Syndrome. That said, while we did cut the scale in half, we ensured that we still measured each dimension of the syndrome (over choosing only a few select dimensions).

The current study relied on cross-sectional, self-report data increasing the likelihood of common method variance (CMV which

can inflate relationships artificially or otherwise bias the data in some way; Doty & Glick, 1998; Lindell & Whitney, 2001; Malhotra et al., 2017). That said, disattenuated correlations control for measurement error. Additionally, the CFA support a multifactor solution, while CMV would enhance the likelihood of support for a unidimensional, rather than multidimensional, factor solution (Harman, 1976). Multi-source data (e.g., other rated behaviour) is recommended to further examine the relationships between the CSS and other variables in future. For instance, self-report data can be collected on the CSS while a spouse or roommate provides behavioural ratings.

Longitudinal research should be conducted to examine the stability of the measure over time as well as its longitudinal associations with variables such as general mental health outcomes and pandemic-related behaviour (e.g., adherence to public guidelines, substance use, excessive eating). That said, as COVID distress should be a state as it is due to a specific event and not a trait, we would not expect the measure to be stable over long periods of time. In fact, measurement stability would be cause for concern as it could indicate that there are long-lasting mental consequences of the pandemic if scores continue to be high. That said, people with high scores now may be those that stay relatively higher than others over time even as pandemic-related stress habituates and declines with opening up and with reduced risk for serious illness with vaccines. It is unclear whether COVID-19 distress could become chronic (Taylor et al., 2021). It would be interesting to examine who is most susceptible to continued COVID distress over time even as things return to 'normal' (e.g., are traits like anxiety sensitivity related to a relative maintenance of COVID stress over time?).

It is also important to note that the majority of our sample were female (79.4%). While there was still a decent sample size for males ($n = 270$), we had very little representation of those falling outside the gender binary. This may impact the generalizability of our findings to these groups.

While we tested for invariance across study sites (i.e., universities), the experiences of students within these sites may not have been that similar. Since many university classes were not in person and most of these campuses were closed during data collection, it is unclear how many students were “on site” in the university’s city (or even in Canada). Further city- and country-wide research is needed. That said, we did observe site differences that would be expected.

Taylor et al. (2021) found that trait resilience and optimism were negatively correlated with CSS dimensions while health anxiety proneness and intolerance of uncertainty were positively correlated with CSS dimensions. Future research should examine other factors that may impact CSS scores such as other personality traits (e.g., Big Five). Research should also determine if CSS scores impact behaviour during the pandemic (e.g., self-care behaviours, unhealthy coping methods, student academic performance).

6 | CONCLUSION

As the COVID-19 pandemic was a novel, unprecedented event, research is being conducted quickly. As many variables are often of interest to researchers, there is a need for shorter scales that can quickly capture constructs while avoiding participant survey fatigue. The current study found that a brief version of the CSS was structurally valid and possessed partial measurement invariance across institutions with varying levels of impact of the pandemic; the subscales were internally consistent and showed expected overlap with general anxiety and depression, establishing construct validity.

Various studies have found that the pandemic environment, social distancing and lockdown have negatively impacted mental health (e.g., Ahmed et al., 2020; Tang et al., 2020; Zajacova et al., 2020). It is important that researchers continue to examine mental health as the pandemic continues and once it is behind us. It is unclear at what rate these elevated stress symptoms will be reduced following the pandemic or if they will reduce at all in the short term (Taylor et al., 2020a). As such, researchers should continue to use COVID-specific scales to assess stressors related to the pandemic.

AUTHOR CONTRIBUTIONS

All authors contributed to the conceptualization, data collection, and draughting of the manuscript.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

ETHICS STATEMENT

REB approval was obtained from each of the five participating post-secondary institutions.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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