



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Measuring COVID-19-related fear and threat in Australian, Indian, and Nepali university students

Francesca E. Collins*

School of Psychological Sciences, Monash University, Clayton, VIC 3800, Australia
University of California Education Abroad Program, 6950 Hollister Ave #200, Goleta, CA 93117, United States

ARTICLE INFO

Keywords:

COVID-19
University students
Fear
Mental health
Australia
India
Nepal
International students

ABSTRACT

The present study describes the adaption and validation of a brief measure of contagion-related fear and threat in Australian, Indian, and Nepali university students in Australia at the height of the first wave of the COVID-19 pandemic. Adapted from Ho, Kwong-Lo, Mak, and Wong's (2005) SARS-related fear scale, the Contagion Fear and Threat Scale (CFTS) was rapidly adapted to capture the experience of COVID-19 pandemic-related fear. The factor structure and validity of the 6-item scale were established among Australian ($n = 154$), Indian ($n = 111$), and Nepali ($n = 149$) university students studying in Australia in May–June 2020. Factor analysis revealed two 3-item factors in the Australian student sample: Fear of Infection and Existential Threat. These factors were confirmed in the Indian and Nepali student samples and mirror those found by the Ho et al. (2005) in their original instrument. The convergent and discriminant validity of the full CFTS, Fear of Infection, and Existential Threat scales are indicated via correlations with established measures of depression, anxiety, stress, subjective wellbeing, and religiosity. Differences in the performance of the Fear of Infection and Existential Threat scales are considered in terms of the respective objective and subjective nature of the constructs.

1. Introduction

It is well-established that Australian university students report poorer mental health than the general Australian population (Stallman et al., 2019). International university students in Australia report even poorer mental health than their domestic counterparts, especially in relation to financial stress, loneliness, depression, and anxiety (Forbes-Mewett, 2019). International education is Australia's fourth largest export and, in 2019, the country welcomed 758,154 international students to its shores (Australian Government Department of Education, 2019). In accepting their cultural and economic contribution to the country, Australia is obliged to actively support international students' psychological wellbeing.

On 12 March 2020, the World Health Organization declared the COVID-19 outbreak a pandemic and by 23 March Australia had entered lockdown. Strict social-distancing measures were implemented, international borders were closed, and universities across the country shifted from on-campus delivery to online delivery (Ting & Palmer, 2020). While some restrictions loosened in some domains in early June 2020 (e. g., hospitality, primary, and secondary education), the restrictions regarding social-distancing, international borders, and universities

remain in place into 2021.

The impact of the lockdown on university students in Australia was immediate and significant. University campuses shut down with little warning and the main providers of part-time employment for university students – hospitality and retail outlets – were ordered to close. The impact was compounded for international students in Australia who were geographically separated from their support networks and faced significant financial and housing stress (Soong & Procter, 2020).

1.1. Measuring contagion-related psychological responses

The Australian lockdown commenced shortly before the author was to commence a broad investigation into the psychological wellbeing of domestic and international students in Australia. The author believed an exploration of psychological wellbeing at this time would be incomplete without direct examination of students' psychological responses to contagion.

Interest in psychological responses to contagion has increased in the early 21st century in the wake of Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome, and Ebola outbreaks (World Health Organization, n.d.). Compared to other health threats, contagion

* School of Psychological Sciences, Monash University, Clayton, VIC 3800, Australia
E-mail address: francesca.collins@monash.edu.

engenders fear because of its imminence (i.e., its spread is inevitable), invisibility (i.e., its presence isn't apparent), and transmissibility (i.e., it spreads easily and without discrimination; Pappas et al., 2009). This contagion-related fear is heightened by perceptions of the speed of transmission and exposure to contagion-related misinformation (Amin, 2020; Pappas et al., 2009).

A search of the pre-2020 literature revealed a dearth of quantitative measures of contagion-related fear. Research emerging from the most recent comparable epidemic, the SARS epidemic of 2002–2004, mainly used semi-structured interviews and general measures of fear, trauma, and psychological wellbeing (Ho et al., 2005; Stuijzand et al., 2020). SARS research also tended to focus on the experiences of healthcare professionals (Ho et al., 2005; Stuijzand et al., 2020) rather than the general population.

With the rapid global spread of COVID-19, the first half of 2020 saw a flurry of COVID-19-related psychological response scale development. Lee's (2020) Coronavirus Anxiety Scale is a brief, 5-item screener for clinical levels of anxiety related to COVID-19. Kachanoff et al. (2020) developed the COVID-19 Threat Scale, a 10-item measure of perceptions of realistic threat to financial and physical safety and symbolic threat to sociocultural identity. Ahorsu et al. (Ahorsu et al., 2020) developed the Persian language, 7-item Fear of COVID-19 scale measuring fear and anxiety clinical symptoms associated with COVID-19. Finally, Taylor et al. (Taylor et al., 2020) developed the 36-item COVID Stress Scales, a comprehensive measure of psychological reactions to COVID-19: contamination fears, economic fears, xenophobia, compulsive behavior, and traumatic stress symptoms.

Missing from the research literature was a brief, non-diagnostic measure of contagion-related fear that could be applied to any contagious disease and across a wide range of adult populations. A potential basis for such a scale was Ho et al.'s (2005) SARS-related fear scale.

1.2. The present study

The present study was part of a broader study examining the protective and risk factors for psychological wellbeing in Australian, Indian, and Nepali university students studying in Australia. Constructs of interest in the broader study included depression, anxiety, stress, religiosity, subjective wellbeing, collectivism, and acculturation. The COVID-19 pandemic emerged in Australia shortly before data were scheduled to be collected. As no relevant measures were available at that time, Ho et al.'s (2005) SARS-related measure was adapted for use.

The aim of the study presented here was to determine the suitability of the adapted scale as a general contagion-related fear measure, for use across a range of diseases and populations. The author aimed to: 1) evaluate the adapted scale's factor structure via exploratory and confirmatory factor analyses, using SPSS v.26 and AMOS v.27, respectively; and 2) establish the scale's reliability, measurement invariance, and, constructs captured as part of the broader study, the adapted scale's convergence with theoretically related constructs (i.e., depression, anxiety, stress, and subjective wellbeing), and divergence with theoretically unrelated constructs (i.e., religiosity). Convergent validity was further examined in terms of via examination of factor loadings and average variance extracted.

2. Method

2.1. Participants

Participants were domestic and international university students studying in Australia between 5 May 2020 and 7 June 2020, a period of nation-wide COVID-19-related self-isolation and social restriction in Australia. Data from three culturally distinct university student groups were analyzed: Australian domestic students; Indian university students studying in Australia; and Nepali university students studying in Australia. All participants were aged 18 or over and were fluent in

written and spoken English as required for admission to Australian universities.

The Australian group comprised 154 Australian domestic (i.e., citizens and permanent residents of Australia) university students. They ranged in age from 18 to 60 years with a mean age of 25.45 years ($SD = 9.04$). The Australian group included 99 women (64%), 50 men (32%), 3 participants who identified as non-binary (2%), and 2 participants who did not indicate their gender (2%).

The Indian group comprised 111 Indian nationals studying at Australian universities. They ranged in age from 18 to 33 years with a mean age of 24.16 years ($SD = 3.22$). The Indian group included 63 women (57%), 47 men (42%), and 1 participant who did not indicate their gender (1%).

The Nepali group comprised 148 Nepali nationals studying at Australian universities. They ranged in age from 18 to 31 years with a mean age of 23.48 years ($SD = 3.80$). The Nepali group included 94 women (64%), 50 men (34%), and 4 participants who did not indicate their gender (3%).

2.2. Materials and procedure

The study was approved by the xxxxx Human Research Ethics Committee (Project ID: 22957) prior to the commencement of data collection. Participants were invited to participate in the online study via Facebook advertisements. Participation was voluntary, anonymous, and offered the opportunity to enter a draw (via a separate online form) for one of ten \$100 Amazon vouchers.

Participants completed a range of measures as part of the broader investigation of university student psychological wellbeing, however, only the measures and data pertaining to the present study are reported here. The measures were administered online at Qualtrics.com and included demographic items (age, gender, international-domestic student status, and home country), and measures of contagion-related fear, psychological distress (depression, anxiety and stress), subjective wellbeing, and religiosity.

2.2.1. Psychological responses to contagion items

Ho et al.'s (2005) SARS-related fear scale was developed to measure the psychological impact of the 2002–2004 SARS outbreak on frontline health workers in Hong Kong hospitals. The 19-item scale comprises 18 items measuring fear of infection and one item measuring infection related self-efficacy. Factor analysis of the 18 fear items produced three significant 3-item factors: 1) fear of infection (i.e., *Fear I will be infected, Worry if my family will be infected, and I fear that I will infect others*), 2) feelings of insecurity (i.e., *Feel that I have lost control of life, Feel that life is threatening, and Feel very unsafe about myself*), and sense of job-related instability (i.e., *Worry if my friends and family will keep a distance from me due to my job duties, Fear distressed because of the upsurge in workload, and Worry if I will be assigned to SARS wards*). In the present study, the factor originally labelled 'Insecurity' was renamed 'Existential Threat' to better reflect the non-specific sense of threat to one's existence, rather than fear, described in these items.

For the present study, the six items making up Ho et al.'s (2005) fear of infection and existential threat factors were retained, providing a focused, 6-item measure. Each item included the stem, *The current COVID-19 pandemic makes me...*; the name of the disease or outbreak can be changed as necessary. Participants responded to each item on a 4-point Likert scale, as used in the original study, where 0 = *Definitely false* and 3 = *Definitely true*.

2.2.2. Depression, Anxiety, and Stress Scales-21

A short form of the 42-item Depression, Anxiety and Stress Scales (DASS; Lovibond & Lovibond, 1996), the Depression, Anxiety and Stress Scales-21 (DASS-21) is a 21-item scale comprising three 7-item subscales measuring symptoms of depression (e.g., *I felt that I had nothing to look forward to*), anxiety (e.g., *I felt I was close to panic*), and stress (e.g., *I*

found it difficult to relax). Participants respond to items on a 4-point Likert scale where 0 = *Never* and 3 = *Almost always*. Item responses are summed to create subscale scores and a total score. The DASS-21 authors recommend doubling the subscale and total scores so that they can be compared with scores from the original 42-item DASS-42, however, this was not considered necessary in the present study. As such, DASS-21 total scores are reported from a possible range of 0–63 and subscale scores are reported from a possible range of 0–21.

The DASS-21 demonstrates good to excellent internal consistency. Cronbach's α s have been reported ranging from 0.82–0.90 for Depression, 0.74–0.83 for Anxiety, and 0.82–0.87 for Stress, across several countries (Lee, 2019; Rosenthal et al., 2008; Zanon et al., 2020). Cronbach's α s for DASS-21 total scores range from 0.90–0.94 (Crawford et al., 2011; Scholten et al., 2017).

In non-clinical populations, DASS-21 total scores and subscale scores are typically at the very low end of the scoring range. DASS-21 total scores have been reported between 8.9 and 11.51 (Crawford et al., 2011; Sinclair et al., 2012). Mean subscale scores have been reported ranging from 1.57–5.03 for Depression, 1.44–4.51 for Anxiety, and 1.79–7.27 for Stress (Lee, 2019; Praherso et al., 2017; Sinclair et al., 2012; Zanon et al., 2020).

2.2.3. Personal Wellbeing Index - Adult

The Personal Wellbeing Index-Adult (PWI-A; International Wellbeing Group, 2013) is a 7-item measure of satisfaction with various domains of life including Standard of Living, Personal Health, Achieving in Life, Personal Relationships, Personal Safety, Community-Connectedness, and Future Security. Participants respond to statements on an 11-point Likert scale where 0 = *No satisfaction at all* and 10 = *Completely satisfied*. Scores for all seven items are multiplied by 10, summed, then averaged to create a Subjective Wellbeing score ranging from 10 to 100.

The PWI-A demonstrates good to excellent internal consistency with Cronbach's α s reported between 0.70 and 0.91 in Australian samples (Hutton et al., 2013; International Wellbeing Group, 2013; Jovanović et al., 2019).

For individuals, the normative range for Subjective Wellbeing scores is 50–100 (International Wellbeing Group, 2013) with Australians typically reporting scores ranging from 72 to 75.43 (Khor et al., 2020; Misajon et al., 2016; Weinberg et al., 2018).

2.2.4. Duke University Religion Index

The 5-item Duke University Religion Index (DUREL; Koenig and Bussing, 2010) measures frequency of engagement in Organizational Religious Activity (e.g., attending services; one item), frequency of engagement in Non-Organizational Religious Activity (e.g., private prayer; one item), and level of Intrinsic Religiosity (e.g., personal religious commitment). The Intrinsic Religiosity subscale comprises three items accompanied by 5-point Likert scales where 1 = *Definitely not true* and 5 = *Definitely true of me*. The DUREL demonstrates good to excellent internal consistency with Cronbach's α s reported between 0.75 and 0.92 and mean scores between 3.15 and 10.4 (Lace & Handal, 2018; Palmer Kelly et al., 2019; Stanford et al., 2019).

2.2.5. Data analysis

Analyses were carried out in SPSS v.26 (descriptives, normality, correlations, reliability, validity, exploratory factor analysis) and AMOS v.27 (confirmatory factor analysis).

Significant Shapiro-Wilk statistics suggested all six contagion-related fear items were non-normally distributed, however, examination of the Q-Q plots indicated all distributions were normal. An exploratory factor analysis was conducted on the Australian data in SPSS v.26 with Maximum Likelihood and Promax rotation. A determinant value of 0.16, greater than the required 0.00001 was obtained and, for all six items, tolerance values were greater than 0.2 and VIF values less than 10, indicating an absence of multicollinearity (see Table 1).

Table 1

Correlation matrix for the 6 CFTS items in the Australian group.

	1.	2.	3.	4.	5.
1. Fear that I will be infected					
2. Fear that I will infect others	0.45				
3. Worry that my family will be infected	0.49	0.51			
4. Feel very unsafe about my self	0.41	0.25	0.37		
5. Feel that life is threatening	0.32	0.23	0.34	0.72	
6. Feel that I have lost control of life	0.14	0.15	0.17	0.38	0.41

Note. Determinant = 0.16. All correlations $p < .05$.

Confirmatory factor analysis was conducted on the Australian, Indian and Nepali data in AMOS v.27 with Maximum Likelihood extraction. Model fit and was assessed in terms of chi-square (χ^2 ; $p > .05$), Comparative Fit Index (CFI; ≥ 0.90), and Root Mean Square Error of Approximation (RMSEA; < 0.08). A multigroup CFA was conducted and measurement invariance (configural, metric, and scalar) was assessed in terms of $\Delta\chi^2$, ΔCFI (< 0.01), and ΔRMSEA (≤ 0.015) (Chen, 2007; Xu & Tracey, 2017).

The other variables reported in this study (i.e., depression, anxiety and stress, subjective wellbeing, and religiosity) were selected prior to the emergence of the pandemic so were not chosen specifically for their proposed relationship with the contagion-related fear items. However, depression, anxiety, stress, and subjective wellbeing scores were expected to be associated with (and, thereby, demonstrate the convergent validity) contagion-related fear items as they represent negative, and in the case of subjective wellbeing, positive affective states. As religiosity is theoretically unrelated to affective state (Koenig and Bussing, 2010), it was used to demonstrate the divergent validity of the contagion-related fear items.

3. Results

3.1. Exploratory factor analysis

To determine factor structure of the six contagion-related fear items, an exploratory factor analysis was carried out on the Australian group data ($n = 154$). The six items were assessed as factorable based on a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value of 0.74, above the recommended value of 0.60 (Carpenter, 2018), and a Bartlett's Test of Sphericity value of $\chi^2(15) = 273.23$, $p < .001$.

Item-total correlations for all six items were ≥ 0.3 , however, Cronbach's α (0.76) could be marginally improved (to 0.77) by the removal of the item, *Feel that I have lost control of life*. All items correlated significantly with one another at ≥ 0.3 , again, with the exception of this item. Any gain in internal consistency achieved by the removal of this item would be offset by the reduction of one factor to, at best, an uninterpretable two items. For this reason, all items were retained, and the six items deemed suitable for factor analysis.

The exploratory factor analysis was carried out with Maximum Likelihood extraction and Promax rotation, as recommended by Carpenter (2018). Communalities were all ≥ 0.3 , except for the item, *Feel that I have lost control of life* ($r = 0.22$). Two factors emerged with Eigenvalues greater than 1, explaining 67.10% of the variance. The three Existential Threat (hereafter, Threat) items loaded at ≥ 0.4 on the first factor which explained 46.84% of variance and the three Fear of Infection (hereafter, Fear) items loaded ≥ 0.4 on the second factor which accounted for an additional 20.26% of the variance. This model demonstrated good fit, $\chi^2(4) = 3.19$, $p = .53$, and was retained for further investigation.

3.2. Confirmatory factor analysis

Confirmatory factor analysis of the two-factor solution was conducted using with Maximum Likelihood extraction on the data from the Australian, Indian ($n = 111$; KMO = 0.77; Bartlett's $\chi^2(15) = 234.71$, p

< .001) and Nepali ($n = 149$; $KMO = 0.76$; Bartlett's $\chi^2(15) = 172.91$, $p < .001$) groups. The 2-factor solution demonstrated good model fit in: the Australian data ($\chi^2(4) = 3.20$, $p = .53$), explaining 67.11% of the variance; the Indian data ($\chi^2(4) = 3.15$, $p = .53$), explaining 69.98% of the variance; and the Nepali data ($\chi^2(4) = 4.83$, $p = .31$), explaining 59.90% of variance (see Table 2).

The two-factor model demonstrated excellent goodness of fit across all three groups (see Table 3). Multigroup CFA revealed measurement invariance across the three groups at the configural and metric levels but not at the scalar level (see Table 4).

3.3. Construct validity

Correlations for CFTS total and factor scores and the DASS-21 total and subscale scores, Subjective Wellbeing scores, and DUREL scores are shown in Table 5.

Across all three groups, mild to moderate correlations were found between the CFTS total, Fear, and Threat scores and DASS total, Depression, Anxiety, and Stress scores with the exception of Fear and Anxiety and Fear and Stress in the Nepali sample. Across all groups, Subjective Wellbeing was mildly to moderately negatively associated with CFTS total and Threat scores. Subjective Wellbeing was also negatively associated with Fear in the Australian group. Across all groups, CFTS total, Fear and Threat scores were unrelated to Intrinsic Religiosity, Organizational Religious Activity, and Non-Organizational Religious Activity.

Across all three groups: all CFTS items loaded more highly on their assigned factor than on the other factor; and the average variance extracted (AVE) for each CFTS factor was greater than its correlation with the other constructs measured.

3.4. CFTS descriptives

Table 6 shows the descriptive statistics for the six CFTS items, the CFTS total and subscale scores, the DASS-21 total and subscale scores, the Subjective Wellbeing scores and DUREL scores in the Australian, Indian, and Nepali groups.

ANOVA revealed significant differences between Australian, Indian and Nepali students on CFTS total ($F(2, 411) = 9.96$, $p < .01$; $\eta^2 = 0.03$), Fear ($F(2, 412) = 8.28$, $p < .01$; $\eta^2 = 0.04$) and Threat ($F(2, 411) = 15.68$, $p < .001$; $\eta^2 = 0.07$) scores.

Post Hoc tests (Dunnett's C) showed that Nepali students scored significantly higher than Australian and Indian students on CFTS total and Threat scores while Nepali and Australian students scored significantly higher on Fear than Indian students.

Fear and Threat subscale scores correlated at 0.52, 0.54, and 0.55 in the Australian, Indian, and Nepali student samples, respectively.

Table 2
Factor loading for the 6 CFTS items in the Australian, Indian, and Nepali groups.

	Australian ($n = 154$)		Indian ($n = 111$)		Nepali ($n = 148$)	
	Threat	Fear	Threat	Fear	Threat	Fear
1. Fear that I will be infected	0.08	0.63	0.13	0.70	-0.01	0.77
2. Fear that I will infect others	-0.11	0.74	-0.14	0.94	0.03	0.65
3. Worry that my family will be infected	0.04	0.71	0.06	0.45	0.01	0.40
4. Feel very unsafe about my self	0.80	0.07	0.67	0.17	0.44	0.27
5. Feel that life is threatening	0.88	-0.04	0.86	0.04	0.91	-0.13
6. Feel that I have lost control of life	0.48	-0.03	0.74	-0.13	0.41	0.20

Table 3

CFA goodness of fit statistics for the two-factor model in Australian, Indian and Nepali university student groups.

	$\chi^2(df)$	CFI	RMSEA (90% CI)
Australia	7.21(8)	1.0	0.00 (0.00, 0.89)
India	11.70(8)	0.98	0.07 (0.00, 0.14)
Nepal	8.56(8)	0.99	0.02 (0.00, 0.10)

Note: χ^2 = chi square; df = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval.

Table 4

Measurement invariance (configural, metric and scalar) for the two-factor model across Australian, Indian and Nepali groups.

	$\chi^2(df)$	CFI	RMSEA (90% CI)	$\Delta\chi^2(df)$	Δ CFI	Δ RMSEA
Configural	27.47 (24)	0.99	0.02 (0.00, 0.05)			
Metric	38.56 (32)	0.99	0.02 (0.00, 0.05)	11.09(8)	0.0	0.0
Scalar	68.92 (34)*	0.95	0.05 (0.03, 0.07)	29.64 (2)*	-0.04	0.03

Note: χ^2 = chi square; df = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval; Δ = change.

* $p < .05$.

4. Discussion

The aim of the present study was to adapt Ho et al.'s (2005) SARS-related fear scale as a brief, reliable, and valid measure of contagion-related fear for use across a range of diseases and populations. The adapted scale, the Contagion Fear and Threat Scale, was validated among Australian, Indian, and Nepali university students studying in Australia at the height of the first wave of the COVID-19 pandemic.

4.1. Factor structure

Across all three groups, factor analysis of the 6-item CFTS revealed the same two factors originally identified by Ho et al. (2005): one factor reflecting fear of infection, and the second factor reflecting existential threat related to the pandemic.

The two factors were moderately correlated ($r = 0.52-0.55$) and, along with the CFTS full scale, demonstrated acceptable to good internal consistency across the three groups with Cronbach's α ranging from 0.62 to 0.80.

The two-factor model demonstrated excellent fit in all three groups. Examination of measurement invariance indicated invariance in terms of the factor structure (i.e., configural) and factor loadings (i.e., metric), however, noninvariance was indicated at the scalar level suggesting that differences in the mean scores for CFTS Fear and Threat were not related to differing levels in contagion-related fear and threat, but to something else. A possible explanation for this is language. It was assumed that all participants, being fluent in written and spoken English, would understand the CFTS items in a similar way. However, while English is an official language of India and Australia, it is not an official language in Nepal. As speakers of English as an additional language, Nepali students may have understood the items differently to their Australian and India counterparts. Translation of the CFTS to Nepali will reveal whether scalar noninvariance can be explained at this linguistic level.

4.2. Construct validity

Considerable evidence was found for the convergent validity of the Fear and Threat factors. In all three groups, CFTS items loaded more highly on their assigned factors than on the other factor and the AVE for

Table 5

Correlations for CFTS total, Fear, and Threat scores, DASS-21 total and subscale scores, Subjective Wellbeing scores and DUREL subscale scores in Australian, Indian and Nepali groups.

	Australian (n = 154)			Indian (n = 111)			Nepali (n = 148)		
	CFTS	Fear	Threat	CFTS	Fear	Threat	CFTS	Fear	Threat
DASS-21 total	0.53**	0.30**	0.59**	0.50**	0.27**	0.57**	0.33**	0.21*	0.36**
Depression	0.43**	0.20*	0.52**	0.42**	0.20 ^a	0.50**	0.33**	0.23**	0.35**
Anxiety	0.48**	0.26**	0.54**	0.51**	0.29**	0.56**	0.27**	0.15 ^b	0.30**
Stress	0.51**	0.35**	0.51**	0.47**	0.27**	0.52**	0.28**	0.16 ^c	0.31**
Subjective Wellbeing	-0.30**	-0.22*	-0.27**	-0.36**	-0.10	-0.48**	-0.22 ⁺	0.11	-0.24*
Intrinsic Religiosity	0.01	-0.03	0.04	-0.09	0.01	-0.15	0.03	-0.02	0.07
Organizational Religious Activity	0.24	0.28*	0.15	-0.10	-0.08	-0.08	-0.03	-0.13	0.07
Non-Organizational Religious Activity	0.01	-0.05	0.06	-0.18	-0.11	-0.20	0.05	-0.04	0.11
Average variance extracted	0.52	0.48	0.55	0.55	0.53	0.58	0.40	0.40	0.40

Note: CFTS = Contagion fear and Threat Scale; DASS-21 = Depression, Anxiety and Stress Scales; DUREL = Duke University Religion Index.

- * p = .05.
- ** p = .01.
- ^a p = .053.
- ^b p = .10.
- ^c p = .07.

Table 6

Descriptive statistics for CFTS items, CFTS total and subscale scores, DASS-21 total and subscale scores, Subjective Wellbeing, and DUREL subscale scores in the Australian, Indian, and Nepali groups.

	Australian (n = 154)					Indian (n = 111)					Nepali (n = 148)				
	Mean	SD	Skew	Kurt	α	Mean	SD	Skew	Kurt	α	Mean	SD	Skew	Kurt	α
1. Fear that I will be infected	1.99	1.02	-0.20	-0.44	-	1.58	0.88	-0.28	-0.59	-	1.78	0.80	-0.64	0.23	-
2. Fear that I will infect others	1.66	0.10	-0.23	-0.89	-	1.30	1.01	0.01	-1.23	-	1.31	1.02	0.05	-1.20	-
3. Worry that my family will be infected	2.02	0.90	-0.70	-0.19	-	1.65	0.10	-0.31	-0.93	-	2.11	0.88	-0.89	0.20	-
4. Feel very unsafe about my self	0.72	0.84	0.91	-0.04	-	1.04	0.96	0.36	-1.07	-	1.18	0.97	0.12	-1.20	-
5. Feel that life is threatening	0.72	0.86	0.95	-0.01	-	1.00	1.03	0.56	-0.94	-	1.67	1.05	-0.37	-1.04	-
6. Feel that I have lost control of life	1.04	1.04	0.45	-1.13	-	1.04	1.10	0.48	-1.23	-	1.16	1.00	0.12	-1.32	-
CFTS total	8.14	3.80	0.09	-0.32	0.76	7.59	4.22	0.17	-0.90	0.80	9.22	3.76	-0.18	-0.18	0.73
Fear	5.65	2.33	-0.46	-0.29	0.73	4.52	2.34	-0.18	-0.74	0.73	5.20	2.04	-0.42	-0.11	0.62
Threat	2.48	2.22	0.57	-0.45	0.74	3.07	2.61	0.58	-0.71	0.80	4.01	2.36	-0.04	-0.76	0.68
DASS-21 total	20.17	13.19	0.44	-0.42	0.94	18.97	13.06	0.57	0.08	0.94	15.25	13.18	0.75	0.05	0.95
Depression	7.73	5.95	0.60	-0.65	0.92	6.87	5.10	0.58	-0.17	0.88	5.36	4.89	0.76	-0.18	0.86
Anxiety	4.39	3.94	1.01	1.13	0.82	5.05	4.16	0.82	0.16	0.82	4.28	4.303	1.08	0.86	0.85
Stress	8.14	5.10	0.25	-0.80	0.88	7.05	4.87	0.55	0.34	0.87	6.16	5.019	0.58	-0.44	0.87
Subjective Wellbeing	48.45	14.89	-0.60	0.06	0.89	52.01	15.32	-0.73	0.88	0.89	50.99	14.50	-0.45	0.82	0.87
Intrinsic Religiosity	7.38	4.20	0.49	-1.16	0.93	9.62	3.21	-0.41	-0.47	0.75	10.17	2.82	-0.38	-0.06	0.79
Organizational Religious Activity	2.33	1.50	1.04	0.21	-	3.16	1.38	0.08	-0.69	-	2.90	1.12	0.24	0.59	-
Non-Organizational Religious Activity	1.99	1.591	1.44	0.62	-	2.60	1.59	0.65	-0.84	-	2.53	1.54	0.66	-0.96	-

both factors were greater than their correlations with the other related constructs examined. Contagion-related fear and threat are both negative affective constructs. As expected, they were positively related to the other negative affective constructs, and negatively related to other positive affective constructs, under examination in the broader study of university student wellbeing.

Convergence with related negative affective constructs was indicated by the significant mild to moderate correlations between CFTS total and Threat scores and DASS total, Depression, Anxiety, and Stress scores across all three samples ($r = 0.27-0.59$). Fear scores were correlated with all DASS scale and subscale scores in the Australian sample ($r = 0.20-0.35$), DASS total, Anxiety, and Stress scores in the Indian sample ($r = 0.27-0.29$), and DASS total and Depression scores in the Nepali sample ($r = 0.21$ and 0.23 , respectively). Where correlations with Fear scores were not significant, they approached significance. Convergent validity was further suggested by mild to moderate negative correlations between CFTS total and Threat scores and the positive affective construct of Subjective Wellbeing across all three samples ($r = -0.22-0.48$). The Fear scale correlated with Subjective Wellbeing in the Australian sample but not in the Indian and Nepali samples.

As expected, CFTS total, Fear, and Threat scores were unrelated to the non-affective construct of religiosity, indicating discriminant validity.

4.3. Fear of Infection versus Existential Threat

It is notable that, across all groups, Fear scores were higher than Threat scores and Threat scores were more strongly related to DASS-21 total and subscale scores and Subjective Wellbeing scores than were Fear scores. This may be explained by the nature of the two CFTS subscales. The object of Fear of Infection is specific and external to the self (i.e., COVID-19 infection). Existential Threat, however, has no specific object, rather it is an unanchored and subjective experience of threat to one's own existence, albeit triggered, in this case, by the COVID-19 pandemic. The moderate relationship between Threat and DASS total, Depression, Anxiety and Stress scores can be understood as capturing the subjective and non-specific character of these constructs (Lovibond & Lovibond, 1996). Similarly, Subjective Wellbeing represents satisfaction with a range of life domains rather than a specific domain such as Standard of Living or Personal Health.

4.4. Limitations and future research

As all participants were studying in Australia at the time of data collection, features specific to the Australian experience of this first wave of COVID-19 are likely to have moderated CFTS full, Fear, and Threat scores. At the time, restrictions were swiftly implemented, actively enforced, and broadly adhered to in Australia (Australian Government, 2020). Furthermore, Australian infection rates were low by global standards, all participants had access to socialised, high-quality healthcare, and the capacity of health system was not at risk of being overwhelmed (Australian Government, 2020).

Furthermore, data were collected around six weeks after Australia's first wave peak of daily cases, when new infections were typically in the single digits. At that time, COVID-19 hadn't taken a hold in India and Nepal which were still weeks away from their first wave peak of daily infections (Roser et al., 2020). So, while COVID-19 was recognized (Ho et al., 2005) as a significant threat in Europe and the Americas during May and June 2020, the threat was objectively less for Australian, Indian and Nepali students in Australia and their families in India and Nepal.

Participant age may also have affected CFTS full, Fear, and Threat scores. In Australia, although people in their 20s (90% of the current sample) are more likely to contract the disease, people over the age of 70 are far more likely to die from the disease. Compared to older age groups, the present sample may not have perceived COVID-19 to be life-threatening (covid19data.com.au, 2020; Ting et al., 2020).

The CFTS should be administered to people from a range of age groups and countries at different stages of pandemic to determine its psychometric performance across the lifespan and across pandemic waves. Translation of the CFTS is encouraged to determine whether the scalar measurement noninvariance found here is an artefact of speaking English as an additional language.

Finally, the psychometrics of the English and translated CFTS should be explored alongside those of the other recently developed measures of COVID-19-related psychological responses in relation to both COVID-19 and other impending epidemics such as measles and polio (World Health Organization, 2020). Each of these measures has been devised for a distinct purpose; it is anticipated the more COVID-focused measures will have limited usefulness beyond the current pandemic.

4.5. Conclusion

Future pandemics are inevitable and the impact on psychological wellbeing variable depending on geographic location, age, local policy, and other sociocultural variables. The CFTS represents a brief, reliable, and valid measure of contagion-related fear and threat suitable across a range of diseases and populations. Knowledge of, and preparation for, the psychological impact of pandemics will go a long way toward helping the world's citizens adapt to the 'new normal'.

CRediT authorship contribution statement

Francesca E. Collins: Conceptualization, Methodology, Investigation, Analysis, Writing – Original Draft, Reviewing and Editing.

References

- Ahorsu, D. K., Lin, C.-Y., Imani, V., Saffari, M., Griffiths, M. D., & Pakpour, A. H. (2020). The fear of COVID-19 scale: Development and initial validation. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-020-00270-8>.
- Amin, S. (2020). *The psychology of coronavirus fear: Are healthcare professionals suffering from corona-phobia?* *International Journal of Healthcare Management*, 1–8. <https://doi.org/10.1080/20479700.2020.1765119>.
- Australian Government. (2020). Coronavirus (COVID-19)—Official Australian Government information. Australia <https://www.australia.gov.au/>.
- Australian Government Department of Education. (2019). December 2019 end of year summary. Australian Government Department of Education <https://international.education.gov.au/research/International-Student-Data/Documents/MONTHLY%20SUMMARIES/2019/December%202019%20End%20of%20year%20summary.pdf>.

- Carpenter, S. (2018). Ten steps in scale development and reporting: A guide for researchers. *Communication Methods and Measures*, 12(1), 25–44. <https://doi.org/10.1080/19312458.2017.1396583>.
- Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, 14(3), 464–504. <https://doi.org/10.1080/10705510701301834>.
- covid19data.com.au. (2020). Coronavirus (COVID-19) in Australia. Coronavirus (COVID-19) in Australia. <https://www.com.au/>.
- Crawford, J., Cayley, C., Lovibond, P. F., Wilson, P. H., & Hartley, C. (2011). Percentile norms and accompanying interval estimates from an Australian general adult population sample for self-report mood scales (BAI, BDI, CRS-D, CES-D, DASS, DASS-21, STAI-X, STAI-Y, SRDS, and SRAS): Percentile norms for mood scales. *Australian Psychologist*, 46(1), 3–14. <https://doi.org/10.1111/j.1742-9544.2010.00003.x>.
- Forbes-Mewett, H. (2019). Mental health and international students: Issues, challenges and effective practice (research digest 15, p. 17). International Education Association of Australia. <https://www.ieaa.org.au/documents/item/1616>.
- Ho, S. M. Y., Kwong-Lo, R. S. Y., Mak, C. W. Y., & Wong, J. S. (2005). Fear of severe acute respiratory syndrome (SARS) among health care workers. *Journal of Consulting and Clinical Psychology*, 73(2), 344–349. <https://doi.org/10.1037/0022-006X.73.2.344>.
- Hutton, V. E., Misajon, R., & Collins, F. E. (2013). Subjective wellbeing and "felt" stigma when living with HIV. *Quality of Life Research*, 22(1), 65–73. <https://doi.org/10.1007/s11136-012-0125-7>.
- International Wellbeing Group. (2013). *Personal wellbeing index* (5th ed.). Deakin University: Australian Centre on Quality of Life <http://www.acqol.com.au/instruments#measures>.
- Jovanović, V., Cummins, R. A., Weinberg, M., Kaliterna, L., & Prizmic-Larsen, Z. (2019). Personal wellbeing index: A cross-cultural measurement invariance study across four countries. *Journal of Happiness Studies*, 20(3), 759–775. <https://doi.org/10.1007/s10902-018-9966-2>.
- Kachanoff, F. J., Bigman, Y. E., Kapsakis, K., & Gray, K. (2020). Measuring realistic and symbolic threats of COVID-19 and their unique impacts on well-being and adherence to public health behaviors. Advance online publication *Social Psychological and Personality Science*. <https://doi.org/10.1177/1948550620931634>.
- Koenig, H. G., & Büsing, A. (2010). The Duke University Religion Index (DUREL): A five-item measure for use in epidemiological studies. *Religions*, 1(1), 78–85. <https://doi.org/10.3390/rel1010078>.
- Khor, S., Fuller-Tyszkiewicz, M., & Hutchinson, D. (2020). *Australian normative data—Subjective wellbeing*. In *Personal wellbeing index manual* (6th ed.). Australian Centre on Quality of Life: Deakin University.
- Lace, J. W., & Handal, P. J. (2018). Confirming the tripartite structure of the Duke University religion index: A methodological approach. *Journal of Religion and Health*, 57(2), 704–716. <https://doi.org/10.1007/s10943-017-0556-0>.
- Lee, D. (2019). The convergent, discriminant, and nomological validity of the Depression Anxiety Stress Scales-21 (DASS-21). *Journal of Affective Disorders*, 259, 136–142. <https://doi.org/10.1016/j.jad.2019.06.036>.
- Lee, S. A. (2020). Coronavirus Anxiety Scale: A brief mental health screener for COVID-19 related anxiety. *Death Studies*, 44(7), 393–401. <https://doi.org/10.1080/07481187.2020.1748481>.
- Lovibond, S. H., & Lovibond, P. F. (1996). *Manual for the depression, anxiety*. The Psychology Foundation of Australia Inc: Stress Scales. <http://www2.psy.unsw.edu.au/dass/>.
- Misajon, R., Pallant, J., & Bliuc, A.-M. (2016). Rasch analysis of the personal wellbeing index. *Quality of Life Research*, 25(10), 2565–2569. <https://doi.org/10.1007/s11136-016-1302-x>.
- Palmer Kelly, E., Hyer, M., Payne, N., & Pawlik, T. M. (2019). A mixed-methods approach to understanding the role of religion and spirituality in healthcare provider wellbeing. *Psychology of Religion and Spirituality*. <https://doi.org/10.1037/rel0000297>.
- Pappas, G., Kiriaze, I. J., Giannakis, P., & Falagas, M. E. (2009). Psychosocial consequences of infectious diseases. *Clinical Microbiology and Infection*, 15(8), 743–747. <https://doi.org/10.1111/j.1469-0691.2009.02947.x>.
- Praharso, N. F., Tear, M. J., & Cruwys, T. (2017). Stressful life transitions and wellbeing: A comparison of the stress buffering hypothesis and the social identity model of identity change. *Psychiatry Research*, 247, 265–275. <https://doi.org/10.1016/j.psychres.2016.11.039>.
- Rosenthal, D. A., Russell, J., & Thomson, G. (2008). The health and wellbeing of international students at an Australian university. *Higher Education*, 55(1), 51–67. <https://doi.org/10.1007/s10734-006-9037-1>.
- Roser, M., Ritchie, H., Ortiz-Ospina, E., & Hasell, J. (2020). Coronavirus pandemic (COVID-19). OurWorldInData.Org <https://ourworldindata.org/coronavirus>.
- Scholten, S., Velten, J., Bieda, A., Zhang, X. C., & Margraf, J. (2017). Testing measurement invariance of the Depression, Anxiety, and Stress Scales (DASS-21) across four countries. *Psychological Assessment*, 29(11), 1376–1390. <https://doi.org/10.1037/pas0000440>.
- Sinclair, S. J., Siefert, C. J., Slavin-Mulford, J. M., Stein, M. B., Renna, M., & Blais, M. A. (2012). Psychometric evaluation and normative data for the depression, anxiety, and stress scales-21 (DASS-21) in a nonclinical sample of U.S. adults. *Evaluation & the Health Professions*, 35(3), 259–279. <https://doi.org/10.1177/0163278711424282>.
- Soong, H., & Procter, N. (2020). *COVID-19 increases risk to international students' mental health*. The Conversation: Australia urgently needs to step up. <http://theconversation.com/covid-19-increases-risk-to-international-students-mental-health-australia-urgently-needs-to-step-up-137596>.
- Stallman, H. M., Ohan, J. L., & Chiera, B. (2019). Reducing distress in university students: A randomised control trial of two online interventions. *Australian Psychologist*, 54(2), 125–131. <https://doi.org/10.1111/ap.12375>.

- Stanford, M. S., Oxhandler, H. K., & Ellor, J. W. (2019). Assessing the usefulness of the god questionnaire. *Psychology of Religion and Spirituality*. <https://doi.org/10.1037/rel0000292>.
- Stuijtzand, S., Deforges, C., Sandoz, V., Sajin, C.-T. C.-T., Jaques, C., Elmers, J., & Horsch, A. (2020). *Psychological impact of an epidemic/pandemic on the mental health of healthcare professionals: A rapid review [preprint]. In review*. <https://doi.org/10.21203/rs.3.rs-30156/v1>.
- Taylor, S., Landry, C. A., Paluszek, M. M., Fergus, T. A., McKay, D., & Asmundson, G. J. G. (2020). Development and initial validation of the COVID stress scales. *Journal of Anxiety Disorders*, 72, 102232. <https://doi.org/10.1016/j.janxdis.2020.102232>.
- Ting, I., & Palmer, A. (2020, May 4). One hundred days of the coronavirus crisis [text]. ABC News <https://www.abc.net.au/news/2020-05-04/charting-100-days-of-the-coronavirus-crisis-in-australia/12197884>.
- Ting, I., Scott, N., & Workman, M. (2020). Charting the COVID-19 spread in Australia. ABC News <https://www.abc.net.au/news/2020-03-17/coronavirus-cases-data-reveals-how-covid-19-spreads-in-australia/12060704?nw=0>.
- Weinberg, M. K., Seton, C., & Cameron, N. (2018). The measurement of subjective wellbeing: Item-order effects in the personal wellbeing index—adult. *Journal of Happiness Studies*, 19(1), 315–332. <https://doi.org/10.1007/s10902-016-9822-1>.
- World Health Organization. (2020, November 6). UNICEF and WHO call for emergency action to avert major measles and polio epidemics <https://www.who.int/news/item/06-11-2020-unicef-and-who-call-for-emergency-action-to-avert-major-measles-and-polio-epidemics>.
- World Health Organization. (n.d.). WHO disease outbreaks. WHO disease outbreaks; World Health Organization. Retrieved 6 July 2020, from <http://www.who.int/emergencies/diseases/en/>.
- Xu, H., & Tracey, T. J. G. (2017). Use of multi-group confirmatory factor analysis in examining measurement invariance in counseling psychology research. *The European Journal of Counselling Psychology*, 6(1), 75–82. <https://doi.org/10.5964/ejcop.v6i1.120>.
- Zanon, C., Brenner, R. E., Baptista, M. N., Vogel, D. L., Rubin, M., Al-Darmaki, F. R., ... Zlati, A. (2020). Examining the dimensionality, reliability, and invariance of the depression, anxiety, and stress scale–21 (DASS-21) across eight countries. *Assessment*, 107319111988744. <https://doi.org/10.1177/1073191119887449>.