Evaluation of the English version of the Fear of COVID-19 Scale and its relationship with behavior change and political beliefs.

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As the clock strikes midnight GMT on May 20th, the total number of coronavirus cases sits at 5,079,82 worldwide, with 329,179 deaths (Worldometers, 2020). Worldometers (2020) is just one of several websites offering close to real-time updates on coronavirus cases, with country-specific data allowing people to order countries by the total number of cases, total number of deaths, and rates/1,000,000 of population. Although many individuals may choose to avoid these somewhat morbid websites, the constant news coverage on coronavirus makes such information near impossible to avoid, providing people with little respite from the suffering. With news coverage emphasizing the rapid transmission and relatively high mortality rate, fearfulness is a natural response (Lin, 2020; Pappas, Kiriaze, Giannakis, & Falagas, 2009). While fear may motivate people to abide by public health messages that aim to reduce the spread of coronavirus, such as social distancing and hand washing (Harper, Satchell, Fido, & Latzman, 2020; Pakpour & Griffiths, 2020; Tannenbaum et al., 2015), it may also lead to a number of psychological (e.g., anxiety) and psychosocial (e.g., prejudice) consequences (Holmes et al., 2020; Mamun & Griffiths, 2020; Sibley et al., 2020). For example, news coverage that the virus originated in China has resulted in Asian people in Western countries experiencing increased levels of racism (Aratani, 2020; Biddle, 2020; Jan, 2020).

The first step in investigating the relationship between fear of coronavirus, and its association with psychological and psychosocial factors, and behavior change, is the development of a valid psychometric instrument. To this end, Ahorsu et al. (2020) developed the Fear of COVID-19 Scale (FCV-19S). The FCV-19S measures participant’s agreement with 7-items (e.g., “I am afraid of coronovirus-19”). The initial reliability and validity of the FCV-19S was conducted in Iranian, with Ahorsu et al. (2020) reporting sound internal consistency (*α* = .82) and concurrent validity, with the scale positively correlating (*r* = .425) with a measure of anxiety and depression. In rapid time, the FCV-19S has been translated and validated in Bangla (Sakib et al., 2020), Italian (Soraci et al., 2020), Arabic (Alyami, Henning, Krägeloh, & Alyami, 2020), Russian (Reznik, Gritsenko, Konstantinov, Khamenka, & Isralowitz, 2020), Hebrew (Bitan et al., 2020), and Turkish (Satici, Gocet-Tekin, Deniz, & Satici, 2020). Here, we present the first psychometric assessment and validation of the scale in English.

**Methods**

**Participants and Procedure**

Two samples were collected in New Zealand. Sample 1 consisted of 1,624 participants of which 1397 completed all questions used in analyses and was collected during Alert Level 4. Alert Level 4 was the highest level of lockdown imposed in New Zealand, with people instructed to stay at home and limit contact to the people that they live with (see *New Zealand Lockdown Rules* below for more detail on Alert Level 4). Sample 1 consisted of largely female participants (39.7%), who were between 18 and 88 years old (*Mean (M)* = 47.5 years; *Standard Deviation (SD)* = 16.3 years), and were largely New Zealand European (84.6%; 5.7% Maori or Pacifika, 1.8% Asian, and 7.9% other). Sample 2 consisted of 1,111 participants of which 1023 completed all questions and was collected during Alert Level 3. Level 3 immediately followed Alert Level 4, allowing people to expand their social circle to close family that they do not live with (see *New Zealand Lockdown Rules* below for more detail on Alert Level 3). Sample 2 consisted of marginally more female (69.7%) than male participants, who were between 18 and 85 years old (*M* = 42.7 years; *SD* = 13.2 years), and were largely New Zealand European (75.4%; 7.6% Maori or Pacifika, 3.4% Asian, and 13.6% other).

With respect to recruit, both samples were recruited via posts on popular Social Networking Sites and articles on several New Zealand news websites. Participants who agreed to take part in the study clicked on a hyperlink and were taken to the study webpage. The first page included a description of the study and the electronic consent forms. Participants who provided consent were then asked to complete a 15-minute survey. The study was reviewed and approved by the University of Otago Human Ethics Committee.

**Measures**

**Demographic Information**. Age, gender (male, female, other), and ethnicity were collected.

**Fear of COVID-19 Scale (FCV-19S)**. The FCV-19S is a 7-item measure of the extent to which a participant fear COVID-19 (Ahorsu et al., 2020). The scale asks participants’ to indicate the extent to which they agree with each item (e.g., “I am most afraid of coronavirus-19”) from 1 (strongly disagree) to 7 (strongly agree). Both Sample 1 (*α* = .89) and Sample 2 (*α* = .88) completed the FCV-19S.

**Perceived Vulnerability to Disease Scale (PVDS)**. The PVDS is a 15-item measure of a participant’s perceived disease vulnerability and asks them to rate from 1 (strongly disagree) to 7 (strongly agree) the extent to which they agree with each item (Duncan, Schaller, & Park, 2009). The scale has two subscales, 7 items measure perceived infectability (e.g., “I have a history of susceptibility to infectious diseases”) and 8 items measure germ aversion (e.g., “It really bothers me when people sneeze without covering their mouths”). Both Sample 1 (perceived infectability: *α* = 0.90, germ aversion: *α* = 0.71) and Sample 2 (perceived infectability *α* = 0.92, germ aversion *α* = 0.77) completed the PVDS. See Supplementary Table 1 for Confirmatory Factor Analysis.

**Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS).** The WEMWBS is a 14-item measure of mental well-being and participants are asked to indicate from 1 (none of the time) to 5 (all of the time) how often they experience each statement (e.g., “I’ve been feeling optimistic about the future”, “I’ve been feeling close to other people”) (Tennant et al., 2007). Only Sample 2 (*α* = .91) completed the WEMWBS. See Supplementary Table 2 for Confirmatory Factor Analysis.

**Lockdown Behavior.** A State of National Emergency was declared in New Zealand on March 25 2020, providing the New Zealand Government with access to “…extra-ordinary powers that will support delivery of an effective and timely response to COVID-19” (Ardern, 2020). In brief, this allowed the implementation of a 4-level Alert System. Alert Level 4 was implemented between March 26 and April 27, with all businesses (expect essential services) and educational facilities closed. Further, a set of rules regarding personal movement were implemented, with people instructed to stay home, only associate with those they live with, and limit travel to their local area. Alert Level 3 immediately followed Alert Level 4, implemented between April 28 and May 3. Alert Level 3 allowed some businesses and educational facilities to open. Social contact, however, was still severely limited, with people only allowed to extend their social circle to close family they do not live with. To assess whether participants abided by New Zealand’s Lockdown Rules, participants were asked to indicate from 1 (strongly disagree) to 7 (strongly agree) whether they abided by five rules (e.g., “I ensure I maintain the 2-meter rule when out in public”) (Table 4).

**Political Beliefs**. Given recent work suggesting COVID-19 has become highly politicized in the United States (Conway, Woodard, Zubrod, & Chan, 2020; Rothgerber et al., 2020), we included a single exploratory item to assess participants’ political beliefs (Jost, 2006; Sibley & Wilson, 2007). Specifically, following Sibley and Wilson (2007), participants were given the instructions “Often, people use the terms “liberal” or “conservative” to describe their political beliefs. How would you rate yourself in these terms?” (p. 75). Participants responded on a scale ranging from 1 (very liberal), to 4 (moderate), through to 7 (very conservative).

**Data Analysis**

Descriptive statistics were used to describe the study participants’ characteristics. In addition, we report the skewness, kurtosis, and distributions of each scale item in the FCV-19S, the internal consistency (Cronbach’s alpha), and inter- and item-total correlations. We conducted a Confirmatory Factor Analysis using Maximum Likelihood estimation to measure the factor structure of the FCV-19S and report the factor loadings and the goodness of fit (Root Mean square error of approximation (RMSEA where good fit is typically less than 0.1), and Comparative Fit Index (CFI where good fit is typically more than 0.9). Finally, to test the concurrent validity, we used Pearson’s R correlations to measure the relationship between the FCV-19S and the PVDS (Samples 1 and 2) and the WEMWBS (Sample 2).

Most published psychometric reports have focused on classical test theory. The use of classical test theory, in which raw scores, linear combinations of these scores, and responses that are ordinal in scale, are usually considered as data on an interval scale. Rasch analysis is a statistical technique traditionally for binary data but some polytomous generalizations can also be used for interval data (Lin, Broström, Nilsen, Griffiths, & Pakpour, 2017). Standard Rasch analyzes are based on unidimensional models. In unidimensional models, it is assumed that only one hidden feature of the person determines the person's performance in the questionnaire. If the data does not fit well with the Rasch model, the unidimensional assumption is rejected. This means that more than one hidden feature has affected a person's performance, so the feature cannot be measured well using this questionnaire (i.e. FCV-19S) (Lin & Pakpour, 2017). Rasch analysis using the partial credit model was used to assess the unidimensionality and item fits of the FCV-19S (Masters, 1982). Item validity was assessed using Information-weighted fit statistic (infit) mean square (MnSq), and outlier-sensitive fit statistic (outfit) MnSq with values between 0.5 and 1.5 were considered acceptable fit. The presence of disordering threshold in the FCV-19S was assessed by using average and step measures of the descriptors. A monotonic increase in difficulties between 0.5 and 1.5 suggests no disordering.

The unidimensionality of the FCV-19S was examined by conducting principal component analysis of the residuals (PCAR) on the items. Explaining at least 50% of the variance in the Rasch dimension and an eigenvalue of less than 2.0 on 1st contrast provide the evidences of unidimensionality (Linacre, 2012). The response pattern across subgroups of the population (age and gender groups) were assessed by Differential Item Functioning (DIF).

All analyses were conducted in R (version 4.0.0; R Core Team, 2019) using LAVAAN (Rosseel, 2012) and WINSTEPS 3.71 software (Linacre, 2012).

**Results**

Table 1 shows the descriptive statistics for Sample 1 and 2. As seen in Table 1, for Samples 1 and 2 respectively, the mean FCV-19S score was 15.6 and 18.3 (SD = 7.7 and 7.9), PVD was 57.0 and 58.5 (SD = 10.9 and 14.0), and WEMWBS was 49.1 (SD = 8.7). Table 2 shows the summary statistics and item analysis for each scale item in the FCV-19S (mean item scores, standard deviation, skew, kurtosis, item difficulty, item discrimination, and internal consistency if item was deleted). As seen in Table 2, item 3, 6 and 7 were not normally distributed (indicated by a Skew and Kurtosis falling outside of the -2 to 2 range), due to the fact that most participants “strongly disagreed” with these items. Finally, the internal consistency if an item was deleted ranged from .84 to .86, suggesting that dropping any item in the scale would not improve overall internal consistency.

CFA of the FCVS-19 scale showed good fit with CFI of 0.90 for Sample 1 and 0.92 for Sample 2 (Table 3). RMSEA was slightly higher than levels indicative of good fit, with RMSEA of 0.16 for Sample 1 and 0.13 for Sample 2, where a traditional cutoff of good fit is normally less than 0.1. However, both studies did independently support a similar level of fit and all significantly loaded onto the same latent factor with standardized loadings between 0.6 and 0.8.

All items fitted well with their latent construct as the infit and outfit MNSQ were within acceptable range (0.5–1.5) in both samples. The most difficult item for Sample 1 and Sample 2 was “my hands become clammy when I think about coronavirus-19”. In contrast, the easiest item of Sample 1 and Sample 2 was “I am most afraid of coronavirus-19”. A monotonic increase in threshold values (i.e. h average and step measures) for item difficulties (i.e. the seven-point Likert scales) were found in both samples. No DIF was seen across gender and age subgroups of both Sample 1 and Sample 2 (i.e., DIF contrasts < 0.5). The Rasch dimension demonstrated that the FCV-19S explained 64.2% and 67.2% of the variance in both general and student samples, with eigenvalues of 12.57 and 14.32, respectively. The first contrasts gave eigenvalues of 1.84 and 1.74 for both Sample 1 and Sample 2, respectively.

To measure concurrent validity, we correlated the FCV-19S with perceived vulnerability to disease (Sample 1 and 2) and wellbeing (Sample 2). The FCV-19S demonstrated good concurrent validity. Specifically, there was a moderately strong relationship between the FCV-19S and the two subscales of perceived vulnerability to disease scale: perceived infectability (Sample 1: *r* = 0.35, *p* < 0.001; Sample 2: *r* = 0.40, *p* < 0.001) and germ aversion (Sample 1: *r* = 0.39, *p* < 0.001; Sample 2: *r* = 0.45, *p* < 0.001). In addition, there was a negative relationship between FCV-19S and the WEMWBS (*r* = -0.31, *p* < 0.001), such that those who had higher fear scores reported lower overall wellbeing scores. Finally, when assessing participants’ adherence to New Zealand’s Lockdown Rules, FCV-19S was significantly associated with adherence with all five rules during Alert Level 4 (Sample 1) and three of the five rules during Alert Level 3 (Sample 2) (Table 4).

Finally, consistent with the view that COVID-19 has become a politicized topic, there were modest negative correlations between the FCV-19S scores and political beliefs (Sample 1: *M* = 3.74, *SD* = 1.49, *rho* = -.20, *p* < .001; Sample 2: *M* = 2.57, *SD* = 1.15, *rho* = -.07, *p* = .014). That is, participants that rated themselves as more toward the conservative end of the political spectrum recorded lower FCV-19S scores.

**Discussion**

The primary aim of the current study was to evaluate the English version of the FCV-19S. Across two large samples, the FCV-19S had high internal consistency. Mirroring the Bangla (Sakib et al., 2020), Italian (Soraci et al., 2020), Arabic (Alyami et al., 2020), and Hebrew (Bitan et al., 2020) validations studies, however, participants tended to “strongly disagree” with items 3, 6, and 7. As Alyami et al. (2020) note, items 3, 6, and 7, refer to somatic responses to COVID-19 fear (e.g., “My heart races or palpitates when I think about getting coronavirus-19”), rather than the more general level of fear tapped by the remaining items (e.g., “When watching news and stories about coronavirus-19 on social media, I become nervous or anxious”). Despite this, there was little evidence deleting items would improve the internal consistency of the scale.

Consistent with the earlier validation studies, the FCV-19S displayed a moderately strong relationship with the perceived infectability and germ aversion subscales of the PVD scale (Duncan et al., 2009). Further, the FCV-19S scores were negatively correlated with the WEMWBS, reflecting the fact that as fear of COVID-19 increased wellbeing decreased. This finding is consistent with previous studies reporting positive correlations the FCV-19S and the Hospital Anxiety and Depression Scale (Ahorsu et al., 2020; Alyami et al., 2020), Patient Health Questionnaire (Sakib et al., 2020), and the Depression and Anxiety Stress Scale (Bitan et al., 2020).

With respect to the motivating role of fear, there was a significant relationship between FCV-19S scores and adherence to the lockdown rules that were implemented in New Zealand (Harper et al., 2020; Pakpour & Griffiths, 2020; Tannenbaum et al., 2015). For example, fear of COVID-19 was associated with participants maintaining the 2-meter rule (i.e., maintain 2-meter distance from other people when out in public) and keeping physical to outdoor places that can be readily accessed by foot. This finding is consistent with Harper et al. (2020), who reported a positive correlation between FCV-19S scores and participants judgement of the degree to which several behaviors and practices had changed due to the pandemic (e.g., hand washing, child and elder care, etc.).

Finally, consistent with the view that the politicization of COVID-19 is not limited to the US, participants that rated themselves as more conservative displayed lower FCV-19S scores than participants that rated themselves more toward the liberal end of the political spectrum. Although conservative politicians in New Zealand have not gone as far US President Donald Trump, who early on referred to the virus as a hoax (Franck, 2020), they have argued that the liberal government should reduce alert levels more quickly, effectively communicating a lower level of risk (Burrows, 2020; Coughlan, 2020). Indeed, in the US, Rothgerber et al. (2020) demonstrated that perceptions of health risk (e.g., the likelihood of being infected with COVID-19) mediated the relationship between conservatism and abiding by social distancing rules.

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