

An evaluation of the psychometric properties of the Fear of COVID-19 Scale in a sample of help-seeking men

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Abstract

Aim: The Fear of COVID-19 Scale is a widely used measurement tool for related anxieties, however previous studies validating the scale report varying fit indices, often below accepted cut-off points. This suggests re-specification of the scale may be required. The present study aimed to examine the psychometric properties of the English-version of the Fear of COVID-19 Scale in a population of help-seeking males using exploratory (EFA) and confirmatory factor analysis (CFA).

Material and methods: Data from 621 males aged 18–80 years (mean=38.23, SD=13.59) was collected via a cross-sectional open online survey. Along with the 7-item Fear of COVID-19 Scale, the PHQ-4 and PROMIS Anger Short Form were used to measure probable anxiety, depression and anger. Data were randomly partitioned into two subsamples and separate factor analyses were conducted with robust CFA corrections applied for non-normality.

Results: A 4-item single-factor version of the scale was identified reporting excellent model fit (R-RMSEA=.033, R-CFI=.998, R-TFI=.997, SRMR=.012) and good internal consistency ($\alpha=.86$). Age and probable anxiety effects were observed.

Discussion: Relative to existing validation studies of the Fear of COVID-19 Scale, the present study provides improved psychometrics of the 4-item version of the scale, while scale means observed were comparable to other studies.

Conclusion: This study validates a 4-item version of the Fear of COVID-19 Scale to assess related anxieties in a help seeking male population. Future research should seek to validate the 4-item version in other sub-populations.

COVID-19; anxiety; exploratory factor analysis; confirmatory factor analysis; men's mental health

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The negative worldwide impact of the SARS-CoV-2 novel coronavirus (COVID-19) has been far reaching. As health systems struggle to ensure the wellbeing of infected individuals, the direct physical health impact of the pandemic has been ever present, with close to four million deaths observed globally as of June 2021 [1]. Alongside the impacts of this death toll, governments have had to enact strategies contain the

virus and abate community transmission. Chief among these strategies in many nations has been the implementation of strict lockdown measures, where individuals have been forced into physical isolation and countless points of public access have been required to close. The implementation and persistence of these measures has prompted consideration of the mental health impacts [2,3].

The largest enforced isolation period in human history has posed a major threat to individuals' mental health and led to the proliferation of widespread psychological distress, fuelled by existential threats of health and death anxiety, uncertainty about the future, and loneliness [4,5]. These conditions have meant that many individuals have been unable to work, connect with others, or engage in other mental health promotion activities that necessitate social contact [6]. A wealth of research since the beginning of the pandemic has examined rates of common mental ill-health symptoms, including depression and anxiety. Longitudinal research in Europe and the United Kingdom comparing levels of psychological distress before the pandemic to those observed during stay-at-home orders, has indicated a marked rise in the proportion of people experiencing levels of distress that meet clinical thresholds [7,8]. For anxiety specifically, a recent meta-analysis of 43 studies indicated an anxiety prevalence of 25% during the COVID-19 period [9]; over three times higher than the estimated worldwide prevalence prior to the pandemic (7.3%; [10]). In the absence of specific scales that assess anxiety directly related to COVID-19, such research has commonly utilized well-established measures of generalized anxiety, including the Beck Anxiety Inventory [11], the Depression Anxiety Stress Scale [12], and the Hospital Anxiety and Depression Scale [13]. Yet moving forward, there is a need for reliable and valid measures that allow us to specifically understand manifestations of COVID-19-specific anxiety as a distinct clinical construct, such that we can gauge (ideally over time) risk and protective factors to peoples' wellbeing as the pandemic continues.

Previous research focusing on mental health during the pandemic has also largely examined demographic correlates of psychological distress in terms of between-group differences

(such as comparing men and women). Particularly concerning anxiety, one Turkish study reported elevated levels of anxiety among women but not men [14]. To better understand the gendered mental health effects of COVID-19 at a more nuanced level, there is a need for within-group research to identify particular at-risk groups of individuals. Given the proportionally higher death rate experienced by men diagnosed with COVID-19 [15], potentially elevated COVID-19-related distress may be seen in this population. This might especially apply to younger men who may be more likely to be negatively affected economically, and men working in male-dominated industries drastically impacted by social distancing requirements [16]. Moreover, retrenchment from employment is a well-established risk factor for psychological distress and suicidality in men [17], highlighting a need to understand COVID-19 related anxiety in men given the increased rates of unemployment precipitated by the pandemic worldwide.

Concerning measurement of COVID-specific anxiety, the Fear of COVID-19 Scale (FCV-19S; [18]) was originally validated as a single-factor 7-item self-report scale, and has become a widely used measurement tool for COVID-19-related anxiety. That said, sub-population validation of the Fear of COVID-19 Scale is limited, especially studies reporting comparative exploratory and confirmatory factor analyses (CFA) with suitably powered subsamples. While some studies have reported model fit indices for the FCV-19S (see below), only one published study has reported a CFA analysis based on the English language version (e.g., Winter and colleagues [19]). Specifically, Winter and colleagues reported data from two large New Zealand samples (n 's = 1,397 and 1,023); however, model fit indices of the single-factor model were below accepted cut-offs. This suggests that the original 7-item version shows poor model fit and requires re-specification.

Several studies that have translated the English FCV-19S reporting varying model fit indices — with many being below accepted values (e.g., $<.05$ for RMSEA and SRMR, and $>.95$ for CFI and TLI) — calling into question the psychometric validity of the scale [20-24]. Some studies have reported acceptable model fit for the FCV-19S, albeit with correlated error variance suggestive of model misspecification [25-27]. Exceptions to

this include Spanish studies by García-Reyna and colleagues [28] and Piqueras and colleagues [29]. García-Reyna reported excellent model fit indices for the 7-item scale in a sample of 2,860 hospital staff from Mexico, though the overarching chi-square test was significant, suggesting potential model misspecification [28]. Similarly, Piqueras and colleagues reported excellent model fit indices among 1,146 participants from Spain and the Dominican Republic, though the chi-square test was not reported [29].

Four additional studies have validated a two-factor FCV-19S structure, including a bi-factor analysis in support of using the general factor (e.g., total score). These studies were conducted with sufficiently large samples of 1,291 Argentinians [30], 832 Peruvians [31], 629 Japanese adolescents [32], and 1,700 Chinese respondents [33]. In each case, contrasting the original single-factor structure [18], these studies evaluated models testing a 7-item two-factor model assessing; i) emotional fear reactions, and ii) somatic expressions of fear.

Despite significant global uptake of the FCV-19S, only one study using the English version has examined model fit [19], which reported unsatisfactory indices. Hence, the aim of this study was to address the gap in psychometric data for the scale. Ensuring the FCV-19S is both valid and reliable in this population is therefore critical. Using a large sample of help-seeking men, we evaluated the psychometric properties of the FCV-19S using exploratory and confirmatory factor analysis, examining potential differences in relation to Fear of COVID-19 according to age, and a probable diagnosis of generalised anxiety disorder.

METHOD

Participants

Data was provided by 621 males, aged 18-80 years ($M=38.23$, $SD=13.59$). Participants were recruited online via the *HeadsUpGuys* website (<https://headsupguys.org>), described below.

Measures

FCV-19S [18]. The FCV-19S is a 7-item measure designed to assess the extent to which a person

fears COVID-19. The scale asks participants to indicate the extent to which they agree to each item (e.g. 'I am afraid of losing my life because of coronavirus – 19') from 1 (strongly disagree) to 7 (strongly agree). Higher scores indicate higher levels of fear of COVID-19. Cronbach alpha reliability for the full sample was .89.

Patient Health Questionnaire-4 [34]. The PHQ-4 is a brief screening measure to assess anxiety and depression in the general population and primary care. The scale asks participants to answer the frequency of specific symptoms over the preceding two weeks (e.g., 'Over the last 2 weeks, how often have you been bothered by feeling nervous, anxious or on edge?'), from 0 (not at all) to 3 (nearly every day). The scale produces a total score and two subscale scores; one for anxiety and one for depression (2 items per subscale) where higher subscale scores indicate higher anxiety and depression. The scoring categories for the subscales are 'Severe' (score range 9-12), 'Moderate' (6-8), 'Mild' (3-5), and 'Normal' (0-2) risk of anxiety or depression (e.g., domain scores ≥ 3 reflect probable anxiety or depression respectively). Cronbach alpha reliability of the total score for the full sample was $\alpha=.87$.

PROMIS Emotional Distress – Anger, Short Form [35]. The Patient-Reported Outcomes Measurement Information System (PROMIS) Emotional Distress-Anger Short Form is an 8-item measure that assesses the domain of anger in adults > 18 years-old. The scale asks participants to indicate how often they have been bothered by the following (e.g. 'I was irritated more than people knew') during the past 7 days rated using a four-point scale anchored by 1 (never) and 5 (always). Higher scores indicate higher levels of emotional distress/anger. Cronbach alpha reliability for the full sample was .89.

Procedure

Participants were recruited into a cross-sectional open survey online via the *HeadsUpGuys* website (<https://headsupguys.org>). The survey was open from April 1 to May 30, 2020. *HeadsUpGuys* is a leading global resource for men, providing information about depression and professional services [36]. Prospective participants were taken to the independent survey

webpage hosted by Qualtrics, and presented with the informed consent page. Eligibility criteria included being 18 years or older, having online access, being able to read and understand English, and self-identifying as male. No exclusion criteria were specified. A prize draw of \$500 (CAD) was included. Following the provision of informed consent, participants completed the survey online. Ethics approval for the study was granted by the Behavioural Research Ethics Board at the University of British Columbia (H20-01401).

Data analysis

Analyses were undertaken in SPSS Statistics 26.0 and Stata 15.0. To accommodate expected revisions to the FCV-19S, we partitioned the full dataset into two samples using a random number generator in SPSS. In the first sample, we conducted a parallel analysis to determine the number of factors within the scale, and then undertook exploratory factor analysis (EFA; principal axis factoring) with direct oblimin rotation enabling factors to correlate. Factor loadings below .32 were suppressed and any cross-loading items omitted [37], as were any factors with a solitary loading item. Following identification of the EFA solution, we undertook confirmatory factor analysis (CFA) using data from the second sample. We used the accepted val-

ues of RMSEA and SRMR $<.05$, and CFI and TLI $>.95$ to indicate model fit [38], and reported corresponding AIC and BIC values. To account for non-normality of Sample 2 (Doornik-Hansen $\chi^2(14)=336.60$, $p<.001$) we applied the robust Sattora-Bentler corrected goodness of fit indices for the RMSEA, CFI and TLI [39] in Stata. We also evaluated the 7-item 2-factor model identified in previous research (c.f. [30-33]). Reliability indices for Sample 2 were calculated using Cronbach's alpha and McDonald's omega coefficients, non-parametric (Spearman) correlations explored associations with symptom domains, dependent z-tests determined significant differences in the magnitude of correlations. Multivariate analysis (MANOVA) was undertaken separately on Samples 1 and 2 to examine age (18-39 years versus 40+ years) and probable anxiety effects (PHQ-4 <3 versus PHQ-4 ≥ 3) for the FCV-19S items, with effect sizes reported using partial eta-squared.

RESULTS

The demographic profiles of the Samples 1 and 2 were equivalent, with the exception of the Emotional Distress Scale (anger), where scores were marginally higher ($d=0.18$) for Sample 1 (see Table 1). The mean PHQ-4 score of 6.53 and 6.46 respectively placed participants in the moderate range, on average, for depression/anxiety.

Table 1. Demographics by sample.

	Sample 1 (n=309)	Sample 2 (n=312)	Inferential	p-value
Age (years)	37.68 (13.09)	38.78 (14.06)	$t=1.01$, $df=619$	.315
Country	% (n)	% (n)	$\chi^2=1.22$, $df=4$	.874
Canada	70.5 (217)	69.8 (217)	–	–
US	18.2 (56)	20.9 (65)	–	–
Other	11.3 (35)	9.3 (29)	–	–
Sexuality	% (n)	% (n)	$\chi^2=5.09$, $df=3$	.165
Heterosexual	70.2 (217)	66.0 (206)	–	–
Gay	16.5 (51)	23.1 (72)	–	–
Bisexual	10.0 (31)	7.4 (23)	–	–
Other	3.2 (10)	3.5 (11)	–	–
Relationship status	% (n)	% (n)	$\chi^2=5.16$, $df=5$	.397
Single	46.3 (143)	50.6 (158)	–	–

Committed	22.3 (69)	18.9 (59)	–	–
Married	31.4 (97)	30.4 (95)	–	–
Education	% (n)	% (n)	$\chi^2=1.98, df=4$	.739
High school	15.2 (47)	13.5 (42)	–	–
Some college	22.7 (70)	21.8 (68)	–	–
Technical diploma / trade	17.8 (55)	16.0 (50)	–	–
Undergraduate	26.2 (81)	31.1 (97)	–	–
Postgraduate	9.0 (56)	8.9 (55)	–	–
Employment	% (n)	% (n)	$\chi^2=6.28, df=5$	.280
Full-time	51.5 (159)	54.2 (169)	–	–
Part-time	10.4 (32)	12.8 (40)	–	–
Not working	43.0 (133)	33.0 (103)	–	–
Psychosocial domains	% (n)	% (n)	–	–
Previous counselling (yes)	29.1 (181)	32.4 (201)	$\chi^2=2.24, df=1$	.134
Current family doctor (yes)	74.1 (229)	74.7 (233)	$\chi^2=0.26, df=1$	.871
Symptom domains	M (SD)	M (SD)	–	–
PHQ-4	6.53 (3.51)	6.46 (3.53)	$t=0.28, df=619$	.780
Anger	16.04 (4.11)	15.27 (4.34)	$t=2.29, df=619$	.022
Fear of COVID-19 (7-item)	16.31 (6.11)	16.03 (6.08)	$t=0.58, df=619$	.660
Fear of COVID-19 (4-item)	8.52 (3.59)	8.27 (3.52)	$t=0.88, df=619$	.378

EFA (Sample 1): Parallel analysis indicated a 3-factor solution. Accordingly, a 3-factor EFA solution was imposed on the data (KMO=.888, Bartlett's test of sphericity $p<.001$), which converged in 11 iterations. The item "It makes me uncomfortable to think about Coronavirus-19" (Item

2) loaded on a single factor, and hence this item was deleted. The parallel analysis was rerun, which yielded a 2-factor solution. The EFA was rerun (KMO = .880, Bartlett's test of sphericity $p<.001$), converging in 6 iterations, accounting for 61.71% of the total variance (see Table 2).

Table 2. Fear of COVID-19 Scale item descriptive statistics and EFA loadings with direct oblimin rotation.

Item	M(SD)	Factor 1	Factor 2
7 My heart races or palpitates when I think about getting Coronavirus-19	1.88 (1.06)	.972	-.108
3 My hands become clammy when I think about Coronavirus-19	1.72 (0.90)	.697	.006
5 When watching news and stories about Coronavirus-19 on social media, I become nervous or anxious	2.81 (1.26)	.641	.108
6 I cannot sleep because I'm worrying about getting Coronavirus-19	1.86 (0.96)	.617	.238
4 I am afraid of losing my life because of Coronavirus-19	2.32 (1.25)	-.018	.854
1 I am most afraid of Coronavirus-19	2.72 (1.18)	.070	.657
Percentage variance	–	56.96%	4.75%

Note. Factor extraction undertaken with principal axis factoring

CFA (Sample 2): The 6-item, 2-factor model identified in Sample 1 was subsequently tested using CFA. The 6-item version was compared to the original single-factor 7-item version, and the

two-factor 6-item. Given previous literature recommends factors to include ≥ 3 -items to ensure stable reliability estimates [40], we also explored a version omitting the factor comprising 2-items

(e.g., a single-factor 4-item version). As can be seen from Table 3, all model fit indices were noticeably better for the 4-item version relative to comparators. Of note, the 4-item model was the only version with a non-significant scaled chi-square value which indicates it was the only

model to reproduce the observed covariances among the items and fit the data well. Indices in Table 3 suggest that the 4-item model should be retained over others as it offers improved interpretability relative to the original 7-item version, or the 7-item two-factor model.

Table 3. CFA model fit indices for the Fear of COVID-19 Scale (n=312).

Model ^a	Scaled χ^2 (p)	df	RMSEA-robust	CFI-robust	TFI – robust	SRMR	AIC	BIC
Original 7-item	86.44 (<.001)	14	0.142	.930	.895	.052	5632.09	5710.70
Two-factor 6-item	13.63 (.092)	8	0.050	.993	.987	.024	4753.51	4824.63
Two-factor 7-item	53.81 (<.001)	13	0.109	.957	.931	.040	5595.47	5677.82
Uni-factor 4-item	2.58 (.275)	2	0.033	.998	.997	.012	3049.46	3094.38

Note. Using Satorra-Bentler scaled χ^2 and robust corrected RMSEA, CFI and TFI values.

Robust Satorra-Bentler adjusted CFA factor loadings for the single-factor 4-item version were all high. As can be seen from Figure 1, each item loaded on the Fear of COVID-19 latent variable at .70 or greater.

Internal consistency: Cronbach alpha reliability values were acceptable for all versions: For the 7-item $\alpha=.89$; for the 4-item (and factor 1 of 6-item) $\alpha=.86$; and for factor 2 of the 6-item $\alpha=.77$. McDonald’s omega values were conducted from the single-factor versions; 4-item version =.86, original 7-item version =.89.

Non-parametric associations: The 4-item version of the FCV-19S was strongly correlated with the full 7-item version ($r_s=.94, p<.001$), indicating 88.36% of shared variance and little conceptual information lost between the two scale versions. The 4-item version demonstrated a stronger relationship with the PHQ-4 total score (7-item $r_s=.14, p=.017$; 4-item $r_s=.203, p<.001$), with this difference statistically significant ($z=19.01, p<.001$). The 4-item also reported a stronger correlation with the anxiety items of the PHQ-4 (7-item $r_s=.22, p>.001$; 4-item $r_s=.29, p<.001$), with this difference statistically significant ($z=18.49, p<.001$). Neither versions correlated with the depression items of the PHQ-4 ($p's>.05$). The 4-item version was correlated with the anger scale

($r_s=.15, p=.006$), whereas the 7-item version was not ($r_s=.09, p=.107$).

Age and anxiety effects: Multivariate analysis for Sample 1 indicated significant main effects of age ($\Lambda=.966, F(302, 4)=2.67, p=.032, \eta^2=.034$) and probable anxiety ($\Lambda=.816, F(302, 4)=17.02, p<.001, \eta^2=.184$). While age-based univariate effects failed to reach significance, univariate anxiety effects were marked, with three items achieving medium sized effects (see Table 4). Similar effects were observed for Sample 2 where multivariate main effects of age ($\Lambda=.960, F(305, 4)=3.20, p=.013, \eta^2=.040$) and probable anxiety ($\Lambda=.914, F(305, 4)=7.17, p<.001, \eta^2=.086$) were seen (see Table 4). Younger men and men with probable anxiety tended to report higher scores. There was no age \times anxiety multivariate interaction. For age, univariate effects were observed for items 5 and 7, with small effects observed. For probable anxiety, univariate effects were observed for all items, again with small magnitude effects.

Table 4. Mean (SD) for age and anxiety effects for Fear of COVID-19 items and total score

Sample 1	Age effects			Anxiety effects		
	18-39 (n=177)	40+ (n=135)	Univariate F, p, η^2	No anxiety (n=156)	Probable anxiety (n=156)	Univariate F, p, η^2
Item 3	1.80 (0.95)	1.62 (0.81)	3.12, .079, .010	1.58 (0.75)	1.87 (1.01)	8.63, .004, .027
Item 5	2.98 (1.28)	2.59 (1.19)	7.32, .007, .023	2.52 (1.16)	3.10 (1.29)	17.68, <.001, .054

Item 6	1.87 (0.98)	1.84 (0.94)	0.09, .765, .000	1.60 (0.80)	2.11 (1.05)	23.09, <.001, .069
Item 7	1.99 (1.15)	1.73 (0.92)	4.50, .035 , .014	1.59 (0.84)	2.17 (1.17)	24.89, <.001, .074
Sample 2	18-39 (n=190)	40+ (n=119)	Univariate F, ρ, η^2	No anxiety (n=143)	Probable anxiety (n=166)	Univariate F, ρ, η^2
Item 3	1.83 (0.95)	1.71 (0.88)	1.19, .277, .004	1.51 (0.70)	2.02 (1.02)	25.75, <.001, .077
Item 5	2.92 (1.32)	2.70 (1.14)	2.32, .136, .007	2.28 (1.06)	3.31 (1.21)	61.92, <.001, .168
Item 6	1.84 (1.02)	1.97 (1.00)	1.27, .261, .004	1.52 (0.74)	2.21 (1.10)	40.07, <.001, .115
Item 7	2.04 (1.12)	1.96 (1.05)	0.44, .501, .001	1.58 (0.87)	2.38 (1.13)	47.67, <.001, .134

Note. Bolded values indicate $p < .05$

DISCUSSION

The present study provides validation of a short form of the FCV-19S in a population of mental health help-seeking males. The findings show that a 4-item single-factor version of FCV-19S has good internal consistency, high factor loadings and fit indices that outperformed those of the initial 7-item scale. It is therefore suggested that the 4-item version of the FCV-19S may be a more robust measure that should be retained and utilized over other alternatives (and tested in other sub-samples) to measure COVID-19 related anxiety.

Across both Samples 1 and 2, multivariate age and anxiety effects were established. Younger men and men with probable anxiety reported higher scores on the 4-item FCV-19S, indicating higher COVID-19 fear levels. While COVID-19 presents increased mortality risk in older populations [41], higher fear of COVID-19 in younger men may reflect study and employment concerns and financial instability fears, which can severely impact younger populations. Younger populations have reported more significant loneliness during lockdowns and restrictions than older populations [42], contributing to COVID related anxieties. Moreover, while previous research has found elevated levels of anxiety during the pandemic in women [14], the present results highlight that fear of COVID-19 manifests as a clinically-meaningful anxiety presentation in help-seeking males, particularly among younger men. The specific measurement of fear of COVID-19 as opposed to the more generalised anxiety measures applied in previous research might have contributed to the observed

results [9]. This could be due to the explicit connection between COVID-19 and unemployment which may invoke considerable psychological distress in men. Further, men in previous research have been known to under-report anxiety when measured in a generalised sense [43].

The current research presents one of the few psychometric studies of the FCV-19S to undertake both an EFA and CFA analysis, and the only study to do so with the English version of the scale. Of the previous studies that have undertaken both EFA and CFA analysis, some used the same sample for both analyses (e.g., [25,27,28]), which is advised against as it generates overly optimistic model fit indices [44]. The 4-item version presented here, however, offers a more parsimonious option that can be used in assessing COVID-19 related fear.

The 4-item version of the FCV-19S indicated extremely good model fit (R -RMSEA = .033, R -CFI = .998, R -TFI = .997, SRMR = .012), outperforming the 7-item version validated by other studies. For example, Winter and colleagues [19] report a CFI of .90 and .92, and a RMSEA of .16 and .13 respectively for their two samples, both being out of the accepted range for CFA model fit. García-Reyna and colleagues [28] report model fit statistics for the 7-item version in Spanish (CFI = .99, $RMSEA$ = .03, $SRMR$ = .010) that are similar to our findings for the 4-item version; however, the significant chi-square for their model suggests potential model misspecification. Conversely, CFA of the 4-item version validated in the present study had a non-significant chi square, indicating overall improved model fit. Piqueras and colleagues [29] also validated the 7-item version, again with inferior fit

statistics to our 4-item version (CFI=.982, RMSEA=.058, SRMR=.022). Overall, the 4-item version has demonstrated superior model fit when compared to the widely used 7-item measure, and future research should endeavor to provide further validation of this option on different sub-populations.

In comparison to other studies we observed means of 16.31 and 16.03 for Samples 1 and 2 respectively for the original 7-item scale, which are consistent with multiple previous studies that report means between 15.17 and 18.3 (e.g., [19, 25, 29, 45, 46]). This indicates that the current sample is similar in levels of COVID-19 related fear to other global populations. Some variation is apparent in the literature, with sample means ranging from 13.39 [47] to 21.68 [24], suggesting that fear of COVID-19 may differ in populations depending on geographic location and the severity of the pandemic in different areas.

Validating the FCV-19S in sub-populations is important as individuals may respond to items diversely, based on pre-existing attitudes and personal experiences. The validation of the FCV-19S in a help-seeking male population is particularly relevant due to the negative effect of the COVID-19 pandemic on mental health [48] and specifically for men with pre-existing mental illness such as anxiety and depression [49, 50]. Notably, we observed stronger associations between the 4-item version of the FCV-19S and the PHQ-4 domains relative to the initial 7-item version, suggesting that the 4-item version may provide a more accurate assessment of the mental health effects of COVID-19-related anxiety, and may be a more useful tool for researchers and clinicians in measuring this construct.

The present study has some limitations. Data for this study were collected via an online self-report survey and therefore clinical diagnostic information regarding anxiety and depression levels is not available. As with all COVID-19 research, it is also important to note that survey responses are likely influenced by the local severity of COVID-19 at the time of data collection, and therefore may not be reflective of attitudes towards COVID-19 elsewhere or across the span of the pandemic and into the future. Additionally, the sample under study here were from a population of help-seeking men, whose experiences of COVID-related anxiety may not

be generalisable to those of men more broadly. It is recommended that future research is undertaken with the 4-item version validated in this study, to examine the factor structure further and determine whether it has superior fit over competing models in other sub-populations. Given the 4-item version was highly correlated ($r>.9$) with the 7-item version, we suggest that it offers a more parsimonious assessment option which may be particularly attractive to researchers using the scale in ecological momentary assessment studies.

This work contributes to the body of growing literature on the effect of the COVID-19 pandemic on mental health by providing validation of a short form of the English version of the FCV-19S in a population of help-seeking males who may be particularly vulnerable to the social, financial and mental health impacts of COVID-19.

Declarations

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REFERENCES

1. World Health Organisation. WHO Coronavirus (COVID-19) dashboard. 2021. Retrieved from: <https://covid19.who.int/>
2. Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, Ballard C, Christensen H, Silver RC, Everall I, Ford T. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *Lancet Psychiat*. 2020.
3. Bauld CM, Letcher P, Olsson CA. Supporting the dying and bereaved during COVID-19. *Aust Psychol*. 2021; 1-5.
4. Killgore WD, Cloonan SA, Taylor EC, Dailey NS. Loneliness: A signature mental health concern in the era of COVID-19. *Psychiat Res*. 2020; 290: 113-117.

5. Menzies RE, Menzies RG. Death anxiety in the time of COVID-19: theoretical explanations and clinical implications. *Cog Behav Ther.* 2020; 13.
6. Wright L, Steptoe A, Fancourt D. Are we all in this together? Longitudinal assessment of cumulative adversities by socioeconomic position in the first 3 weeks of lockdown in the UK. *J Epidemiol Community Health.* 2020 Sep 1;74(9):683-8.
7. Pierce M, Hope H, Ford T, Hatch S, Hotopf M, John A, Kontopantelis E, Webb R, Wessely S, McManus S, Abel KM. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiat.* 2020; 7(10): 883-92.
8. Shanahan L, Steinhoff A, Bechtiger L, Murray AL, Nivette A, Hepp U, Ribeaud D, Eisner M. Emotional distress in young adults during the COVID-19 pandemic: Evidence of risk and resilience from a longitudinal cohort study. *Psychol Med.* 2020; 1-10.
9. Santabábara J, Lasheras I, Lipnicki DM, Bueno-Notivol J, Pérez-Moreno M, López-Antón R, De la Cámara C, Lobo A, Gracia-García P. Prevalence of anxiety in the COVID-19 pandemic: An updated meta-analysis of community-based studies. *Prog Neuro-Psychopharm Biol Psychiat.* 2021; 109: 110207.
10. Stein DJ, Scott KM, de Jonge P, Kessler RC. Epidemiology of anxiety disorders: from surveys to nosology and back. *Dialog Clin Neurosci.* 2017; 19(2): 127.
11. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consul Clin Psychol.* 1988; 56(6): 893.
12. Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther.* 1995; 33(3): 335-43.
13. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatrica Scandi.* 1983; 67(6): 361-70.
14. Özdin S, Özdin B. Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: The importance of gender. *International Journal of Social Psychiatry.* 2020 Aug;66(5):504-11.
15. Bhopal SS, Bhopal R. Sex differential in COVID-19 mortality varies markedly by age. *Lancet.* 2020; 396(10250): 532-533. [https://doi.org/10.1016/S0140-6736\(20\)31748-7](https://doi.org/10.1016/S0140-6736(20)31748-7)
16. King TL, Lamontagne AD. COVID-19 and suicide risk in the construction sector: preparing for a perfect storm. *Scandi J Pub Health.* 2021; 1403494821993707.
17. Richardson C, Robb KA, O'Connor RC. A systematic review of suicidal behaviour in men: A narrative synthesis of risk factors. *Soc Sci Med.* 2021; 113831.
18. Ahorsu DK, Lin CY, Imani V, Saffari M, Griffiths MD, Pakpour AH. The Fear of COVID-19 Scale: development and initial validation. *Int J Ment Health Addict.* 2020; 1-9. <https://doi.org/10.1007/s11469-020-00270-8>
19. Winter T, Riordan BC, Pakpour AH, Griffiths MD, Mason A, Poulgrain JW, Scarf D. Evaluation of the English version of the Fear of COVID-19 Scale and its relationship with behavior change and political beliefs. *Int J Ment Health Addict.* 2020; 1-1 <https://doi.org/10.1007/s11469-020-00342-9>
20. Alyami M, Henning M, Krägeloh CU, Alyami H. Psychometric evaluation of the Arabic version of the Fear of COVID-19 Scale. *Int J Ment Health Addict.* 2020; 1-14. <https://doi.org/10.1007/s11469-020-00316-x>
21. Satici B, Gocet-Tekin E, Deniz ME, Satici SA. (2020). Adaptation of the Fear of COVID-19 Scale: Its association with psychological distress and life satisfaction in Turkey. *Int J Ment Health Addict.* 2020. <https://doi.org/10.1007/s11469-020-00294-0>
22. Soraci P, Ferrari A, Abbiati FA, Del Fante E, De Pace R, Urso A, Griffiths MD. Validation and psychometric evaluation of the Italian version of the Fear of COVID-19 Scale. *Int J Ment Health Addict.* 2020; 1-10. <https://doi.org/10.1007/s11469-020-00277-1>
23. Tsiropoulou V, Nikopoulou VA, Holeva V, Nasika Z, Diakogiannis I, Sakka S, Kostikidou S, Varvara C, Spyridopoulou E, Parlapani E. Psychometric properties of the Greek version of FCV-19S. *Int J Ment Health Addict.* 2020; 1-10. <https://doi.org/10.1007/s11469-020-00319-8>
24. Wakashima K, Asai K, Kobayashi D, Koiwa K, Kamoshida S, Sakuraba M. The Japanese version of the Fear of COVID-19 scale: Reliability, validity, and relation to coping behavior. *PLoS ONE.* 2020; 15(11): e0241958. <https://doi.org/10.1371/journal.pone.0241958>
25. Cavaleiro FRS, Sticca MG. Adaptation and Validation of the Brazilian Version of the Fear of COVID-19 Scale. *Int J Ment Health Addict.* 2020; 1-9. <https://doi.org/10.1007/s11469-020-00415-9>
26. Haktanir A, Seki T, Dilmaç B. Adaptation and evaluation of Turkish version of the fear of COVID-19 Scale. *Death Stud.* 2020; 1-9. <https://doi.org/10.1080/07481187.2020.1773026>
27. Wibowo YS, Utami RK, Nadia Y, Nizenyumukiza E, Setiawati FA. The fear of coronavirus scale: Exploratory and confirmatory factor analysis. *Konselor.* 2020; 9(2): 75-80. <https://doi.org/10.24036/0202092109075-0-00>
28. García-Reyna B, Castillo-García GD, Barbosa-Camacho FJ, Cervantes-Cardona GA, Cervantes-Pérez E, Torres-Mendoza BM, Fuentes-Orozco C, Pintor-Belmontes KJ, Guzmán-Ramírez BG, Hernández-Bernal A, González-Ojeda A. Fear of COVID-19 Scale for hospital staff in regional hospitals in Mexico: A brief report. *Int J Ment Health Addict.* 2020; 1-12. <https://doi.org/10.1007/s11469-020-00413-x>
29. Piqueras JA, Gomez-Gomez M, Marzo JC, Gomez-Mir P, Falco R, Valenzuela B. Validation of the Spanish version of Fear of COVID-19 Scale: Its association with acute stress and coping. *ResearchSquare.* 2020. <https://doi.org/10.21203/rs.3.rs-75063/v1>
30. Caycho-Rodríguez T, Vilca LW, Cervigni M, Gallegos M, Martino P, Portillo N, Barés I, Calandra M, Burgos Videla C. Fear

- of COVID-19 scale: Validity, reliability and factorial invariance in Argentina's general population. *Death Stud.* 2020; 1-10. <https://doi.org/10.1080/07481187.2020.1836071>
31. Huarcaya-Victoria J, Villarreal-Zegarra D, Podestà A, Luna-Cuadros MA. Psychometric Properties of a Spanish Version of the Fear of COVID-19 Scale in General Population of Lima, Peru. *Int J Ment Health Addict.* 2020; 1-14. <https://doi.org/10.1007/s11469-020-00354-5>
 32. Masuyama A, Shinkawa H, Kubo T. Validation and psychometric properties of the Japanese version of the fear of COVID-19 scale among adolescents. *Int J Ment Health Addict.* 2020; 1-11. <https://doi.org/10.1007/s11469-020-00368-z>
 33. Chi X, Chen S, Chen Y, Chen D, Yu Q, Guo T, Cao Q, Zheng X, Huang S, Hossain MM, Stubbs B. Psychometric evaluation of the Fear of COVID-19 Scale among Chinese population. *Int J Ment Health Addict.* 2020; 1-16. <https://doi.org/10.1007/s11469-020-00441-7>
 34. Kroenke K, Spitzer RL, Williams JB, Löwe B. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics.* 2009; 50(6): 613-621. [https://doi.org/10.1016/S0033-3182\(09\)70864-3](https://doi.org/10.1016/S0033-3182(09)70864-3)
 35. Pilkonis PA, Choi SW, Reise SP, Stover AM, Riley WT, Cella D, PROMIS Cooperative Group. Item banks for measuring emotional distress from the Patient-Reported Outcomes Measurement Information System (PROMIS®): Depression, anxiety, and anger. *Assessment.* 2011; 18(3), 263-283. <https://doi.org/10.1177/1073191111411667>
 36. Ogrodniczuk J, Oliffe J, Beharry J. HeadsUpGuys: Canadian online resource for men with depression. *Can Fam Physician.* 2018; 64(2), 93.
 37. Worthington RL, Whittaker TA. Scale development research: A content analysis and recommendations for best practices. *Counsel Psychol.* 2006; 34(6): 806-38.
 38. Garrido LE, Abad FJ, Ponsoda V. Are fit indices really fit to estimate the number of factors with categorical variables? Some cautionary findings via Monte Carlo simulation. *Psychol Methods.* 2016; 21(1): 93-111. <https://doi.org/10.1037/met0000064>
 39. Langer W. How to use Stata's SEM command with non-normal data. A new normality correction for the RMSEA, CFI and TLI. Meeting of the German Stata Users Group, Munich, Germany. 2019.
 40. Tabachnick BG, Fidell LS, Ullman JB. Using multivariate statistics. Boston, MA: Pearson; 2007 Mar 3.
 41. Levin AT, Hanage WP, Owuso-Boaitey N, Cochran KB, Walsh SP, Meyerowitz-Katz G. Assessing the age specificity of infection fatality rates for COVID-19: systematic review, meta-analysis, and public policy implications. *Eur J Epidemiol.* 2020; 35: 1123-1138. <https://doi.org/10.1007/s10654-020-00698-1>
 42. Groarke JM, Berry E, Graham-Wisener L, McKenna-Plumley PE, McGlinchey E, Armour C. (2020). Loneliness in the UK during the COVID-19 pandemic: Cross-sectional results from the COVID-19 Psychological Wellbeing Study. *PLoS ONE.* 2020; 15(9): e0239698. <https://doi.org/10.1371/journal.pone.0239698>
 43. Clark LH, Hudson JL, Haider T. Anxiety specific mental health stigma and help-seeking in adolescent males. *J Child Fam Stud.* 2020: 1-2.
 44. Izquierdo I, Olea J, Abad FJ. Exploratory factor analysis in validation studies: uses and recommendations. *Psicothema.* 2014; 26(3): 395-400. <https://doi.org/10.7334/psicothema2013.349>
 45. Barrios I, Ríos-González C, O'Higgins M, González I, García O, Díaz NR, Castaldelli-Maia JM, Ventriglio A, Torales J. Psychometric properties of the Spanish version of the Fear of COVID-19 Scale (FCV-19S).
 46. Martínez-Lorca M, Martínez-Lorca A, Criado-Álvarez JJ, Armesilla MD. The fear of COVID-19 scale: validation in Spanish university students. *Psychiat Res.* 2020; 113350.
 47. Kubb C, Foran H. Measuring COVID-19 related anxiety in parents: psychometric comparison of four different inventories. *JMIR Ment Health.* 2020; 7(12): e24507. <https://doi.org/10.2196/24507>
 48. Xiong J, Lipsitz O, Nasri F, Lui LM, Gill H, Phan L, Chen-Li D, Iacobucci M, Ho R, Majeed A, McIntyre RS. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *J Affect Disord.* 2020; 277, 55-64. <https://doi.org/10.1016/j.jad.2020.08.001>
 49. Alonzi S, La Torre A, Silverstein MW. The psychological impact of pre-existing mental and physical health conditions during the COVID-19 pandemic. *Psychol Trauma.* 2020; 12(S1): S236-S238. <http://dx.doi.org/10.1037/tra0000840>
 50. Rains LS, Johnson S, Barnett P, Steare T, Needle JJ, Carr S, Taylor BL, Bentivegna F, Edbrooke-Childs J, Scott HR, Rees J. Early impacts of the COVID-19 pandemic on mental health care and on people with mental health conditions: framework synthesis of international experiences and responses. *Soc Psychiatry Psychiatr Epidemiol* 2021, 1-12. <https://doi.org/10.1007/s00127-020-01924-7>