



The effects of fear of COVID-19 among Spanish healthcare professionals in three years after the pandemic onset via validation of the FCV-19S: a prospective study

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Abstract

Despite being validated in different populations to assess fear of COVID-19, the Fear of COVID-19 Scale (FCV-19S) has scatter validations in healthcare professionals, often with several limitations, especially in Spanish-speaking professionals. Our research aims to extend previous studies by: (i) using a large sample of Spanish nurses and physicians; (ii) incorporating longitudinal data; and (iii) using a covariance-based SEM methodology to test different factor structures. 686 Spanish healthcare professionals ($M=42.7$ years; 80.5% women; 76.7% nurses) participated in 2021 (Time 1), of whom, 216 were reassessed one year later (Time 2). The results ($S-B\chi^2=69.134$, $df=13$, $p<0.001$, $CFI=0.974$, and $SRMR\leq 0.031$) supported a two-factor structure with a factor of somatic reactions and another of emotional expressions of fear of COVID-19. The FCV-19S evidenced strong factorial measurement invariance regarding gender, professional category, age and professional experience and also showed significantly higher levels of fear of COVID-19 in women, nurses, and professionals under 40 years old. The internal consistency was high for the somatic factor ($\omega=0.86$; $\alpha=0.85$), the emotional factor ($\omega=0.82$; $\alpha=0.82$) and the overall scale ($\alpha=0.89$). The scale showed good convergent, divergent, and incremental validity with respect to psychological symptomatology, perceived health, burnout, and worry about contagion. Finally, the FCV-19S showed criterion validity regarding generalized anxiety disorder, burnout, and the risk of leaving the profession. The FCV-19S evidenced excellent psychometric properties in Spanish healthcare professionals and was predictive of different health outcomes one year after administration. Study implications and limitations are also discussed.

Keywords COVID-19 · FCV-19S · Fear · Healthcare professionals · Mental health · Spain · Validation

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Introduction

The COVID-19 pandemic has been a major burden on countries' healthcare systems, not only logistically, but has also affected the mental health of healthcare personnel, comprising different disorders such as stress, anxiety and insomnia (Pappa et al., 2020). These disorders have also led to other types of consequences such as post-traumatic stress and sleep disorders which have lowered the quality of life among healthcare personnel (Pappa et al., 2020). In Spain, which has experienced a substantial number of affected individuals and deaths at the pandemic's onset, the consequent strain on the country's economic framework and the health of its inhabitant has been decidedly more intense than in many other nations across Europe (Pinilla et al., 2021). This challenging scenario has severely threatened the stability of its until that moment well-established national health care system, imposing substantial workloads on healthcare workers, thereby jeopardizing their mental health (Priede et al., 2021). Various factors may have contributed to these negative consequences. Among them, the lack of personal protective equipment and working on the frontline with infectious patients stand out. Some studies have also shown that the fear of contagion, whether the individual's own or that of a family member, is one of the factors with a clear influence on the deterioration of the health of healthcare professionals during the pandemic (García-Hedrerera et al., 2021).

Given the magnitude of the COVID-19 pandemic and the psycho-emotional implications it entailed, Ahorsu et al. (2020a, b) developed a brief and valid seven-item instrument to assess an individual's fear of COVID-19, namely, the COVID-19 Fear Scale (FCV-19S), with a unidimensional structure. The FCV-19S was developed using two types of psychometric testing: classical test theory (CTT) analysis and Rasch analysis (Ahorsu et al., 2020a, b). Since its initial development, the FCV-19S has been translated and tested in over 20 languages with excellent psychometric properties, including the Spanish version (Piqueras et al., 2021). Its factorial structure has been debated as to whether it has one or two factors, with most psychometric studies confirming a one-factor structure (Mailliez et al., 2022; Soraci et al., 2022; Waddimba et al., 2023). Most of those who have identified a two-factor structure agree that these factors are emotional response and somatic response (Masuyama et al., 2022; Reznik et al., 2021), although other authors propose a difference between emotional factor and fear-related thinking (Yang et al., 2022). Internal consistency values exceed 0.80, and total scores on the FCV-19S have shown significant positive associations with anxiety, depression, and stress (Mailliez et al., 2022; Soraci et al., 2022; Waddimba et al., 2023), and negative associations

with happiness, mental well-being, emotional regulation and life satisfaction (Green et al., 2021; Stănculescu, 2022).

Validations have been carried out among different populations, especially in the general public. However, validations have also been observed among university students (Min et al., 2022; Perz et al., 2022; Yang et al., 2022), including medical students (Dadfar et al., 2021) or among children and adolescents (Masuyama et al., 2022). To date, the FCV-19S has been little studied among healthcare professionals (Ahorsu et al., 2022; Hawley et al., 2022; Llorente-Alonso et al., 2021), despite the relevance that this particular fear has among this population (Crowe et al., 2021; Della Monica et al., 2022). Additionally, there is only one validation study that, predominantly using a general population sample, has explored this instrument in a longitudinal manner (Waddimba et al., 2023).

Regarding previous validations among Spanish samples, all of them describe a unifactorial model, in different samples including elderly people over 60 years of age (Cárdenas Soriano et al., 2022), adults (Piqueras et al., 2021), and university students (Martínez-Lorca et al., 2020). Among the Spanish-speaking healthcare population, there have been two published studies. One was conducted with Colombian physicians (Mercado-Lara et al., 2022), in which two items were eliminated, which was criticized by some of the FCV-19S developers for not respecting the structure and content validity of the original instrument (Lin et al., 2023). The second one, in Spain, was a validation study comprising 194 health professionals. Here, a unifactorial model was reported with high internal consistency (0.90), and the scale's total score was positively associated with anxiety, depression and psychological detachment and negatively associated with collaborative work, relaxation, search for challenges, and control (Llorente-Alonso et al., 2021).

Taking into account the significant incidence of fear of COVID-19 among healthcare professionals due to their continuous contact with it (Crowe et al., 2021), and given the scarcity of validation studies of this instrument among healthcare professionals, the present study aimed to validate the FCV-19S among Spanish healthcare professionals. The study also aimed to overcome some of the limitations of the previous validation study of Spanish healthcare professionals carried out by Llorente-Alonso et al. (2021). More specifically, the study by Llorente-Alonso et al. (2021) used a relatively small sample (under 200 participants) composed almost exclusively of nursing professionals and women. Methodologically, the partial least squares methodology was used, which, in addition to not considering the measurement error of the variables by not using latent variables, is more prone to obtain biased estimators, and presents difficulties in identifying mis-specified models and is not very suitable for confirmatory purposes (Rönkkö et al., 2016). That is why several authors prefer covariance-based SEM

methodology as a superior and more suitable alternative for this type of research (Goodhue et al., 2012; Rönkkö et al., 2016).

Therefore, the present study aimed to extend the findings of the previous study (Llorente-Alonso et al., 2021) by: (i) using a large sample of health professionals (nurses and physicians) from various parts of the country; (ii) incorporating longitudinal data; and (iii) using a covariance-based SEM methodology in which the adjustment of different factorial structures of the scale was tested. Consequently, guided by the aforementioned studies that predominantly reveal a single-factor structure, the present research hypothesizes that the FCV-19S will demonstrate a unidimensional configuration in Spanish healthcare professionals, providing strong evidence of reliability and appropriate validity concerning psychological distress variables.

Method

Participants

A total of 686 healthcare professionals (mean age = 42.7 years; 80.5% women; 76.7% nurses) were recruited during the year 2021 (Time 1 [T1]) from different hospital units in three regions of Spain (Comunidad de Madrid, Cataluña, and Comunidad Valenciana). Among these initial participants, 216 were reassessed one year later (Time 2 [T2]). Socio-demographic and occupational characteristics of the total sample as well as of physicians and nurses are separately detailed in Table 1.

Procedure

The present study is part of a larger prospective study (covering the 2020–2022 period) aimed to assess the effect of the COVID-19 pandemic on the mental health of Spanish healthcare workers and associated psychosocial variables. Owing to the pressing necessity to evaluate the immediate mental health consequences at the outset of the COVID-19 pandemic, a non-probability convenience sampling was used. Data to validate the FCV-19S were collected in 2021 ($n = 686$) and 2022 ($n = 216$) using an online survey administered to professionals in the Spanish healthcare system who were working during the onset of the COVID-19 crisis. This method of survey application was adopted in response to the COVID-19 pandemic's isolation and social distancing protocols. The first page of the survey described the study aim and requested informed consent. The recruitment process utilized a multi-faceted approach. Initially, healthcare professionals were directly contacted through institutional email lists. To enhance the scope of recruitment, the survey

link was disseminated via a personal contact network, utilizing social media platforms including Facebook, Twitter, and LinkedIn. Furthermore, team leaders across various medical specialties in selected hospitals were engaged to ensure a broad and diverse representation of participants. For longitudinal follow-up, participants were re-assessed one year later using the same online platform. Email reminders, utilizing initial survey contact information, were sent to ensure sustained engagement over the study's duration. The study was approved by the ethics committee of Hospital Universitario Fundación Alcorcón (Reference 20/88, date 04/05/2020).

Measures

Socio-demographic and professional variables [assessed at T1] Demographic variables (gender and age) and professional characteristics (medical unit worked in, years of experience working in the profession, having direct contact with COVID-19 patients, and number of months having direct contact with COVID-19 patients) were evaluated using a self-developed questionnaire.

Fear of COVID-19 [assessed at T1] Fear of COVID-19 was assessed using the FCV-19S [(Ahorsu et al., 2020a, b); Spanish version (Martínez-Lorca et al., 2020)]. This 7-item instrument has a 5-point Likert response format ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Although it was originally designed to provide a total score (Ahorsu et al., 2020a, b), various studies find evidence of the existence of an emotional factor (Items 1, 2, 4 and 5) and a somatic factor (Items 3, 6 and 7) (Huarcaya-Victoria et al., 2022; Masuyama et al., 2022; Reznik et al., 2021). Higher scores indicate a higher level of fear of COVID-19. The internal consistency is reported in the Results section and was assessed both with a conventional estimator based on the covariance between items using Cronbach's alpha (α) and with an estimator based on the item factor loadings using McDonald's omega (ω).

Depressive, anxiety and stress symptoms [assessed at T1 and T2] The Depression, Anxiety and Stress Scale [DASS-21 (Lovibond & Lovibond, 1995); Spanish version (Daza et al., 2002)] was used to assess the level of anxiety, depression and stress symptoms. The scale contains 21 items (seven per dimension) rated on 4-point Likert response format from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*) with higher scores indicate a higher degree of affective symptomatology. In the present study, internal consistency was very good at both T1 ($\alpha = 0.90$, 0.86 and 0.89 for depression, anxiety, and stress symptoms,

Table 1 Demographic characteristics (measured at Time 1) of the healthcare professionals assessed at Time 1 ($n=686$) and Time 2 ($n=216$)

	Nurses at Time 1 ($n=526$)			Physicians at Time 1 ($n=160$)			Total sample at Time 1 ($n=686$)			Nurses at Time 2 ($n=151$)			Physicians at Time 2 ($n=65$)			Total sample at Time 2 ($n=216$)		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Gender																		
Male	93	17.7	41	25.6	134	19.5	20	13.2	14	21.5	34	15.7						
Female	433	82.3	119	74.4	552	80.5	131	86.8	51	78.5	182	84.3						
Unit																		
Intensive care unit	210	39.9	24	15.0	234	34.1	58	38.4	14	21.5	72	33.3						
General ward	140	26.6	41	25.6	181	26.4	51	33.8	16	24.6	67	31.0						
Emergency room	88	16.7	24	15.0	112	16.3	24	15.9	4	6.2	28	13.0						
Primary care	88	16.7	71	44.4	159	23.2	18	11.9	31	47.7	49	22.7						
Direct assistance to COVID-19 patients																		
No	151	28.7	30	18.8	181	26.4	43	31.8	16	24.6	64	29.6						
Yes	375	71.3	130	81.3	505	73.6	103	68.2	49	75.4	152	70.4						
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD						
Age [21–66 years]	41.3	10.2	47.02	10.0	42.7	10.5	41.8	9.7	46.8	10.1	43.3	10.1						
Experience in the profession [0–43 years]	18.1	10.1	19.7	9.7	18.5	10.0	19.1	9.9	19.7	9.5	19.3	9.8						
Time directly assisting COVID-19 patients [0–13 months]	7.6	3.2	8.1	3.2	7.7	3.2	7.7	3.2	8.2	3.2	7.8	3.2						

The ranges of values given in square brackets belong to the total sample. SD, standard deviation

respectively) and T2 ($\alpha=0.90, 0.86$ and 0.87 for depression, anxiety, and stress symptoms, respectively).

Burnout [assessed at T1 and T2] The Maslach Burnout Inventory-Human Services Survey [MBI-HSS (Maslach et al., 1997); Spanish version (Gil-Monte, 2005)] was used to assess the level of burnout. This 22-item scale has a 7-point Likert response format ranging from 0 (*never*) to 6 (*everyday*). The instrument assesses three burnout dimensions: emotional exhaustion (i.e., feelings of depletion and overloading of an individual's emotional and physical resources; 9 items), cynicism (i.e., a callous, negative, or excessively detached response to various aspects of the job and the individuals associated with it; 5 items), and low personal accomplishment (i.e., a sense of incompetence and a lack of achievement and productivity at work; 8 items). Adequate internal consistency was observed at T1 ($\alpha=0.91, 0.77$ and 0.85 for emotional exhaustion, cynicism, and personal accomplishment, respectively) and T2 ($\alpha=0.91, 0.78$ and 0.85 for emotional exhaustion, cynicism, and personal accomplishment, respectively).

Generalized anxiety disorder [assessed at T1] The presence of the DSM-IV symptoms of generalized anxiety disorder was assessed using the 7-item self-rated Generalized Anxiety Disorder Scale [GAD-7 (Spitzer et al., 2006); Spanish version (García-Campayo et al., 2010)]. This 7-item scale has a 4-point Likert response format ranging from 0 (*not at all*) to 3 (*nearly every day*). Higher scores indicate more severe symptoms. In this study, an excellent internal consistency was obtained at T1 ($\alpha=0.94$).

General health perception [assessed at T1] The perception of the participant's general state of health was evaluated using a single item (i.e., "*Do you consider your current state of health as...*") with a Likert-type response format ranging from 1 (*bad or very bad*) to 4 (*good or very good*). Higher scores indicate better perceived health.

Worry about the possibility of contagion of COVID-19 from oneself or from a family member [assessed at T1 and T2] An item was included for each type of concern (i.e., "*What is your level of worry about the possibility of self-contagion by COVID-19?*" and "*What is your level of worry about the possibility of contagion of other family members by COVID-19?*") with a 3-point Likert response format ranging from 1 (*not at all worried*) to 3 (*very worried*).

Thoughts of leaving the profession [assessed at T1] To assess whether participants had ever contemplated leaving the profession as a consequence of the pandemic, a dichotomous (yes/no) item was used (i.e., "*After everything that*

has happened with the COVID-19 pandemic, have you thought about leaving your profession?").

Psychological assistance [assessed at T1] In order to assess whether the participant had requested psychological help due to the pandemic and its impacts, a dichotomous (yes/no) item was used (i.e., "*Have you requested psychological assistance at any time during these months due to the effects that the pandemic has produced on you?*").

Statistical analysis

Data corresponding to this research is accessible via the Open Science Framework (https://osf.io/9tus4/?view_only=d7f5cfeab716411ab126577dd7687df8). IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA) was used for the following analyses: (i) descriptive statistics, (ii) differences between groups, (iii) convergent/divergent validity, (iv) incremental validity, and (v) criterion validity. The factor structure, the measurement invariance, and the reliability of the scale were analyzed applying structural equation modeling (SEM) methodology with Mplus version 8.5 (Los Angeles, CA, USA).

First, the sociodemographic characteristics of the study participants at T1 ($n=686$) and T2 ($n=216$) were examined. There were no missing values, as the online form used meant the online survey could only be submitted if all questions were answered.

The factor structure of the FCV-19S was explored by confirmatory factor analysis (CFA) testing the main configurations supported by previous research: the one-factor structure, the two-factor structure, and the bi-factor structure (each item loads simultaneously on both one of the two uncorrelated factors and on a general factor). Considering the absence of univariate normality (significant p -values in the Kolmogorov–Smirnov test for all FCV-19S items), which is a prerequisite for multivariate normality, the models were tested following a *model comparison strategy* using the MLM robust estimation method (maximum likelihood parameter estimates with standard errors and the mean-adjusted χ^2 statistic), also referred to as Satorra-Bentler χ^2 (S-B χ^2). Since χ^2 penalizes larger sample sizes (generally over 200 participants), increasing the probability of erroneously rejecting models that fit the data properly (Garson, 2012), this statistic was accompanied with a series of alternative adjustment indices such as the comparative fit index (CFI) and the Standardized Root Mean Square Residual (SRMR). Despite its wide use, the Root Mean Square Error of Approximation (RMSEA) was not used because it is overly sensitive in models with few degrees of freedom (Kenny et al., 2014), such as the current one. To compare

non-nested models, the Akaike Information Criterion (AIC) was used as a parsimony index. Therefore, the global adjustment of each assessed model was determined based on the following cut-off points: $S-B\chi^2$ p -value ≥ 0.05 , CFI ≥ 0.95 , SRMR ≤ 0.08 , and AIC of less magnitude suggesting increased parsimony (Hu & Bentler, 1999). Moreover, and simultaneously, the model's local adjustment was explored through the standardized factor loadings (λ) and the item's individual reliability (R^2), with $\lambda \geq 0.70$ and ≥ 0.50 , as well as $R^2 \geq 0.50$ and ≥ 0.25 , denoting good and acceptable local fit, respectively (Hair et al., 2014).

The covariance-based SEM analysis involved a series of structured steps. Initially, we defined our models, grounded in theoretical insights and previous research. This was followed by model identification, a crucial step to confirm our models' appropriateness for the data of the study. The MLM method was then employed to effectively utilize our data's covariance structure. Subsequently, we assessed model fit using the aforementioned adjustment indices. The last step was to consider possible improvements to the model, in line with the statistical guidelines and the theoretical framework.

Once the most robust factor structure for the FCV-19S was established, measurement invariance analyses were performed to assess the psychometric equivalence (same structure and meaning) of the construct across groups (Putnick & Bornstein, 2016). The variables selected to make group comparisons via multi-group CFA were gender (males vs. females), professional category (physicians vs. nurses), age (40 years or younger vs. older than 40 years) and professional experience (10 years of experience or less vs. more than 10 years).

Three nested models with progressive restrictions were compared between the two groups of each of the four aforementioned grouping variables in order to test configural (pattern of items that load on their corresponding factor constrained to be equal between groups), metric (factor loadings constrained to be equal, in addition to the previous step's restrictions), and scalar (item intercepts constrained to be equal, in addition to the two previous steps' restrictions) invariance. Configural invariance is achieved if CFI and SRMR indices show an adequate fit of the model in this first step (Putnick & Bornstein, 2016). Metric invariance is reached if the model of the second step (i.e., metric) shows a decrease in CFI ≤ 0.01 and an increase in SRMR ≤ 0.03 with respect to the fit of the first model (i.e., configural) (Chen, 2007). Scalar invariance is achieved if the model of the third step (i.e., scalar) shows a decrease in CFI ≤ 0.01 and an increase in SRMR ≤ 0.015 with respect to the fit of the second model (i.e., metric) (Chen, 2007). If two groups reach measurement invariance, it is assumed that comparisons can be made between these groups (Putnick & Bornstein, 2016).

As aforementioned, the internal consistency of the scale (or the subscales) was assessed both by the α coefficient and by CFA-based procedures such as the ω coefficient. The second method has the advantage of not being affected by the number of items or their lack of homogeneity and is preferable when SEM methodology is used (Garson, 2012). Scores over 0.70 for ω and α suggest adequate composite reliability of the scale or factor (Chen, 2007; Kline, 2011).

Subsequently, group comparisons in FCV-19S scores by gender, professional category, age, and professional experience were explored using t -tests. To quantify the magnitude of these possible differences Cohen's d was computed. Values of 0.20, 0.50, and 0.80 indicate small, medium, and large effect sizes, respectively (Cohen, 1988).

Bivariate correlations between FCV-19S scores, assessed solely at T1, and a series of theoretically-related variables (symptoms of anxiety, stress and depression, general health perception, and worry about the contagion of COVID-19 by themselves and their families), measured at T1 and T2, were performed in order to explore convergent and discriminant validity. Without specifying specific cut-off points, Campbell and Fiske note that those correlations that are significantly different from zero and sufficiently large are indicative of convergent validity (Campbell & Fiske, 1959). Regarding discriminant validity, correlations greater than 0.90 pose a problem when it comes to differentiating between different variables or between dimensions of the same construct (Rönkkö & Cho, 2020), so the cut-off point of 0.90 proposed by Kline was used in the present study (Kline, 2011).

To assess incremental validity, multiple linear regression analyses were performed exploring the independent associations of FCV-19S scores with psychological symptoms (anxiety, depression and stress) and burnout dimensions, measured at T1 and T2, after controlling for specific occupational and sociodemographic factors that could determine such outcomes (Haynes & Lench, 2003). The *enter method* was employed in the analyses.

Finally, criterion validity was assessed by exploring mean differences in FCV-19S scores depending on the healthcare worker's status at T1 on the variables of burnout, generalized anxiety disorder, thoughts of leaving the profession, and receipt of psychological assistance. The status of general anxiety disorder was determined by using the cut-off point (≥ 10 points in GAD-7) (García-Campayo et al., 2010); whereas high burnout status was established following the cut-off points (≥ 26 , ≥ 9 and ≥ 35 points for the MBI dimensions of emotional exhaustion, cynicism, and personal accomplishment, respectively) recommended by Merino-Plaza et al. (2018) for Spanish health professionals. Cohen's d effect size was also computed to quantify the magnitude of these possible differences.

As mentioned in this section, although not all variables could be assessed at both time points (i.e., T1 and T2), the present study incorporates longitudinal data in the following analyses: a) in the examination of the demographic characteristics of the sample at T1 and T2 via descriptive statistical analysis; b) in the exploration of the association of FCV-19S scores at T1 with worry about contagion and psychological symptoms of anxiety, depression, and stress at T2 through bivariate correlations; and c) in the analysis of the independent longitudinal impact of T1 FCV-19S scores on burnout and the mentioned psychological symptoms at T2, via multiple linear regression (adjusted for occupational and sociodemographic factors).

Results

Factor structure

The one-dimensional structure proposed by the original authors of the scale (Ahorsu et al. (2020a, b) was first tested, which obtained an unsatisfactory fit ($S-B\chi^2=146.953$, $df=14$, $p<0.001$, $CFI=0.938$, $SRMR\leq 0.042$, and $AIC=12,699.626$). In contrast, the structure of two correlated factors supported by several authors (Masuyama et al., 2022; Reznik et al., 2021; Stănculescu, 2022) obtained an adequate fit and also appeared to be more parsimonious ($S-B\chi^2=69.134$, $df=13$, $p<0.001$, $CFI=0.974$, $SRMR\leq 0.031$, and $AIC=12,602.197$). On the contrary, it was not possible to obtain evidence to support the bi-factor structure since the model could not be estimated due to the improper solutions obtained (the matrix was not positively defined). These results support a factor structure of two correlated factors (emotional and somatic) that also obtain a fairly good local fit (see Fig. 1).

Measurement invariance

The invariance analyses showed that the two-factor structure was invariant in terms of gender, professional health category, age, and professional experience (see Supplementary Table 1). The different groups that were compared showed an equivalent configuration, factor loadings, and item intercepts.

Reliability

Regarding reliability, the scale showed high internal consistency (ω of 0.82 and 0.86 for the emotional and somatic factor, respectively; α of 0.82, 0.85 and 0.89 for the emotional factor, the somatic factor and the overall score, respectively).

Mean comparisons by group

Once the psychometric equivalence of the FCV-19S between groups was verified, differences were found in the mean levels of fear of COVID-19 in three of the four grouping variables explored (see Supplementary Table 2). Therefore, nurses (compared to physicians) and those professionals 40 years of age or younger (compared to the older participants) showed significantly higher levels of fear of COVID-19 both in the two factors (emotional and somatic) and in the overall fear level. The effect size of these differences was small. Females also showed significantly higher levels of fear of COVID-19. In this case, these differences were of greater magnitude both for the emotional factor and for the overall score, with a small-medium effect size. No significant differences were found between groups regarding professional experience.

Convergent and discriminant validity

In general, the emotional factor, the somatic factor, and the overall FCV-19S score had significant associations with all the variables selected for this analysis, both at T1 and T2 (see Table 2). These findings suggest the existence of convergent validity. The FCV-19S scores showed moderate relationships with both the mental health variables and with the questions that specifically assessed worry about COVID-19 contagion (individuals themselves or family members), as well as small associations with general health perception. For those variables assessed on two occasions, all the correlations of the FCV-19S were higher at T1 than in T2 (after one year). More specifically, and with regard to mental health symptoms, the emotional and somatic factors of FCV-19S showed very similar associations with depressive and stressful symptoms; whereas in the case of anxious symptoms, the somatic aspects were the ones that were more strongly related. The medium–high correlations established with the questions concerning the level of concern regarding contagion from COVID-19 (slightly closer to the emotional than the somatic subscale), showed evidence of discriminant validity of the FCV-19S. In addition, the correlation of 0.74 found between the emotional and somatic dimensions also suggests that both factors, although strongly associated, are conceptually distinguishable.

Incremental validity

Multiple linear regression analyses were performed to explore the incremental validity of the FCV-19S, over and above the possible incidence of occupational and sociodemographic factors, with respect to psychological symptoms and burnout dimensions. These analyses were carried out

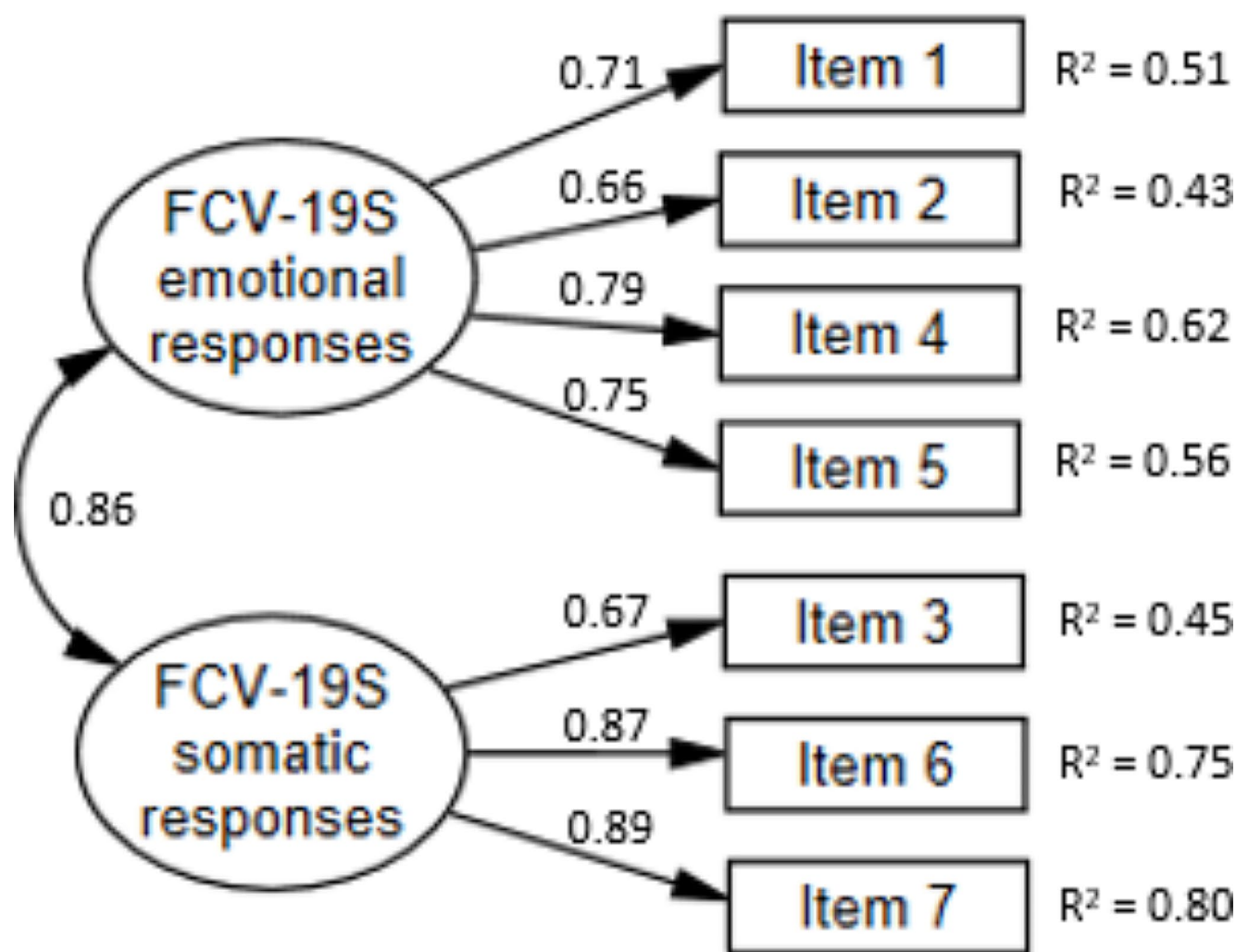


Fig. 1 Factor loadings and communalities of the FCV-19 S two-factor structure

Table 2 Descriptive statistics and bivariate correlations (r) between FCV-19S and mental health symptoms, general health perception and worry about the contagion of COVID-19 by themselves and their families at Time 1 ($n=686$) and Time 2 ($n=216$)

	Scores range	Mean	SD	FCV-19S emotional (T1)	FCV-19S somatic (T1)	FCV-19S overall score (T1)
FCV-19S emotional (T1)	4–20	11.31	4.00	-	0.74***	0.95***
FCV-19S somatic (T1)	3–15	5.54	2.78	-	-	0.90***
FCV-19S overall score (T1)	7–35	16.86	6.33	-	-	-
Anxiety symptoms (T1)	0–21	5.34	4.59	0.48***	0.55***	0.54***
Anxiety symptoms (T2)	0–21	4.28	4.29	0.24***	0.38***	0.33***
Stress symptoms (T1)	0–21	9.71	4.73	0.41***	0.38***	0.43***
Stress symptoms (T2)	0–21	8.49	4.70	0.14*	0.20**	0.19**
Depressive symptoms (T1)	0–18	5.64	4.21	0.45***	0.43***	0.47***
Depressive symptoms (T2)	0–21	5.57	4.88	0.24***	0.26***	0.27***
General health perception (T1)	1–4	3.01	0.74	-0.23***	-0.25***	-0.25***
Worry about COVID-19 contagion (T1)	1–3	2.23	0.50	0.50***	0.41***	0.50***
Worry about COVID-19 contagion (T2)	1–3	1.65	0.67	0.29***	0.27***	0.31***
Worry about a family member COVID-19 contagion (T1)	1–3	2.63	0.52	0.44***	0.46***	0.44***
Worry about a family member COVID-19 contagion (T2)	1–3	2.00	0.59	0.29***	0.26***	0.31***

T1 scores at the first Time, T2 scores at the second Time. The FCV-19S and the question about the general health perception were administered only in the first Time. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

for the variables evaluated in both at T1 (see Table 3) and T2 (see Supplementary Table 3). Regarding the psychological symptoms evaluated at T1, the emotional and somatic factors of the FCV-19S jointly explained an additional percentage of variance (with respect to the sociodemographic and occupational variables) of 25.7%, 13.4%, and 18.8% of the symptoms of anxiety, stress and depression, respectively. These percentages were reduced, respectively, to 12.7%, 3.2% and 4.4% at T2. Concerning to the burnout dimensions evaluated at T1, the emotional and somatic factors of the FCV-19S jointly explained an additional percentage of variance of 15%, 7.1%, and 1.9% of emotional exhaustion, cynicism, and personal accomplishment, respectively. The aforementioned percentages were reduced, respectively, to 4.9%, 6.1%, and 1.9% at T2.

Criterion validity

Significant differences in the FCV-19S scores (both generally and with respect to their emotional and somatic aspects) were found between participants with high burnout status and those with low or moderate burnout (see Table 4). More specifically, a moderate effect size was found for the emotional exhaustion and cynicism dimensions, while a small effect size was obtained for the personal accomplishment dimension. In the latter case, as expected and contrary to the other two dimensions, the levels of fear of COVID-19 were significantly lower among healthcare professionals with high personal accomplishment. Likewise, significant differences in the levels of FCV-19S were found between professionals with probable generalized anxiety disorder and those without (see Table 4). Here, a large effect size was found.

Additionally, significantly higher levels of fear of COVID-19 were found both among professionals who considered leaving the profession (versus those who had not) and among those who received psychological assistance (versus those who did not). A moderate effect size was found for the first of these variables and a relatively low effect size was found for the second.

Discussion

Health professionals have been severely affected by the COVID-19 pandemic, developing different psycho-emotional consequences (Pappa et al., 2020). It is therefore of particular relevance to determine whether the FCV-19S (Ahorsu et al., 2020a, b) is a sufficiently valid instrument to assess the fear that Spanish nurses and physicians have of the disease.

The present findings showed that the Spanish version of the FCV-19S (Martínez-Lorca et al., 2020) exhibited adequate psychometric properties and is a useful instrument for assessing the fear of COVID-19 among Spanish healthcare workers. First, in spite of the evidence of a single-factor structure in the original scale (Ahorsu et al., 2020a, b) and validations conducted in various countries, and contrary to our hypothesis, the findings with medical and nursing professionals in the present study indicated that the two-factor structure exhibited a markedly superior fit than the unidimensional one. In fact, several studies have found evidence that the FCV-19S assesses two dimensions of fear of COVID-19: one related to feelings of fear, discomfort, anxiety, and nervousness, and the other related to the presence of somatic symptoms such as heart palpitations, clammy hands, and insomnia (Barrios et al., 2021; Caycho-Rodríguez et al., 2022; Hawley et al., 2022; Iversen et al., 2022; Magano et al., 2021; Yang et al., 2022). Although some of these studies evidenced the simultaneous existence of both these two factors of fear of COVID-19 and a general factor, the results of the present study did not support the bi-factor structure because the model could not be estimated. However, anomalous results and improper solutions are quite common when applying bi-factor models (Eid et al., 2017). Despite the lack of consensus on the structure of the FCV-19S, the authors of the original scale maintained more recently that the instrument is designed to assess two types of fear responses to COVID-19, one emotional and one somatic (Lin et al., 2023). These findings align with the multidimensional conception of fear advocated by some authors, where fear involves both a set of physical changes (linked to the autonomic nervous system) and subjective sensations experienced in response to changes in one's own environment and body (Mobbs et al., 2019). Therefore, it is possible that many of the validation studies (Mailliez et al., 2022; Nazari et al., 2021; Piqueras et al., 2021; Soraci et al., 2022; Ullah et al., 2021; Waddimba et al., 2023; Winter et al., 2023) have found a unifactorial structure because, after obtaining adequate fit indices, they did not explore the possibility of other models that could fit better (such as the two-factor model). Moreover, the aforementioned studies that found support for the two-factor solution did explore the single-factor structure in all cases. The findings of the present study suggest that the fear of COVID-19 is a multidimensional construct.

The results of the invariance analyses showed that the construct of fear of COVID-19 assessed by the FCV-19S is invariant in terms of age, professional experience, gender, and professional category of healthcare professionals. Previous studies with the Spanish-speaking general population have found that the FCV-19S is invariant in relation to age, gender, country, and worker versus student status

Table 3 Multiple linear regression of the independent associations of the FCV-19S subscales at first Time with psychological symptoms and burnout dimensions at first Time ($n = 686$)

Predictors	Anxiety symptoms (T1)			Stress symptoms (T1)			Depressive symptoms (T1)		
	β	p	$\Delta Adj. R^2$	β	p	$\Delta Adj. R^2$	β	p	$\Delta Adj. R^2$
Step 1			0.095			0.087			0.056
Gender	0.188	<0.001		0.231	<0.001		0.184	<0.001	
Age	-0.085	0.396		-0.156	0.122		-0.082	0.424	
Category	0.126	0.002		0.003	0.950		0.015	0.717	
Experience	-0.103	0.292		-0.024	0.803		-0.072	0.472	
Step 2			0.015			0.041			0.009
Workload	0.127	<0.001		0.207	<0.001		0.101	0.006	
Step 3			0.257			0.134			0.188
FCV-19S emotional	0.129	0.004		0.258	<0.001		0.254	<0.001	
FCV-19S somatic	0.419	<0.001		0.144	0.003		0.225	<0.001	
Total adjusted R^2			0.367			0.262			0.253
	Emotional exhaustion (T1)			Cynicism (T1)			Personal accomplishment (T1)		
Predictors	β	p	$\Delta Adj. R^2$	β	p	$\Delta Adj. R^2$	β	p	$\Delta Adj. R^2$
Step 1			0.042			0.049			0.017
Gender	0.179	<0.001		-0.042	0.266		-0.002	0.964	
Age	-0.019	0.850		-0.162	0.115		0.314	0.003	
Category	-0.045	0.278		-0.077	0.066		0.062	0.144	
Experience	-0.100	0.320		-0.076	0.443		-0.184	0.071	
Step 2			0.071			0.016			0.000
Workload	0.268	<0.001		0.129	<0.001		-0.003	0.945	
Step 3			0.150			0.071			0.019
FCV-19S emotional	0.271	<0.001		0.072	0.176		-0.059	0.290	
FCV-19S somatic	0.155	0.002		0.222	<0.001		-0.105	0.061	
Total adjusted R^2			0.263			0.136			0.036

β standardized regression coefficient with significance levels of t , $\Delta Adj. R^2$ change in adjusted R^2 with significance levels on F -change, $T1$ scores at the first Time. To reduce the length of the table, the information on the variables incorporated in previous steps has been omitted in each step

(Caycho-Rodríguez et al., 2022; Piqueras et al., 2021). However, the evidence concerning Spanish-speaking healthcare professionals is more limited. Therefore, Huaracaya-Victoria et al. (2022), who included 23% of Peruvian healthcare workers among their study participants, found that the bi-factorial structure of the FCV-19S was invariant with respect to the professional sector (healthcare workers versus worker in other sectors or unemployed individuals). In the specific case of Spain, there is only one study to date that has shown that the unifactorial structure (no other was tested) of the FCV-19S is invariant among those healthcare workers who experienced a change in their functions due to COVID-19 versus those who did not (Llorente-Alonso et al., 2021). However, that study had a small sample size (under 200 participants) comprised almost exclusively of nurses and nursing assistants. Using a relatively large Spanish sample, the present study expands on previous findings and supports that the construct of fear of COVID-19, comprising somatic and emotional dimensions, is invariant not only regarding to gender, age, and professional experience, but also with respect to the professional category of the healthcare workers (i.e., physicians versus nurses). Therefore, the construct assessed by the FCV-19S has the same meaning for these subgroups of healthcare workers, which allows comparison of their levels of fear of COVID-19.

The internal consistency of the FCV-19S was good and similar both to that found by the original developers of the scale (Ahorsu et al., 2020a, b) and to that obtained by the authors of the Spanish version used in the present study (Martínez-Lorca et al., 2020). Focusing specifically on the studies with Spanish-speaking health professionals, the reliability was almost identical to that obtained in Spanish nursing professionals (Llorente-Alonso et al., 2021) but somewhat lower than that of Peruvian professionals (Huaracaya-Victoria et al., 2022).

Concerning the analysis of differences between subgroups of healthcare workers, the results are in line with a systematic review and meta-analysis study which concluded that both females and nursing professionals had significantly higher levels of fear during the COVID-19 pandemic (Pappa et al., 2020). The findings of the present study suggest differences in FCV-19S of small-medium magnitude and concur with those found among both Spanish (Piqueras et al., 2021) and other nationalities (Tsipropoulou et al., 2021). This increased fear of the disease among females could be due to the fact that, as a consequence of a combination of biological, environmental, and socialization-related factors, females generally present higher levels of anxiety and fear throughout the life cycle (McLean & Anderson, 2009). Consistent with other authors (Cabarkapa et al., 2020), the present study found higher levels of fear among nurses than in physicians, although the magnitude of these differences

was small. Some researchers (Pappa et al., 2020) propose that this could be due to the increased risk of exposure to COVID-19 patients as a consequence of staying longer and being in closer contact with patients (e.g., biological sample collections for virus detection) (Pappa et al., 2020). Regarding age, the results of those studies that explored differences in the levels of fear of COVID-19 in relation to this variable are not very consistent. In the general population, some studies have found higher levels of fear among middle-aged adults (40–49 years) (Piqueras et al., 2021), while others found that fear was higher but only among individuals aged 75 years or older (Tsipropoulou et al., 2021). The results obtained with the FCV-19S in the present study are consistent with research showing that emotional symptoms associated with COVID-19 are more adverse among younger medical professionals (Hameed et al., 2023b).

Among the few studies with healthcare professionals, only one explored this variable and found that age predicted the level of fear of COVID-19 among Italian healthcare workers (Troisi et al., 2021). Although it had a small effect size, the results of the present study indicated that the levels of fear were higher among healthcare professionals who were 40 years of age or younger than among those who were older than 40 years. It is possible that these modest differences can be explained by the professional category because the percentage of nurses was higher (87.3%) among younger professionals compared to those over 40 years of age (70.5%). This issue should be further explored in future studies.

Regarding convergent and discriminant validity, the present results showed that the FCV-19S had significant associations with anxiety, depression and stress symptomatology at both T1 and T2 (one year after). Previous evidence obtained in the study of the original scale (Ahorsu et al., 2020a, b), in the general Spanish-speaking population (Barrios et al., 2021), and among Spanish healthcare professionals (Llorente-Alonso et al., 2021) indicated that the fear of COVID-19 is consistently related to the presence of mood disorders. Studies specifically using the DASS-21 instrument to assess symptoms of anxiety, depression and stress (Satici et al., 2021; Bitan et al., 2020) have also found significant associations between FCV-19S and these three types of mood symptoms. However, unlike the present study, their authors found that the symptom that was least strongly related was depression (rather than stress). Although this should be confirmed in future studies, this could be related to possible differences between the general population and healthcare professionals. Furthermore, the results concur with those of the only study that explored how the emotional and somatic dimensions of FCV-19S related to these three mood symptoms (Bitan et al., 2020), showing that, while both dimensions maintain similar associations with depression and

Table 4 Mean differences in FCV-19S scores depending on the participant's status on the variables of burnout, generalized anxiety disorder, thoughts of leaving the profession, and receipt of psychological assistance at first Time ($n = 686$)

	Low-moderate emotional exhaustion (n=319)		High emotional exhaustion (n=367)		Low-moderate cynicism (n=437)		High cynicism (n=249)		Low-moderate personal accomplishment (n=270)		High personal accomplishment (n=416)							
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD						
FCV-19S emotional	9.76	3.57	12.67	3.88	-10.20***	-0.78	10.68	3.86	12.43	4.00	-5.62***	-0.45	12.14	3.93	10.78	3.95	4.44***	0.35
FCV-19S somatic ^a	4.51	2.26	6.44	2.87	-9.84***	-0.74	5.03	2.62	6.44	2.82	-6.61***	-0.53	6.06	2.82	5.20	2.70	3.98***	0.31
FCV-19S overall score ^a	14.27	5.30	19.11	6.29	-10.94***	-0.83	15.71	6.00	18.87	6.40	-6.47***	-0.51	18.20	6.32	15.98	6.18	4.56***	0.36
No GAD status (n=410)			GAD status (n=276)				Did not consider leaving the profession (n=425)		Considered leaving the profession (n=261)		Did not receive psychological assistance (n=536)		Received psychological assistance (n=150)					
	M	SD	M	SD	d	t	M	SD	M	SD	d	t	M	SD	M	SD	t	d
FCV-19S emotional	9.96	3.56	13.33	3.75	-11.90***	-0.93	10.50	3.76	12.64	4.01	-7.07***	-0.56	11.00	3.83	12.46	4.36	-3.90***	-0.37
FCV-19S somatic ^{a,b,c}	4.55	2.20	7.01	2.89	-12.03***	-0.98	5.00	2.48	6.41	3.01	-6.36**	-0.52	5.30	2.61	6.40	3.17	-3.90***	-0.40
FCV-19S overall score ^{a,b,c}	14.51	5.24	20.34	6.31	-12.86***	-1.02	15.50	5.76	19.06	6.70	-7.19***	-0.58	16.30	5.99	18.83	7.08	-3.99***	-0.41

M mean average, SD standard deviation, t Student's t, d Cohen's d effect size, GAD generalized anxiety disorder. ^{a, b, c} = Equal variances not assumed for the variables in the first (^a), second (^b) or third (^c) column, respectively, of each row. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

stress symptomatology, the FCV-19S somatic dimension is more closely related than the dimension of anxiety symptoms. Although of lesser magnitude, this pattern of relationships with anxiety, depression, and stress symptomatology of the healthcare workers was maintained over a one-year period. These findings are in line with those obtained in the only longitudinal study carried out with the current scale, which also reported associations of greater magnitude with anxiety than with depression (Waddimba et al., 2023).

Consistent with previous research using the FCV-19S both globally (Ahorsu et al., 2020a, b) and differentiating both dimensions (Iversen et al., 2022), the results of the present study also showed that increased emotional and somatic COVID-19 fear responses are relatively weakly associated with poorer perceived general health. The present study also explored whether fear of COVID-19 could essentially be reduced to individuals experiencing worry about their own and loved ones' contagion. As found in other studies (Iversen et al., 2022), the FCV-19S and its dimensions showed relationships of moderate magnitude with this type of worry, being closer in the case of worry about individuals infecting themselves. The associations between FCV-19S and worry about self-infection were somewhat lower than those obtained by Iversen et al. (2022), which could perhaps be due to the fact that healthcare workers experience the possibility of infection as more ordinary and natural than the general population does. Therefore, the results of the convergent and divergent validity analysis suggest that although the construct of fear of COVID-19 is related to perceptions of an individual's own health and its vulnerability, it seems to be something conceptually distinct and more complex that involves both emotional and somatic aspects of the individual in relation to the COVID-19 and the implications of contracting the virus.

The Spanish version of the FCV-19S (Martínez-Lorca et al., 2020) also exhibited adequate incremental validity among the present sample of Spanish healthcare professionals, explaining significant percentages of additional variance after controlling for occupational and sociodemographic variables in the fear of COVID-19's relationship with anxiety, stress, depression, and burnout. Although some previous studies have suggested that the FCV-19S has predictive capacity on both anxious-depressive (Llorente-Alonso et al., 2021; Satici et al., 2021) and stressful symptomatology (Piqueras et al., 2021; Satici et al., 2021), only Llorente-Alonso et al. (2021) and Piqueras et al. (2021) have found incremental validity of this construct with respect to psychological symptomatology, above and beyond aspects such as psychological empowerment and maladaptive coping, respectively (Llorente-Alonso et al., 2021; Piqueras et al., 2021). The results of the present study go in the same direction and show that, beyond demographic and occupational

factors, the dimensions of the FCV-19S manage to explain a non-negligible proportion of additional variance in symptoms of stress, depression and, especially, anxiety.

In the case of burnout, more empirical evidence has been accumulated among health professionals about the incremental validity of the FCV-19S, with respect to the contribution made by sociodemographic and professional variables, in relation to this professional syndrome (Pang et al., 2022; Stefanatou et al., 2022). The present results are consistent with the findings of these studies. Additionally, they find that emotional exhaustion is the burnout component that shows the strongest and most permanent independent association with fear of COVID-19 (especially with the FCV-19S emotional dimension). In fact, even without exploring incremental validity, other authors have found that emotional exhaustion was the burnout dimension most strongly associated with fear of COVID-19 among medical personnel (Abdelghani et al., 2020). Therefore, it could be hypothesized that feelings of fear, nervousness and discomfort concerning illness, due to their demotivating effect, are more strongly associated with the perception that personal resources (emotional and physical) are exceeded than with a response of psychological distance from healthcare work and patients (i.e., cynicism) or with feelings of reduced competence and achievement at work (i.e., low personal accomplishment) (Algunmameyn et al., 2020).

The findings of the present study also indicate that both the emotional and somatic response to fear of COVID-19 are factors capable of influencing the degree of burnout and psychological symptomatology among healthcare professionals to a higher extent than such determining aspects for this group as gender, age, professional category or work overload (Chutiyami et al., 2021). Moreover, the longitudinal results of the present study suggest that this level of fear of disease also has a specific impact on these well-being variables even after a period of one year has elapsed.

In relation to criterion validity, the level of fear of COVID-19 (both the total score and its two dimensions) was significantly higher among healthcare professionals experiencing high burnout, among those with generalized anxiety disorder (GAD), among those who had considered leaving the profession, and among those who had received psychological assistance. These differences were of particular magnitude for emotional exhaustion and GAD, and of moderate magnitude among those with thoughts of leaving the profession. However, to the best of the present authors' knowledge, although there are no studies with healthcare personnel that have explored these differences, there is evidence of significantly higher scores on the FCV-19S among university students doing healthcare degrees who reported feeling more anxious and exhausted than usual during the pandemic (Zolotov et al., 2022). Therefore, considering the

scale's brevity, this instrument may help in future waves of disease and/or pandemics to identify those healthcare professionals who are at high risk of suffering burnout and anxiety or leaving their profession. It is specifically these at-risk professionals who would be the highest priority to treat through interventions aimed at improving mental health (Chutiyami et al., 2021). It is necessary to assess the vulnerability of health professionals to the fear of COVID-19 in order to establish interventions that protect their mental health. However, for these potential interventions to be effective, they must be developed and implemented with consideration for the cultural context (e.g., by studying their Hofstede's cultural dimensions) in which they will be employed (Shetty et al., 2023), in addition to the health aim and target professional group. Through the present study, the implication that the fear of COVID-19 was associated with burnout was found, establishing the need to assess the fear of healthcare professionals in order to avoid subsequent negative psycho-emotional consequences. Furthermore, any effort or initiative aimed at safeguarding the mental health of the healthcare workers will be even more imperative when dealing with confinement and quarantine scenarios associated with infectious diseases like COVID-19 (Hameed et al., 2023a, b).

Considerations and implications of the use of FCV-19S in Spanish healthcare professionals

Essential considerations regarding the characteristics of participants and the healthcare context must precede the practical use of FCV-19S in healthcare staff. First, the different proportion of healthcare professionals of both genders might seem a priori to be a point of improvement in this research. However, as a reflection of the gender distribution of the health sector, the fact that our study was predominantly female is consistent with World Health Organization data indicating women make up 70% of healthcare professionals (Boniol et al., 2019), a proportion that reaches 84% in the case of Spanish nurses (Instituto de la Mujer, 2020). This gender perspective is crucial because of the particular toll the pandemic has had on women, particularly those in lower paid medical roles, who experienced greater psychological distress (Lopez-Atanes et al., 2021). Concurrently, given that Spain has a decentralized healthcare system divided into 17 autonomous regions (each with its own authority in health matters), it is likely that, as has been demonstrated in previous instances (Campos et al., 2016), the effectiveness of the strategies implemented against COVID-19 in each region has been heterogeneous. Therefore, the confirmed variability in aspects such as transparency in political decisions or the communication of recommended preventive measures during the pandemic (Peña-Ramos et al., 2021)

may have differently impacted (depending on the region) the perception of healthcare professionals regarding their working conditions and feeling of helplessness during this health crisis, consequently influencing their levels of fear of COVID-19. Taking this into account, the FCV-19S might be used to track the degree of fear towards the disease in different regions of the nation, acting as an instrument to pinpoint those health policies and strategies that result in a greater or lesser extent of vulnerability among healthcare staff.

In light of the present findings, healthcare organizations might use the FCV-19S as a preventative tool to not only monitor the somatic and emotional aspects of the fear of the disease among staff but also to early identify those professionals at a higher risk of mental health impairment. This could inform the design of targeted interventions, such as tailored mental health support or workload adjustments, to prevent attrition. Policymakers, on the other hand, might use these insights to shape healthcare workforce policies, focusing on mental health maintenance, professional development, and career sustainability in the face of present and upcoming healthcare challenges.

Limitations

There were several limitations in the present study, such as the use of a non-representative convenience sample of the Spanish healthcare professionals. This may have led to participant's self-selection bias, potentially skewing the representation towards individuals more affected or interested in mental health due to the pandemic. In addition, the use of an online survey could have biased the sample towards a larger number of young participants (Zhang et al., 2023). Consequently, the results of the present validation study cannot necessarily be generalized to other population groups (e.g., health workers of other nationalities) without caution. Therefore, it is suggested that future studies focus on replicating the present findings in more diverse samples (e.g., with greater numbers of male healthcare workers and physicians, etc.). Moreover, although subjective experience is very important in psychological phenomena (Robinson et al., 2013), using self-report measures is also a limitation, since these measures are more susceptible to social desirability bias. Subsequent research utilizing the FCV-19S ought to control for social desirability bias among healthcare workers, since there could be a potential underestimation of their fear level of the disease, influenced by the self-stigma in the sector about manifesting psychological symptoms and pursuing psychological assistance (Huang et al., 2023). For a more comprehensive assessment of fear of COVID-19, in the future, the use of the FCV-19S could be combined with external observer rating or with the measurement of fear biomarkers (Waddimba et al., 2023). Despite the fact that one of the strengths of the

present study is that it included longitudinal data for some of the variables, this does not allow the delineation of causal relationships between the variables. Additionally, since fear of COVID-19 was only assessed at T1, the present study was unable to assess FCV-19S stability over time. Therefore, considering that the study by Waddimba et al. (2023) remains the sole investigation into the temporal evolution of the FCV-19S to date, it becomes imperative for upcoming research endeavors to integrate test–retest reliability analyses. This inclusion will not only bolster the credibility of the research but also enhance our understanding of how the FCV-19S performs over time in different settings. Lastly, another limitation is not having employed other instruments specifically designed for use in the context of this health crisis, assessing variables such as anxiety or grief linked to COVID-19 (Kim et al., 2023; Zhang et al., 2023). This restricts our ability to identify specific vulnerability subgroups among healthcare staff related to the pandemic, beyond the fear of the disease measured by the FCV-19S.

Conclusion

Despite the aforementioned limitations, the present study demonstrates that the FCV-19S has a two-factor structure with consistent psychometric properties among Spanish health professionals, in addition to showing its important role as a risk variable associated with mental health symptoms, general health perception, burnout, thoughts of leaving the profession, and receiving of psychological assistance, even in prospective measures one year after its evaluation. Its factorial invariance is a strength of the instrument which allows its use in health professions irrespective of gender, professional category, age, and professional experience. Future lines of research are needed to develop programs or protocols aimed at protecting or strengthening the emotional health of healthcare professionals confronted at the bedside with infectious diseases such as COVID-19.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s12144-024-06113-2>.

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Data availability The data that support the findings of this study is accessible via the Open Science Framework (https://osf.io/9tus4/?view_only=d7f5cfeab716411ab126577dd7687df8).

Declarations

Ethical approval The study was approved by the Ethics and Clinical Research Committee of the reference hospital of the research team and informed consent was obtained from the participants before the questionnaire was administered. In order to disseminate the study through Primary Care, the study was approved, in turn, by the Central Research Committee. This study was conducted in accordance with the national and international guidelines of the code of ethics, the declaration of Helsinki, the code of good practice, and SAS Order 3470/2009. The processing of personal data collected in this study complied with the Organic Law 15/1999 of 13 December on the Protection of Personal Data (LOPD) and with Regulation (EU) No. 2016/679 of the European Parliament and of the Council of 27 April 2016 on Data Protection (GDPR). All information collected, stored and processed has been collected anonymously.

Patient consent for publication Participants consented to the publication of the results.

Conflicts of interest The authors declare that there is no conflict of interest.

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