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Facing Fear and Embracing Safety: Validation of the COVID-19 Psychosocial Scales in Essential Frontline Workers During the Pandemic

Israel Umbert , Juan José Reyes-Luján , Susana Llorens  and Marisa Salanova 

WANT Prevención Psicosocial y Organizaciones Saludables, Universitat Jaume I (Spain)

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ABSTRACT

Background: The study has two main aims: (1) to analyze and validate the factor structure of the Fear of COVID-19, Workplace health and safety training, and Behavioral Safety Compliance scales (Study 1) in frontline Spanish COVID-19 workers from different sectors (food sector, hospitals, and death care services); and (2) to analyze and validate the factor structure of a reduced version of these scales (Study 2) in Spanish workers in the healthcare sector. **Method:** Analyses carried out using R 1.4.2. allowed us to validate the factor structure of the scales in the two studies. The sample consisted of 361 participants in study 1; and 708 participants in study 2. **Results:** The results indicate that the instruments offer adequate evidence of reliability and validity. **Conclusions:** The questionnaire (especially the short version) can be used by employees who were in frontline of COVID-19 in a reliable and valid way in the post-COVID-19 period, and even to prevent potential similar events that might threaten professionals' physical and mental health in the future.

Afrontando el Temor y Abrazando la Seguridad: Validación de las Escalas Psicosociales COVID-19 en Trabajadores/as Esenciales de Primera Línea Durante la Pandemia

RESUMEN

Antecedentes: el objetivo del presente estudio es doble: (1) analizar y validar la estructura factorial de las escalas del Miedo al COVID-19, Capacitación en seguridad y salud en el lugar de trabajo, y el Cumplimiento de seguridad conductual (Estudio 1) en trabajadores españoles de primera línea de COVID-19 de diferentes sectores (sector alimentario, hospitales y servicios asistenciales de defunciones); y (2) analizar y validar la estructura factorial de una versión reducida de dichas escalas (Estudio 2) en trabajadores españoles del sector sanitario. **Método:** los análisis realizados con el programa R 1.4.2. permiten validar la estructura factorial de las escalas en los dos estudios realizados. La muestra estuvo compuesta por 361 participantes en el estudio 1; y 708 participantes en el estudio 2. **Resultados:** los resultados indican que los instrumentos ofrecen una evidencia adecuada de fiabilidad y validez. **Conclusiones:** el cuestionario (especialmente la versión corta) puede ser utilizado por empleados/as de primera línea de COVID-19 de manera confiable y válida en periodo post-COVID-19 e incluso para prevenir potenciales eventos similares futuros que amenacen potencialmente la salud física y mental de los y las profesionales.

Palabras clave:

Validación
COVID-19
Trabajadores esenciales
Miedo
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The COVID-19 pandemic that originated in Wuhan, China, in December 2019 had serious, far-reaching social, economic, and health-related (physical and mental) consequences. One is the fact that the health and safety of working people was brought into the spotlight and has also become a major concern for organizations. More specifically, at the workplace level, the COVID-19 pandemic has had a major impact on the mental health and psychosocial well-being of essential frontline workers (Qiu et al., 2020). High-risk groups included people working in healthcare, law enforcement, the food industry, and other essential services (especially those providing services to the public).

Due to constant exposure to the virus, increased workload, and concerns about the health of patients and their loved ones, these workers faced high levels of stress and anxiety. The restrictions of detachment have also led to mental health problems, caused by a lack of social and emotional support. Post-traumatic stress, anxiety, insomnia, burnout, somatization, and depression are the most prevalent psychological conditions faced by these workers as a result of the pandemic (Fusar-Poli et al., 2020). To keep up with the increasing demand for medical care and essential services, many of these workers were forced to work overtime in stressful conditions, which has had a significant negative impact on their well-being. This has led to physical and mental exhaustion, as well as to an increased risk of injury and illness (Koontalay et al., 2021).

In this regard, and focusing on the healthcare context, previous research has shown that staff in non-faculty healthcare organizations exhibited high risk factors for insomnia, depression, and Obsessive-Compulsive Disorder during the pandemic (Zhang et al., 2020). Research has also shown that lack of resilience during the pandemic is directly related to the stress and the emotional and physical exhaustion of these workers due to COVID-19 (Yıldırım & Solmaz, 2022). Studies also show that the impact of the pandemic has highlighted gender differences among these groups, where women are often affected most, especially in the healthcare sector. One study showed that women working in healthcare reported higher levels of psychological stress than men (Sanford et al., 2021).

These negative effects on mental health have also been shown in different frontline workers outside the healthcare profession. For example, Frenkel et al. (2021) demonstrate the impact of COVID-19 on European police officers in Austria, Germany, Switzerland, the Netherlands, and Spain, citing the risk of infection and poor communication as the main stressors. Also in this group, Stogner et al. (2020) demonstrate a context characterized by a high level of stress and associated psychiatric problems. More specifically, in Spain, the study by Gómez-Galán et al. (2020) shows high levels of burnout (29%) in all its subscales: emotional exhaustion (54%), depersonalization (58%), and lack of personal development (46%). These data indicate the need to implement prevention and treatment measures for workers in order to reduce stress and anxiety. Similar results have been obtained in the food sector. According to the study by Dumont & Babykina (2022), different main trends are revealed in terms of physical and psychological impacts: (1) 7% of the employees who worked during the confinement reported suffering from COVID-19, (2) increased workload, a more stressful environment, inappropriate customer attitude, lack of recognition, fatigue, and shortages. Lack of government recognition, i.e., lack of preferential allowances for supermarket staff during the period of closure, is also mentioned

frequently. And, as found in the study of the US food sector by Cho et al. (2020): (1) the pandemic significantly reduced the likelihood of continued active employment; (2) an increasing number of workers left their jobs as the rate of COVID-19 infection worsened; (3) the existence of a significant risk of infection led many food industry workers to stop working altogether. In addition, this study highlighted that maintaining the health and safety of workers is essential for a stable food supply.

More recently, McLean et al. (2023) shows the effect of COVID on teacher. Concretely the research shows that hat prolonged school closures due to COVID-19 have negatively impacted the well-being of fourth-grade teachers in the United States. This study describes teachers' depressive and anxiety symptoms and burnout before and 18 months after COVID-19 long-term school closures during the 2020/2021 school year. The study found that younger teachers and teachers of colour were the most affected and suggest that efforts should be made to support these groups of teachers while continuing to address the long-term effects of the COVID-19 pandemic.

One of the major characteristics of frontline workers is that they are in constant contact with people – patients, clients, or other types of subjects – and they are the ones taking care of the population. In the event of a pandemic, the fear of getting sick could lead to feelings of social exclusion stigma, which increases the risk of adjustment disorders and mental health problems such as depression (Zhang et al., 2020). Lin et al. (2020) showed how healthy people who provide services to others exhibit high levels of fear when infected with COVID-19. High levels of fear of COVID-19 can also lead to irrational and unclear thinking (Ahorsu et al., 2020).

In addition, these workers have been exposed to an increased risk of contracting COVID-19 because they were forced to work without proper personal protective equipment due to shortage of supplies. This has led to an increase in the number of cases among these workers and has caused concern among them and their families. Pandemics also compromise safety and security measures against infectious pathogens. Personal protective equipment (PPE), safety protocols and procedures, worker training programs, and detailed controls for compliance have been scarce and inadequate in many cases. In this pandemic, particularly during the first six months, frontline workers did not have adequate personal protective equipment, resulting in high levels of stress (Billings et al., 2021). A study by Sakib et al. (2021) concluded that healthcare professionals who used the same protective equipment for a prolonged period experienced elevated levels of depression. In addition, individuals who felt vulnerable and insecure as a result of the pandemic exhibited elevated levels of fear towards COVID-19. These emotional responses can be attributed to several factors, including the unpredictable nature of the disease, the severity of its impact, gaps in information, and social isolation resulting from a lack of preparedness to cope with the pandemic. Organizational prevention and protection measures should therefore aim to minimize the possibility of exposure to the virus (Cirrincione et al., 2020).

Finally, the lack of training for essential frontline workers has also been a problem during the COVID-19 pandemic. Many of these workers, including medical professionals, nurses, and food industry workers, were ill-prepared to deal with a pandemic of this magnitude. Unfortunately, the lack of adequate training has led

to a number of problems, ranging from inappropriate use of PPE to confusion and uncertainty about how to handle the pandemic and how to cope with stress. For example, Chi's study (2020) of Vietnamese employees in different sectors (manufacturing or processing, tourism and hospitality, and logistics) examined, among other aspects, the relationship between workplace health and safety training, and behavioral safety compliance. In the same vein, Garcia-Fernández et al. (2022) showed that people receiving medical and nursing training are particularly susceptible to the spreading of information about the virus, which has been linked to emotional well-being in this group.

All this demonstrates an urgent need to monitor the short- and long-term consequences of the COVID-19 pandemic and implement interventions (Marcomini et al., 2021) to improve the personal well-being of these frontline COVID-19 professionals. In the current context, the need to design, implement, and evaluate the impact of positive psychological interventions in the organizational context is justified. However, an indispensable previous step is the assessment of the impact that COVID-19 has had in terms of fear, lack of training, and lack of implementation of safety measures, in order to subsequently intervene in a targeted manner. One of the existing theoretical models for measuring the impact of psychosocial factors on the health and well-being of workers and on the effectiveness of the organization in general is the HERO (HEalthy & Resilient Organization) Model (Salanova et al., 2012, 2019, 2020), which is based on a scientifically validated methodology that analyzes whether organizations perform well in two areas: health and resilience. A HERO is an organization that actively undertakes systematic and planned actions to improve processes and outcomes for workers as well as the entire organization. They are also considered resilient because they remain positive in challenging circumstances, they remain strong in adverse situations, and continue to function under great pressure. This methodology allows the participation of different stakeholders of an organization and allows the use of different qualitative (e.g., interviews, Focus Groups) and quantitative (HERO-Check questionnaire) methodologies. Concretely, the HERO-Check questionnaire is a self-report battery of healthy and resilient organizations that allows a diagnosis to be carried out to identify psychosocial factors in the organization and thus guarantee compliance with business obligations regarding occupational risk prevention in Spain. The tool is composed of 52 indicators to evaluate mental health in organization. This tool is divided into three fundamental factors: healthy organizational resources and practices (and also job demands), healthy employees, and healthy organizational results. Furthermore, the HERO model allows for multi-level data analysis based on the IGLO model that enables assessments at the Individual, Group, Leader, and Organizational levels (De Angelis et al., 2020; Nielsen & Christensen, 2021). This is due to the implementation of healthy organizational resources and practices that increase the well-being of individuals and groups, and thus improve healthy organizational outcomes (Gil et al., 2020; Salanova et al., 2012, 2019, 2020).

Based on the relevance of the HERO model for determining the well-being and performance of individuals, groups, and the organization itself, the present study allows for the extension of the model to include measures related to COVID-19, fear, workplace health and safety training, and behavioral safety compliance. These variables are validated for the first time in frontline COVID-19

employees. The aim of the current study is twofold: (1) to analyze and validate the psychometric properties of the Spanish version of the fear of COVID-19, workplace health and safety training, and behavioral safety compliance in COVID-19 frontline staff; and (2) to analyze and validate the factor structure of a reduced version of these scales in the post-COVID period.

In this study, two hypotheses are expected: (1) the fear of COVID-19, workplace health and safety training, and behavioral safety compliance scales will show acceptable psychometric properties in terms of validity and reliability in samples of frontline professionals in the post-COVID period (Hypothesis 1) and (2) the shortened version of the fear of COVID-19, workplace health and safety training, and behavioral safety compliance scales is expected to have similar validity and reliability indices to the original version in samples of frontline professionals (Hypothesis 2).

Study 1

This first study aims to validate the factor structure of the proposed questionnaire that includes the Spanish adaptations of the Fear of COVID-19 scale (Ahorsu et al., 2020); Workplace health and safety training scale (Chi et al., 2020), and Behavioral safety compliance COVID-19 scale (Chi et al., 2020). This study also explores the validity of a short version of aforementioned scales and compares the results with the ones obtained through the long version in a post-pandemic context.

Method

Participants

The general study sample consisted of 618 employees (79% women) from three Spanish companies (25% food sector, 59% hospitals, and 16% death care services). Organizations which participated in the study were selected following convenience and intentional criteria. All workers from the organizations were invited to participate and they decided voluntarily. The inclusion criteria were the following: (1) to be part of the organization for 6 months or more, (2) to be mentally healthy. The participants' most frequent tenure in the company was between 6 and 10 years (38%). After deleting missing cases, the sample consisted of 361 participants (73% women), with the most frequent tenure in the company between 6 and 10 years (42%).

Instruments

Data were collected through three proposed scales, with 16 items that were included as part of the HERO-Check questionnaire (Salanova et al., 2012, 2019, 2020). The proposed scales were: 1) fear of COVID-19, 2) workplace health and safety training, and 3) behavioral safety compliance. The scales were adapted to the specific moment (post-pandemic) at which they were distributed (the study was performed from October 2021 to January 2023), it was no longer the most dangerous moment of the COVID-19 pandemic, because there was already a vaccine. All the three scales were collected using a 5-point Likert scale (from 1 'strongly disagree' to 5 'strongly agree').

Fear of COVID-19 (FC-19) was assessed with 6 from 7 original items (Ahorsu et al., 2020) that were adapted to

the post-pandemic context. One example of an item is *'I'm still afraid of COVID-19'* ($\alpha = .86$). Prior to distributing the questionnaire, a meeting by the Focus Group technique was held with 10 stakeholders from the healthcare sector. This focus group reviewed the questionnaire and the stakeholders stressed that the item *"My hands get clammy when I think about the coronavirus"* could be eliminated, considering (as experts) that it was excessive, given the date at which we launched the study (the study was performed from October 2021 to January 2023).

Workplace health and safety training (WHST) was assessed with 5 items (Chi et al., 2020) that were adapted to the post-pandemic context. One example of an item is: *'Safety issues due to COVID-19 continue to have a high priority in training programs'* ($\alpha = .86$).

Behavioral safety compliance COVID-19 (BSCC-19) was assessed with 5 items (Chi et al., 2020) that were adapted to the post-pandemic context. One example of an item is *'I continue to do my job safely'* ($\alpha = .90$).

Procedure

In each organization, the Human Resource Managers in industry, the supervisors in hospitals, and the researchers in general provided the employees with information about the project. Employees completed a self-report questionnaire (20 minutes) included in the HERO-Check (Salanova et al., 2012, 2019, 2020) by the Qualtrics platform. Inside this general questionnaire, three COVID scales were included. The researchers distributed the questionnaire anonymously by sending the company the Qualtrics access code, thereby guaranteeing the confidentiality of the responses. The study was conducted in accordance with General Data Protection Regulation (GDPR), with approval from the University's Ethics Committee (CD/44/2022).

Data Analysis

Data analysis was performed using R 1.4.2. (R Core Team, 2022). First, the scales' descriptive statistics (means, standard deviations) were calculated. As all the instruments scales were ordinal, correlations were calculated through Spearman's rho (r_s , Puth et al., 2015) were calculated. Scale reliability was estimated with Cronbach's alpha (α) and MacDonald's Omega (ω) using Psych R package (Revelle, 2022). The items' descriptive statistics (means, standard deviations) were also calculated. Correlations between items and the overall scale score were computed as discrimination index for each item, and alpha (α) reliability scores were recalculated for each scale after dropping each item.

To test the hypothesized latent factor structure, four Confirmatory Factor Analyses (CFA) were performed for (1) a three-factor model (each factor representing each scale; model 1); (2) a three-factor model of a reduced version of the scale (two items per scale; model 2); (3) a single-factor CFA for the long version of the scale (model 3); and (4) a single-factor CFA for the reduced version of the scale (model 4). The reduced version was built after calculating the first model factor loadings for each item and choosing those that showed the highest values. CFAs were carried out using lavaan R package (Rosseel, 2012). Due to its robust results for ordinal data, diagonally weighted least squares – mean and variance adjusted (WLSMV) was elected as estimation method (Di Stefano & Morgan, 2014).

Two absolute goodness-of-fit indices were assessed to evaluate the goodness-of-fit of the models: (1) the chi-squared (χ^2) goodness-of-fit statistic and (2) the Root Mean Square Error of Approximation (RMSEA). The χ^2 goodness-of-fit index is sensitive to sample size; for this reason, the use of relative goodness-of-fit measures is recommended (Bentler, 1990). Thus, four relative goodness-of-fit indices were used in their robust versions: (1) Comparative Fit Index (CFI), (2) Normed Fit Index (NFI); (3) Tucker-Lewis Index (TLI, also called the Non-Normed Fit Index); and (4) Incremental Fit Index (IFI). For RMSEA, values smaller than .05 indicated an excellent fit, .08 indicated an acceptable fit, and values greater than .10 led to model rejection (Browne & Cudeck, 1993). Regarding the relative fit indices, values greater than .90 indicated a good fit (Hu & Bentler, 1999). Reliability and discriminant and convergent validity measures were also tested through Composite Reliability (CR), Average Variance Extracted (AVE) for all four proposed models. Also, Maximum Shared Variance (MSV) was reported for both three-factor solutions. Results were considered according to previously proposed cutoff points (see Hair et al., 2010).

Results

Descriptive analysis and reliability results are shown in Table 1. According to Streiner (2003), the α and ω coefficient for each scale shows an excellent reliability, with values higher than .70 and below .90. The correlation between the WHST and the BSCC-19 scales was significant $p = .29$; $r_s < .001$. None of the items had a negative discrimination index, which indicates that all are related with their scales. Furthermore, the α for scales did not improve if an item was dropped.

In Table 2, the absolute and relative goodness-of-fit indices from the Confirmatory Factor Analyses are shown. Both 3-factor models (i.e., Model 1, the three-factor model for the long version of the scale; Model 2, the three-factor model of a reduced version of the scale) had an excellent fit according to relative CFI and IFI indices (values $> .90$). The short version showed excellent NNFI and TLI indices (.91) but a worse RMSEA than the long version (-.02 difference). Cheung and Resvold (2002) proposed that a .01 cutoff value for changes in TLI and CFI is usually accepted as criterion for selecting the model with the best fit. As the model 2 (short version of the scale) showed better relative fit indices and is a more parsimonious model, we chose it as the final version for the scale. Single-factor models did not show acceptable fit indices.

Figures 1 and 2 show the factor loadings for each model. All items in the long-version scale had significant factor loadings, which points out that all items considered have a significant weight in the latent factor variability. All absolute standardized weights in this scale are above .40, which is generally considered a cutoff value for considering the contribution of each item to the latent factor variability (Guadagnoli & Velicer, 1988).

Lastly, Table 3 shows the CR for all factors in Model 1 and 2 exceed .60, indicating a good reliability (Shrestha, 2021). AVEs were between .60 and .83, both for model 1 and 2, indicating an acceptable convergent validity. Except for fear of COVID-19 scales, AVEs showed a better reliability for the reduced version of the scale. MSV indices were lower than AVEs, so data represent evidence in favor of the discriminant validity was supported.

Table 1
Descriptive Information of the Scales and Reliability Test Results (n = 361)

		<i>M</i>	<i>SD</i>	Discr. index	α when item is dropped	α [LL, UL]	ω [LL, UL]	<i>r</i> , correlations		
								FC-19	WHST (<i>p</i> -value)	BSCC-19 (<i>p</i> -value)
FC-19	Item 1	2.87	1.20	.75	.71	.88[.86 - .89]	.89 [.85 - .93]	1	-.03 (.64)	.06 (.26)
	Item 2	2.96	1.23	.72	.68					
	Item 3	2.37	1.20	.79	.75					
	Item 4	2.54	1.14	.78	.74					
	Item 5	1.49	0.82	.68	.60					
	Item 6	1.75	1.02	.80	.72					
WHST	Item 1	3.76	1.23	.70	.63	.85 [.82 - .87]	.86[.74 - .98]		1	.29 (<.001)***
	Item 2	3.66	1.19	.55	.50					
	Item 3	3.62	1.13	.84	.77					
	Item 4	3.71	1.14	.75	.69					
	Item 5	3.36	1.15	.78	.72					
BSCC-19	Item 1	4.75	0.68	.70	.65	.89 [.87 - .91]	.89 [.87 - .96]			1
	Item 2	4.75	0.65	.80	.75					
	Item 3	4.71	0.63	.92	.71					
	Item 4	4.72	0.63	.85	.68					
	Item 5	4.71	0.62	.63	.75					

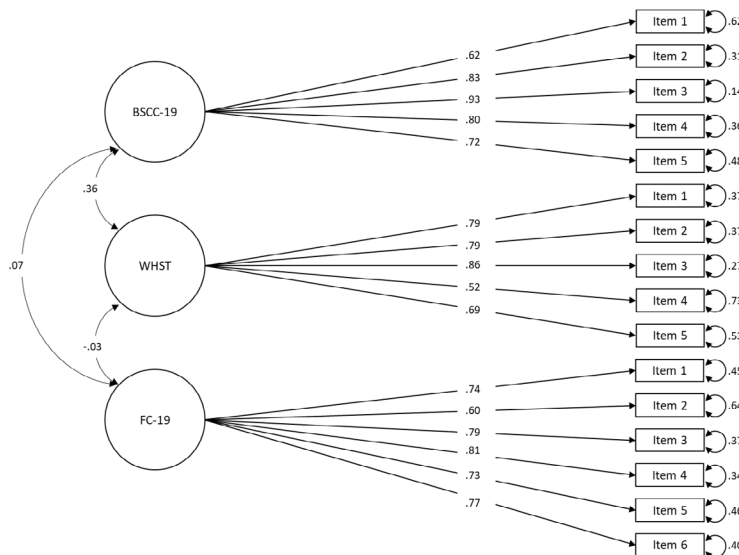
Notes. Items in bold letters correspond to the selected for the short version. FC-19 = Fear of COVID-19 scale; WHST = Workplace health and safety training scale; BSCC-19 = Behavioral safety compliance COVID-19 scale; LL = lower limit; UL = upper limit; Confidence intervals for reliability statistics were built on 95% of confidence; *** *p* < .001.

Table 2
Model Statistics and Comparisons (n = 361)

	χ^2	<i>df</i>	<i>p</i>	CFI	NNFI	TLI	IFI	RMSEA	$\Delta\chi^2$	Δdf	$\Delta p > \chi^2$	ΔCFI	$\Delta NNFI$	ΔTLI	ΔIFI	$\Delta RMSEA$
Model 1	174.24	101	<.001	.910	.893	.893	.912	.045								
Model 2	15.69	6	.015	.966	.916	.916	.967	.067								
Model 3	683.89	104	<.001	.289	.179	.179	.302	.125								
Model 4	120.24	9	<.001	.370	-.049	-.049	.391	.185								
Diff. 1 - 2									158.55	95	-.014	-.056	-.023	-.023	-.055	-.022

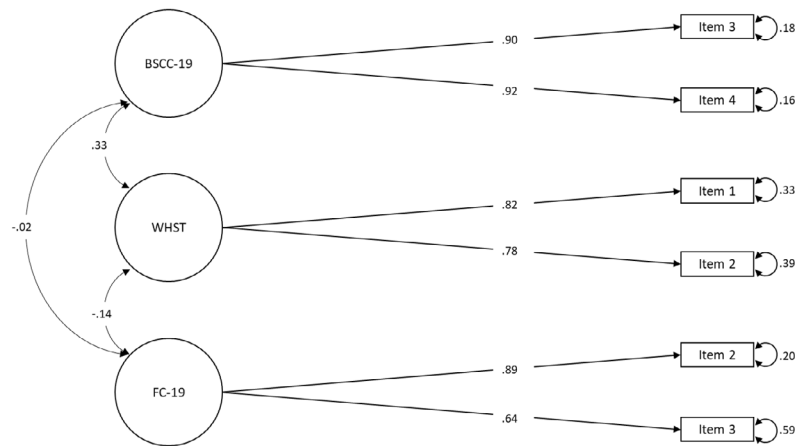
Notes. Model 1 = 3-factor model with the long version of the scale; Model 2 = 3-factor model with the reduced version of the scale; Model 3 = single-factor model with all items; Model 4 = single-factor model for the reduced version of the scale. χ^2 = Chi-square; *df* = degree of freedom; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; TLI = Tucker-Lewis Index; IFI = Incremental Fit Index; RMSEA = Root Mean Square Error of Approximation; Diff. and Δ = differences.

Figure 1
Factorial Model and CFA Results for Model 1



Notes. FC-19 = Fear of COVID-19 scale; WHST = Workplace health and safety training scale; BSCC-19 = Behavioral safety compliance COVID-19 scale.

Figure 2
Factorial Model and CFA Results for Model 2



Notes. FC-19 = Fear of COVID-19 scale; WHST = Workplace health and safety training scale; BSCC-19 = Behavioral safety compliance COVID-19 scale.

Table 3
CR, AVE and MSV (n = 361)

	Model 1			Model 2			Model 3		Model 4	
	CR	AVE	MSV	CR	AVE	MSV	CR	AVE	CR	AVE
FC-19	.82	.67	.01	.61	.61	.01	.83	.21	.44	.19
WHST	.79	.55	.08	.63	.64	.05				
BSCC-19	.79	.62	.08	.65	.83	.05				

Notes. FC-19 = Fear of COVID-19 scale; WHST = Workplace health and safety training scale; BSCC-19 = Behavioral safety compliance COVID-19 scale; Model 1 = 3-factor model with the long version of the scale; Model 2 = 3-factor model with the reduced version of the scale; Model 3 = single-factor model with all items; Model 4 = single-factor model for the reduced version of the scale. CR = Composite Reliability; AVE = Average Variance Extracted; MSV: Maximum Shared Variance.

Study 2

The goal of this second study is to validate the factor structure of the proposed short version of the questionnaire (6 items), which includes 2 items of the Fear of COVID-19 scale (Ahorsu et al., 2020), two items of the workplace health and safety training scale (Chi et al., 2020), and two items of the Behavioral safety compliance COVID-19 scale (Chi et al., 2020) in Spanish hospitals.

Method

Participants

The sample for study 2 was composed of 815 healthcare sector workers (82% women) from 38 Spanish hospitals (4 hospitals with more than 100 employees, 11 hospitals with 51 to 100 employees, and 23 hospitals with less than 51 employees). Organizations invited to participate were selected following convenience and intentional criteria. Within each hospital, individual participation was voluntary. The inclusion criteria were the following: (1) to be part of the organization for 6 months or more, (2) to be mentally healthy. The participants' most frequent tenure in the company was more than 10 years (44%). After deleting missing cases, the sample consisted of 708

participants (71% women), with the most frequent tenure in the company between 6 and 10 years (39%).

Instruments

The instrument consisted of the proposed short-version (6 items) questionnaire, composed of the same scales tested in study 1: (1) fear of COVID-19, (2) workplace health and safety training, and (3) behavioral safety compliance COVID-19. The three scales used a 5-point Likert-type scale (from 1 'strongly disagree' to 5 'strongly agree') for gathering the answers.

Fear of COVID-19 (FC-19) was assessed with two items (Ahorsu et al., 2020) that were adapted to the post-pandemic context. One example of an item is: 'I'm still afraid of losing my life to COVID-19' (p = .57).

Workplace health and safety training (WHST) was assessed with two items (Chi et al., 2020) that were adapted to the post-pandemic context. One example of an item is: 'My organization continues to provide comprehensive training to employees on workplace health and safety issues due to COVID-19' (p = .52).

Behavioral safety compliance COVID-19 (BSCC-19) was assessed with two items (Chi et al., 2020) that were adapted to the post-pandemic context. One example of an item is: 'I continue to guarantee the highest levels of security in the performance of my work' (p = .76).

Procedure

The supervisors as well as the researchers provided their employees with information about the project. Employees completed a self-report questionnaire (20 minutes) included in the HERO-Check (Salanova et al., 2012, 2019, 2020) by the Qualtrics platform. Inside this general questionnaire, 3 COVID scales were included. The researchers distributed the questionnaire anonymously by sending the company the Qualtrics access code, thereby guaranteeing the confidentiality of the responses. The study was conducted in accordance with the General Data Protection Regulation (GDPR), with approval from the University's Ethics Committee (CD/44/2022).

Data Analysis

For this second study, data analysis was performed using R 1.4.2 (R Core Team, 2022). As for study 1, descriptive and correlations estimations, and reliability analysis (i.e., Cronbach’s α and MacDonal’s ω) were performed. Items statistics and inter-correlations were also calculated.

To test the proposed factor structure for this short version of the scale, two CFA were performed: (1) for the three-factor model and (2) for a single-factor CFA. CFA estimators were calculated using the lavaan R package (Rosseel, 2012) and least squares - mean and variance adjusted (WLSMV) as estimation method (Di Stefano & Morgan, 2014). The same absolute and relative goodness-of-fit indices, reliability, and discriminant and convergent validity, given in study 1, were calculated.

Results

Descriptive data and reliability indices of the instrument are shown in Table 4. Reliability test results show acceptable to excellent results. Correlations between scales were all significant.

In Table 5, the absolute and relative goodness-of-fit indices are shown. The proposed short version of the scale has an excellent fit according to relative CFI and IFI indices (values >.90). Acceptable NNFI and TLI indices (.88) and RMSEA (.07). Single-factor models did not show acceptable fit indices. In Figure 3, standardized loadings for each factor are displayed. All items had significant factor loadings.

Table 4
Descriptive Information of the Scales and Reliability Test Results (n=708)

		M	SD	α [LL, UL]	ω [LL, UL]	r, correlations		
						FC-19	WHST (p-value)	BSCC-19 (p-value)
FC-19	Item 1	3.09	1.26	.73 [.69, .77]	.72 [.70, .89]	1t	.23 (<.001)***	.11(.003)**
	Item 2	2.15	1.18					
WHST	Item 1	3.33	1.17	.68 [.64, .73]	.68 [.65, .82]		1	.32(<.001)***
	Item 2	3.41	1.17					
BSCC-19	Item 1	4.17	0.88	.86 [.84, .88]	.86 [.71, .89]			1
	Item 2	4.25	0.77					

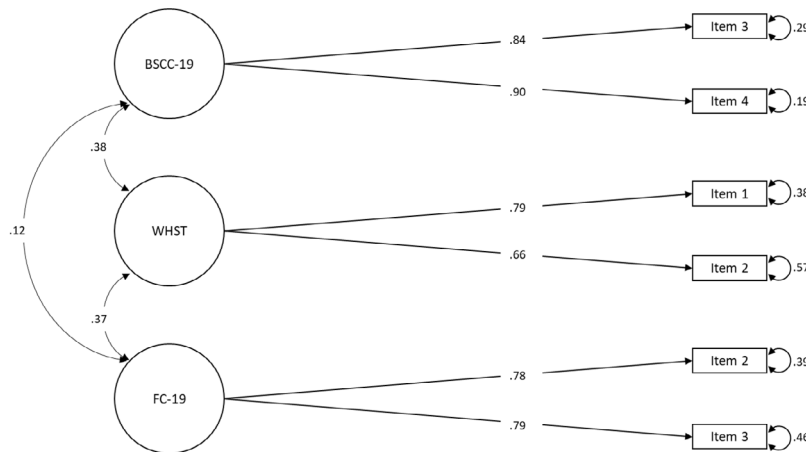
Notes. FC-19 = Fear of COVID-19 scale; WHST = Workplace health and safety training scale; BSCC-19 = Behavioral safety compliance COVID-19 scale; LL = lower limit; UL = upper limit; ** p <.01; *** p <.001.

Table 5
Descriptive Information of the Scales and Reliability Test Results (n=708)

	χ^2	df	p	CFI	NNFI	TLI	IFI	RMSEA	$\Delta\chi^2$	Δdf	$\Delta p > \chi^2$	ΔCFI	$\Delta NNFI$	ΔTLI	ΔIFI	$\Delta RMSEA$
Model 1	30.20	6	<.001	.952	.880	.880	.953	.076								
Model 2	300.81	9	<.001	.419	.032	.032	.426	.214								
Diff 1-2									-270.61	3	.000	.533	.848	.848	.527	-.138

Notes. Model 1 = 3-factor model for the reduced version of the scale; Model 2 = single-factor model for the reduced version of the scale; χ^2 = Chi-square; df: degree of freedom; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; TLI = Tucker-Lewis Index; IFI = Incremental Fit Index; RMSEA = Root Mean Square Error of Approximation; Diff. and Δ = differences.

Figure 2
Factorial Model and CFA Results for Model 2



Notes. FC-19 = Fear of COVID-19 scale; WHST = Workplace health and safety training scale; BSCC-19 = Behavioral safety compliance COVID-19 scale.

Finally, CR for all factors in Model 1 and 2 exceed .60 for all scales except WHST (.59), indicating a good reliability, and AVEs showed values above .50, indicating that data represent evidence in favor of an acceptable convergent validity. MSV indices were lower than AVEs, so discriminant validity was supported (see Table 6). In Table 7 the original and the short version of the scales are shown.

Table 6
CR, AVE and MSV (n=708)

	Model 1			Model 4	
	CR	AVE	MSV	CR	AVE
FC-19	.60	.57	.06	.75	.25
WHST	.59	.53	.10		
BSCC-19	.64	.76	.10		

Notes. Model 1 = single-factor model with all items; Model 4 = 3-factor model with the reduced version of the scale. CR = Composite Reliability; AVE = Average Variance Extracted; MSV = Maximum Shared Variance.

Table 7
Fear of Covid-19 (FC-19) Scale, Workplace Health and Safety Training (WHST) Scale, and Behavioral Safety Compliance Covid-19 (BSCC-19) Scale

Item	Fear of COVID-19 (FC-19) scale
1	I am still afraid of COVID-19.
2	I am still uncomfortable thinking about COVID-19.
3	I'm still afraid of losing my life to COVID-19.
4	When I see news and stories about COVID-19 on social media, I continue to get nervous.
5	I can't sleep well because I continue to worry about getting COVID-19.
6	My heart is still racing or pounding when I think about contracting COVID-19.
Item	Workplace health and safety training (WHST) scale
1	My organization continues to provide comprehensive training to employees on workplace health and safety issues due to COVID-19.
2	All employees are still required to participate in COVID-19 prevention training programs.
3	The COVID-19 prevention training programs provided to me are still adequate to enable me to assess hazards in the workplace.
4	Management continues to promote internal communication on COVID-19 prevention via newsletter, email, Facebook, etc.
5	COVID-19 security issues continue to be a high priority in training programs.
Item	Behavioral safety compliance COVID-19 (BSCC-19) scale
1	I continue to use all necessary safety equipment (masks, hand wash product, etc.) to prevent COVID-19.
2	I continue to respect the safety rules and protocols related to COVID-19 prevention while performing my work.
3	I continue to guarantee the highest levels of security in the performance of my work.
4	I continue to do my job safely.
5	I do not deviate from correct and safe working procedures.

Note. Items in bold correspond to the short version that has been validated.

Discussion

The aim of the present study was twofold: (1) to analyze and validate the factor structure of the scales of fear (Ahorsu et al., 2020), workplace health and safety training (Chi et al., 2020), and behavioral safety compliance (Chi et al., 2020) (Study 1); and (2) to analyze and validate the factor structure of a reduced version of these scales (Study 2) in essential Spanish frontline COVID-19 workers in the post-COVID period.

The results showed that the COVID-19 questionnaire is valid and reliable in both the long and short version, and in a heterogeneous sample of COVID-19 frontline professionals (Study 1) as well as in a sample of healthcare professionals (Study 2). The results confirmed the structure of each scale, as confirmed by previous studies (Ahorsu et al., 2020; Chi et al., 2020).

Reliability and validity levels support the long and the short version (the latter being the one proposed to be adopted for reasons of parsimony and effectiveness) in both studies. Analyses of internal consistency, reliability and convergent validity also show results in favor of the long and short version of the COVID-19 scales. All in all, we can conclude that the scales (especially the short version due to parsimony issues) can be used by frontline COVID-19 employees in a reliable and valid way, as they provide insight into fear of COVID-19, the impact of health and safety training, and employees' workplace behavioral safety compliance on perceived risk during the pandemic. Regarding the COVID-19 fear scale, it is also useful to differentiate fears of COVID-19 according to gender and generation, with women and older workers showing more fear. All in all, we have found empirical evidence that suggests that hypothesis 1 and 2 being more plausible.

The two studies, developed in this article, contribute to providing society with an instrument (short, two items per scale) that allows reliable and valid assessment of fear of COVID-19, workplace health and safety training, and the degree to which employees comply with the health and safety requirements derived from COVID-19 in frontline employees. With only 6 items, this instrument provides an insight into the reality of the COVID-19 experience, and in how people who have been in direct contact with COVID-19 underwent this pandemic.

Institutions should consider the results, obtained from their employees in this questionnaire, to propose Positive Psychological Interventions to improve the well-being of COVID-19 frontline professionals, even in post-COVID-19 periods. Furthermore, the study yields an interesting result for organizations to consider: women show significantly higher levels of fear.

In conclusion, this study shows a suitable instrument with good psychometric properties and a good factor structure of the CFA-based scales. This instrument used in this research could be considered as a screening test. These scales are useful to know the impact of the COVID-19 pandemic on workers' health and safety training, and perception of behavioral safety. Regarding fear, the fear of becoming infected and getting sick produces negative psychological reactions such as anxiety and uncertainty during epidemic periods (Pappas et al., 2009). In addition, it is important to know people's perception of risk in the face of such a threat, and the concern it causes (Ropeik, 2004). It has been shown that the availability of sufficient means of protection and the perception of good organization and management must be assessed in order to cope with future pandemics and to generate more prepared and resilient employees. In light of the lessons learned from the COVID-19 pandemic, it is crucial to build on these experiences and strengthen preparedness for possible future health emergencies. This demonstration aligns with the third objective, outlined in the European Union's Strategic Framework for Health and Safety at Work 2021-2027, which aims to contribute to health policies and improve preparedness for the future. At

the same time, it is imperative to prioritize mental health, and to quickly and effectively improve the response to such crises. It is crucial to establish initiatives that assess emerging issues related to employees' mental well-being and provide recommendations for implementing appropriate measures. Organizations must have a comprehensive framework for risk assessment and preventive actions to safeguard workers' health during a health crisis.

In future research, these scales will make it possible to find out the real characteristics of the frontline sectors of COVID-19 in order to design Positive Psychological Interventions that reduce or eradicate the stressors, present in healthcare organizations, with the aim of promoting the well-being of staff and preventing the appearance of professional burnout, thus contributing to the improvement of the quality of care.

The present study has some limitations. Firstly, it should be mentioned that not all sectors with essential frontline workers are represented in the two studies. For example, public security forces and the transport sector have not been assessed, while the food industry and the health sector have. Therefore, it would be interesting to replicate the results with a more diverse sample of frontline COVID-19 workers. Secondly, it should be noted that the surveys were administered from October 2021 to January 2023, a period of elevated tension during the COVID-19 pandemic due to the different waves of high infections, but not in the first 6 months, which was the start of the pandemic and the worst part of it. Thirdly, the use of the Qualtrics digital platform as a research tool may be considered to have a limitation, because online surveys are more accessible and attractive to participants of a higher socio-economic and educational level (Smith & Leigh, 1997) and, therefore, responses may be more selective. In other future studies, it would be interesting to know the impact of the variables assessed in the present study with well-being variables (e.g., engagement, resilience and quality of service) on COVID-19 frontline staff, as well as the design, implementation, and evaluation of the impact and transfer of Positive Psychological Interventions to mitigate the consequences of COVID-19 and improve the well-being of individuals, groups, leaders, and organizations, and thus contribute to the improvement of the quality-of-service of the sectors that were threatened the most by the pandemic.

Author Contributions

Israel Umbert: Conceptualization, Methodology, Investigation, Resources, Writing - Original Draft, Writing - Review and Editing. **Juan José Reyes-Luján:** Conceptualization, Methodology, Validation, Formal Analysis, Resources, Writing - Original Draft, Writing - Review and Editing. **Susana Llorens:** Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Resources, Writing - Original Draft, Writing - Review and Editing, Supervision, Project Administration, Funding Acquisition. **Marisa Salanova:** Conceptualization, Validation, Investigation, Resources, Writing - Original Draft, Writing - Review and Editing, Supervision, Project Administration, Funding Acquisition.

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Declaration of Interests

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

- Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., & Pakpour, A. H. (2020). The fear of COVID-19 scale: Development and initial validation. *International Journal of Mental Health and Addiction*, 20, 1537-1545. <https://doi.org/10.1007/s11469-020-00270-8>
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107(2), 238-246. <https://psycnet.apa.org/doi/10.1037/0033-2909.107.2.238>
- Billings, J., Ching, B. C. F., Gkofa, V., Greene, T., & Bloomfield, M. (2021). Experiences of frontline healthcare workers and their views about support during COVID-19 and previous pandemics: A systematic review and qualitative meta-synthesis. *BMC Health Services Research*, 21, Article 923. <https://doi.org/10.1186/s12913-021-06917-z>
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing Structural Equation Models* (pp. 136-62). Sage.
- Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, 9(2), 233-255. https://doi.org/10.1207/S15328007SEM0902_5
- Chi, H., Vu, T.V., Vo-Thanh, T., Nguyen, N.P., Van Nguyen, D. (2020). Workplace health and safety training, employees' risk perceptions, behavioral safety compliance, and perceived job insecurity during COVID-19: data of Vietnam. *Data in Brief*, 33, Article 106346. <https://doi.org/10.1016/J.DIB.2020.106346>
- Cho, S. J., Lee, J. Y., & Winters, J. V. (2020). COVID-19 employment status impacts on food sector workers. *IZA Institute of Labor Economics*, Article 13334. <http://dx.doi.org/10.2139/ssrn.3627034>
- Cirincione, L., Plescia, F., Ledda, C., Rapisarda, V., Martorana, D., Moldovan, R. E., Theodoridou, K., & Cannizzaro, E. (2020). COVID-19 Pandemic: Prevention and protection measures to be adopted at the workplace. *Sustainability*, 12(9), Article 3603. <https://doi.org/10.3390/SU12093603>
- De Angelis, M., Giusino, D., Nielsen, K., Aboagye, E., Christensen, M., Innstrand, S. T., ... & Pietrantonio, L. (2020). H-work project: Multilevel interventions to promote mental health in SMEs and public workplaces. *International Journal of Environmental Research and Public Health*, 17(21), Article 8035. <https://doi.org/10.3390/ijerph17218035>
- DiStefano, C., & Morgan, G. B. (2014). A comparison of diagonal weighted least squares robust estimation techniques for ordinal data. *Structural Equation Modeling: A Multidisciplinary Journal*, 21(3), 425-438. <https://doi.org/10.1080/10705511.2014.915373>
- Dumont, C., & Babykina, G. (2022). The impacts of COVID-19 pandemic on the food sector and on supermarket employees in France during the first Lockdown period. *Healthcare*, 10(8), Article 1404. <https://doi.org/10.3390/healthcare10081404>
- Frenkel, M. O., Giessing, L., Egger-Lampl, S., Hutter, V., Oudejans, R. R. D., Kleygrewe, L., Jaspert, E., & Plessner, H. (2021). The impact of the COVID-19 pandemic on European police officers: Stress, demands, and coping resources. *Journal of Criminal Justice*, 72, Article 101756. <https://doi.org/10.1016/J.JCRIMJUS.2020.101756>
- Fusar-Poli, P., Brambilla, P., & Solmi, M. (2020). Learning from COVID-19 pandemic in northern Italy: Impact on mental health and clinical care.

- Journal of Affective Disorders*, 275, 78–79. <https://doi.org/10.1016/j.jad.2020.06.028>
- García-Fernández, L., Romero-Ferreiro, V., López-Roldán, P. D., Padilla, S., Calero-Sierra, I., Monzó-García, M., ... Rodríguez-Jimenez, R. (2022). Mental health impact of COVID-19 pandemic on Spanish healthcare workers. *Psychological Medicine*, 52(1), 195-197. <https://doi.org/10.1017/S0033291720002019>
- Gil-Beltrán, E., Llorens, S., & Salanova, M. (2020). Employees physical exercise, resources, engagement, and performance: A cross-sectional study from HERO Model. *Revista de Psicología del Trabajo y de las Organizaciones*, 36(1), 39-47. <https://doi.org/10.5093/jwop2020a4>
- Gómez-Galán, J., Lázaro-Pérez, C., Martínez-López, J. Á., & Fernández-Martínez, M. D. M. (2020). Burnout in Spanish security forces during the covid-19 pandemic. *International Journal of Environmental Research and Public Health*, 17(23), 1–15. <https://doi.org/10.3390/ijerph17238790>
- Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns. *Psychological Bulletin*, 103(2), 265-275. <https://doi.org/10.1037/0033-2909.103.2.265>
- Hair, J., Black, W., Babin, B., & Anderson, R. (2010). *Multivariate data analysis* (7th ed.). Prentice-Hall.
- Hu, L. T., & Bentler, P. M. (1999). Cut off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: a Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Koontalay, A., Suksatan, W., Prabsangob, K., & Sadang, J. M. (2021). Healthcare workers' burdens during the COVID-19 pandemic: A qualitative systematic review. *Journal of Multidisciplinary Healthcare*, 14, 3015-3025. <https://doi.org/10.2147/JMDH.S330041>
- Lin, C. Y., Broström, A., Griffiths, M. D., & Pakpour, A. H. (2020). Investigating mediated effects of fear of COVID-19 and COVID-19 misunderstanding in the association between problematic social media use, psychological distress, and insomnia. *Internet Interventions*, 21, Article 100345. <https://doi.org/10.1016/j.invent.2020.100345>
- Marcomini, I., Agus, C., Milani, L., Sfgliarini, R., Bona, A., & Castagna, M. (2021). COVID-19 and post-traumatic stress disorder among nurses: A descriptive cross-sectional study in a COVID hospital. *La Medicina del Lavoro*, 112(3), 241–249. <https://doi.org/10.23749/mdl.v112i3.11129>
- McLean, L., Bryce, C., & Johnson, B. (2023). Describing Teachers' Well-Being Prior to and 18 Months After COVID-19 School Closures, with a Focus on Early-Career Teachers and Teachers of Color. *Sage Open*, 13(4). <https://doi.org/10.1177/21582440231217872>
- Nielsen, K., & Christensen, M. (2021). Positive participatory organizational interventions: A multilevel approach for creating healthy workplaces. *Frontiers in Psychology*, 12, Article 696245. <https://doi.org/10.3389/fpsyg.2021.696245>
- Pappas, G., Kiriaze, I. J., Giannakis, P., & Falagas, M. E. (2009). Psychosocial consequences of infectious diseases. *Clinical Microbiology and Infection*, 15(8), 743-747. <https://doi.org/10.1111/j.1469-0691.2009.02947.x>
- Puth, M.-T., Neuhäuser, M., & Ruxton, G. D. (2015). Effective use of Spearman's and Kendall's correlation coefficients for association between two measured traits. *Animal Behaviour*, 102, 77-84. <https://doi.org/10.1016/j.anbehav.2015.01.010>
- Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., & Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *General Psychiatry*, 33, Article 100213. <https://doi.org/10.1136/gpsych-2020-100213>
- R Core Team (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org/>
- Revelle, W. (2022). *psych: Procedures for psychological, psychometric, and personality Research*. Northwestern University, Evanston, Illinois. R package version 2.2.9, <https://CRAN.R-project.org/package=psych>.
- Ropeik, D. (2004). The consequences of fear. *EMBO Reports*, 5, 56-60.
- Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48(2), 1–36. <https://doi.org/10.18637/jss.v048.i02>
- Salanova, M., Llorens, S., Cifre, E., & Martínez, I. M. (2012). We need a hero! Toward a validation of the healthy and resilient organization (HERO) model. *Group and Organization Management*, 37(6), 785–822. <https://doi.org/10.1177/1059601112470405>
- Salanova, M., Llorens, S., & Martínez, I. M. (2019). *Organizaciones saludables. Una mirada desde la psicología positiva* (1ª ed.) [Healthy organizations. A look from Positive Psychology]. Aranzadi.
- Salanova, M. & Soler, C. (2020). Cultivando organizaciones saludables y resilientes: Metodología HERO en la prevención de riesgos psicosociales [Cultivating healthy and resilient organizations: HERO methodology in the prevention of psychosocial risks]. In A. L. García-Izquierdo (Ed.) *Intervención psicosocial para una prevención de riesgos laborales inclusiva* [Psychosocial intervention to an inclusive job risks prevention] (pp. 53-76). Cátedra Asturias Prevención.
- Sanford, J., Agrawal, A., & Miotto, K. (2021). Psychological distress among women healthcare workers: A health System's experience developing emotional support services during the COVID-19 pandemic. *Frontiers in Global Women's Health*, 2, Article 614723. <https://doi.org/10.3389/fgwh.2021.614723>
- Sakib, N., Akter, T., Zohra, F., Bhuiyan, A. K. M. I., Mamun, M. A., & Griffiths, M. D. (2021). Fear of COVID-19 and depression: A comparative study among the general population and healthcare professionals during COVID-19 pandemic crisis in Bangladesh. *International Journal of Mental Health and Addiction*, 21, 976-992. <https://doi.org/10.1007/s11469-020-00477-9>
- Shrestha, N. (2021). Factor analysis as a tool for survey analysis. *American Journal of Applied Mathematics and Statistics*, 9(1), 4-11. <https://doi.org/10.12691/ajams-9-1-2>
- Smith, M. A., & Leigh, B. (1997). Virtual subjects: Using the internet as an alternative source of subjects and research environment. *Behavior Research Methods, Instruments, & Computers*, 29, 496-505. <https://doi.org/10.3758/BF03210601>
- Stogner, J., Miller, B. L., & McLean, K. (2020). Police Stress, mental health, and resiliency during the COVID-19 pandemic. *American Journal of Criminal Justice*, 45(4), 718–730. <https://doi.org/10.1007/s12103-020-09548-y>
- Streiner, D. L. (2003). Starting at the beginning: an introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment*, 80(1), 99-103. https://doi.org/10.1207/S15327752JPA8001_18
- Yıldırım, M., & Solmaz, F. (2022). COVID-19 burnout, COVID-19 stress and resilience: Initial psychometric properties of COVID-19 burnout Scale. *Death Studies*, 46(3), 524–532. <https://doi.org/10.1080/07481187.2020.1818885>
- Zhang, W. R., Wang, K., Yin, L., Zhao, W. F., Xue, Q., Peng, M., Min, B. Q., Tian, Q., Leng, H. X., Du, J. L., Chang, H., Yang, Y., Li, W., Shanguan, F. F., Yan, T. Y., Dong, H. Q., Han, Y., Wang, Y. P., Cosci, F., & Wang, H. X. (2020). Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. *Psychotherapy and Psychosomatics*, 89(4), 242–250. <https://doi.org/10.1159/000507639>