



More than Psychometric Properties of the Fear of Covid-19 Scale. The Struggle of the Portuguese Police Officers

Bárbara Sousa^{1,2,3,4} · Patrícia Correia-Santos³ · Erika Brooke⁵ · Patrício Costa^{1,2,6} · Ângela Maia³

Accepted: 29 March 2024
© The Author(s) 2024

Abstract

The Covid-19 pandemic conveyed consequences for people's physical and mental health. During the worst pandemic scenarios, police officers were one of the most exposed populations. This situation brought these professionals unusual responsibilities, such as adjust work shifts and allocate police officers from operational and administrative services to the Covid-19 supervision teams and put them at an elevated risk of contracting the virus because they are also frontline workers too, and they often did not have personal protective equipment. Due to this, the main objective of this study was to analyze the psychometric properties of a Portuguese version of the Fear of Covid-19 among police officers, as well as to know how the fear of Covid-19 relates to the mental health during the worst wave of the Covid-19 pandemic in Portugal. Participants were 174 police officers aged between 23 and 58 years old ($M=40.81$; $SD=6.83$) who completed the Fear of Covid-19 Scale, the Operational Police Stress Questionnaire, and the Posttraumatic Disorder Checklist for DSM-5. Confirmatory factor analysis revealed a good adjustment fit for the two-factor model. Construct validity was supported, and the internal consistency was good for both periods of assessment. The model proved invariant for both groups (pre and during lockdown) at the measurement, scalar, and structural levels. Study findings suggest that the Portuguese Version of FCV-19S is a reliable measure to assess the fear of Covid-19 among police officers, including during the pandemic development.

Keywords Fear of Covid-19 Scale (FCV-19S) · Psychometric Properties · Police Officers · Confirmatory Factor Analysis (CFA) · Measurement Invariance

Introduction

The coronavirus 2 (SARS-CoV-2), or as it is commonly called Covid-19, is a respiratory illness that was discovered in December of 2019 in Wuhan, China (World Health Organization 2020). As of 19th October 2021, there were almost 2.5 million people infected with this virus worldwide,

and over 4.5 million deaths Covid-19 related. In Portugal, two million people were infected, and eighteen thousand died (World Health Organization 2020), and the medical emergency services and morgues were filled beyond capacity. In this emerging environment, first responders (e.g., doctors, nurses, firefighters, and police officers) had to deal with increased challenges and stressors. Specifically

✉ Bárbara Sousa
id8847@alunos.uminho.pt

Patrícia Correia-Santos
pcrcs06@gmail.com

Erika Brooke
ejbrooke@ufl.edu

Patrício Costa
pcosta@med.uminho.pt

Ângela Maia
angelam@psi.uminho.pt

² ICVS/3B's-P.T. Government Associate Laboratory, Guimarães, Braga, Portugal

³ Psychology School, University of Minho, Braga, Portugal

⁴ Psychology Research Centre, School of Psychology, University of Minho Campus de Gualtar, 4710-057 Braga, Portugal

⁵ Department of Sociology and Criminology & Law, University of Florida, Gainesville, USA

⁶ Faculty of Psychology and Education Sciences of the University of Porto, Porto, Portugal

¹ Life and Health Sciences Research Institute (ICVS), University of Minho, Braga, Portugal

related to officers, these professionals needed to take extra precautions to ensure the safety of society and themselves to prevent the spread of the virus. Being a police officer is already commonly considered one of the most challenging and stressful jobs (Andersen et al. 2015; Terrill and Paoline 2013), and in the current Covid-19 pandemic, the number of stressors related to work assignments and personal safety increased among police officers (Jennings and Perez 2020; Stogner et al. 2020).

Beginning March 2020, when the first case was identified in Portugal, police officers were asked to implement a series of public safety precautions to prevent the spread of the virus. Given that Covid-19 is spread through respiratory droplets, it brought upon additional psychological distress due to its ease of transmission (State University of New York – Institute for Disaster Mental Health (SUNY-IDMH) 2020). Due to not knowing who may be infected, not only doctors and nurses but also firefighters, and police officers, who continued to work on the frontline of danger (Jiang 2021) and fear, isolated themselves from their families for concern of being vehicles of virus transmission. While police officers' training includes their exposure to threat, trauma, and stress, the pandemic increased the physical danger of police work for both officers and their families (Drew and Martin 2020). The possibility of putting their families at risk for the virus became one of the greatest fears among these professionals (Frenkel et al. 2021). Police officers had to adapt to a series of changes in their professional duties. They had to adjust to changes in work schedules and reassignment of officers from operational and administrative services to the Covid-19 supervision teams (Observador 2021). As well as make adjustments in their personal lives, especially for those with minor children to prevent the spread of the disease. The police officers had to control the points of entry and exit of cities and the country, control events with many people, supervise social distance, wear masks coupled with limiting negationists manifestations and confusing communication surrounding covid-19. All of which may have led to increased perceived stress levels (Sener et al. 2021).

After struggling for almost one year with the Covid-19 pandemic, Portugal was hit by the third and worst wave of Covid-19 infections and deaths between January and April 2021. During this time, police officers had to deal with no days off, overtime demands, and a high number of infections among police officers (approximately 13% of police officers were infected with Covid-19), including deaths by Covid-19 (Observador 2021). Despite that, almost 50% of frontline officers remained unimmunized (Observador 2021), increasing the sense of vulnerability, stress, and fear among officers. As a result of all these challenges, police officers had reported experiencing psychological symptoms (Guo et al. 2020; Luchetti et al. 2020). A very marked psychological aspect

of the Covid-19 pandemic is fear (Cavalheiro and Sticca 2020), and some people have even developed or exacerbated symptoms of burnout, stress level, and posttraumatic stress (Frenkel et al. 2021; Jiang 2021; Sener et al. 2021; Stogner et al. 2020; Wu et al. 2021) related to the pandemic. Since fear is one of the main characteristics associated with Covid-19, Ahorsu and colleagues (2020), developed and validated a scale assessing the fear of coronavirus, "the Fear of Covid-19 Scale (FCV-19S)". Its usefulness and ease of application have led several authors to translate and adapt this instrument into different languages, populations and cultures (e.g., Portugal, (Magano et al. 2021), Brazil (Cavalheiro and Sticca 2020), China (Chi et al. 2021), Mexico (García-Reyna et al. 2020) Spain (Huarcaya-Victoria et al. 2020; Martínez-Lorca et al. 2020), Argentina (Caycho-Rodríguez et al. 2020), Italy (Soraci et al. 2020), Israel (Tzur Bitan et al. 2020) Europe (Reznik et al. 2021), Saudi Arabia (Alyami et al. 2021), and Japan (Masuyama et al. 2020). Despite all these versions, the literature is not clear about the factor structure of the FCV-19S. Research has focused essentially on the existence of two models – unidimensional (Ahorsu et al. 2020) and bidimensional (Alyami et al. 2021; Soraci et al. 2020) models. While the one-factor model includes a stable general factor, the two-factor model seems to differentiate emotional concerns from the more somatic components (sweating, palpitations, insomnia) related to Covid-19. Because of the intercorrelation between psychological and somatic manifestations, the one-factor model has been assumed by some authors. Nevertheless, as reported above, some studies (Caycho-Rodríguez et al. 2020; Chi et al. 2021; Huarcaya-Victoria et al. 2020) including the Portuguese version (Magano et al. 2021), seem to differentiate these two dimensions.

Furthermore, several studies have also analyzed the invariance of the measure, especially in comparison groups of gender (e.g., Caycho-Rodríguez et al. 2020; Huarcaya-Victoria et al. 2020), age (e.g., Chi et al. 2021), and occupation (e.g., Huarcaya-Victoria et al. 2020). However, none of these studies assessed the psychometric properties of the FCV-19S for police officers that were a particularly involved in fighting against the covid-19 pandemic. Moreover, these studies also did not assess the measurement invariance according to the pandemic evolution. As such, considering that police officers operated as first responders and faced elevated risks of contracting Covid-19, using confirmatory factor analysis, we aimed to assess the psychometric properties of FVC-19S and its validity and reliability in a sample of Portuguese police officers. Additionally, we also examined how the fear of Covid-19 relates to the symptoms of posttraumatic stress disorders and operational stressors of these professionals, during the worst wave of the covid-19 pandemic in Portugal.

In relation to most psychometric studies (Chi et al. 2021; Huarcaya-Victoria et al. 2020; Magano et al. 2021), we expected to find the two-factor structure to have a better

fit than the unifactorial model. Since these professionals were on duty during different stages of the pandemic evolution, we also explored the factorial model invariance in two groups: pre-lockdown and during-lockdown. We hypothesized that fear of covid-19 would correlate positively with post-traumatic stress symptoms and operational stressors.

Methods

Data Collection

The data for this study were collected through an online survey via Qualtrics. Prior to data collection, consent from the original authors of the FCV-19S (Ahorsu et al. 2020) to validate this measure in Portuguese police officers sample was sought. Once approved, the measure was translated from English to European Portuguese by two independent bilingual translators (i.e., fluent in English and Portuguese). The assessment protocol, part of a PhD project in Portuguese police officers, was submitted and approved by the ethics committee of [removed for blind review]. The police organizations involved [removed for blind review] were also contacted to ask for authorisation.

After organization approval, an e-mail with the study survey link was disseminated to the Police Commanders of the Northern Area of Portugal, with a brief description of the project and the Commanders disseminate the survey to the officers where participants were able to view the online informed consent prior to starting the survey. Finally, the participants had the opportunity to obtain their individual results.

All procedures performed in this study followed the General Regulation of Data Protection, May 2018, and ethical standards of the institutional research committee and with the Helsinki Declaration.

Participants

Data were collected between October 2020 and March 2021. We analysed the data as a total sample and two groups: pre-lockdown (T0 – after the worst wave of covid-19 in Portugal) and during-lockdown (T1 – during worst wave of covid-19 in Portugal). Most of the sample ($n = 174$) responded during the lockdown (70.1%). The complete sample consisted of 174 participants, with 164 (94.83%) males, ranging between 24–59 years old ($M = 41.13$; $SD = 6.51$). The total number of officers who worked in the North of Portugal is estimated at 4,400. The proportion of male versus female officers included in the sample is reflective of the composition of the total percentage of female officers in Portugal, which is 5.6%. One-hundred and thirty-nine participants (79.9%) were married or in a de facto marital status, and 139 (79.9%)

had at least one child. Regarding professional variables, 137 (79%) worked in shifts and had on average 17.23 ($SD = 6.71$) years of service. The majority are low officer rank ($n = 151$, 86.8%) see Table 1.

Measures

Socio-demographic Questionnaire

The socio-demographic questionnaire included variables such as age, gender, marital status, children, and specific questions about the profession, such as professional category, length of service, work-home distance. Information about the intake of psychiatric drugs, past/present psychological support, and the perception of periodic psychological assessments needs were also assessed.

Fear of Covid-19 Scale (Ahorsu et al. 2020)

This scale was developed to assess levels of fear as it relates to prevention and treatment (Ahorsu et al. 2020; Portuguese Version: Magano et al. 2021). It is a seven-item Likert scale that measures the individuals' fear towards Covid-19 infection. The response ranges from 1 to 5 (1 = strongly disagree; 5 = strongly agree). A total score is calculated by adding up each item score, ranging from 7 to 35. The higher the score, the higher level of fear of Covid-19 infection. The original version (Ahorsu et al. 2020) demonstrated a good internal consistency $\alpha = 0.82$. The internal consistency values for the present study are displayed in Table 3.

Operational Police Stress Questionnaire (PSQ-Op) (McCreary et al. 2017; Portuguese Version: Queirós et al. 2020)

This questionnaire was developed to assess operational job stress sources among police officers. This scale has been translated in 14 languages and was chosen because it but lack normative values (McCreary et al. 2017) The PSQ-Op is a 20-item scale evaluated on a 7-point Likert scale ranging from 1 to 7 (1 = not at all stressful" to 7 = very stressful). Higher scores indicate higher levels of stress, with a score of 4 or higher being an indicator of high stress. The Portuguese version (Queirós et al. 2020) demonstrated an excellent internal consistency $\alpha = 0.96$. This study presented the same values of internal consistency. While the authors acknowledge that the scale lacks normative values (McCreary et al. 2017), it was chosen not only because it has been widely used (e.g., translated in 14 languages) but it most examines the stressors associated with doing the job.

Table 1 Sociodemographic and results of the PCL-5, according to time

Indicator	Time				Total		
	Pré-Lockdown		During lockdown		N		
	n	%	n	%			
<i>n</i>	(%)	52	(29.9)	122	(70.1)	174	
Gender	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Male	48	94.2	115	94.3	164	94.3	
Female	3	5.8	7	5.7	10	5.7	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age (<i>M, SD</i>)	44.19	(5.79)	39.83	(6.38)	41.13	6.51	
Education (%)	<i>n</i>	%	<i>n</i>	%	<i>N</i>	%	
Elementary school	2	(3.8)	0	(0)	2	(1.1)	
Basic school	5	(9.6)	7	(5.7)	12	(6.9)	
High school	35	(67.3)	92	(75.4)	129	(73.0)	
University education	10	(11.5)	23	(18.8)	33	(18.9)	
Rank patrol (%)	<i>n</i>	%	<i>n</i>	%	<i>N</i>	%	
Higher	5	(9.5)	10	(7.2)	23	(13.2)	
Lower	47	(90.2)	113	(92.6)	151	(86.8)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Years of service (<i>M, SD</i>)	20.22	(5.80)	15.90	(6.68)	17.23	(6.71)	
					<i>N</i>	%	
Shift-Work	40	(76.9)	97	(79.5)	137	(78.7)	
FCV-19S (<i>M, SD</i>)	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
FCV-19S – Emotional	10.65	(3.40)	9.64	(3.55)	9.94	3.53	
FCV -19S– Cognitive	5.63	(2.10)	4.99	(2.30)	5.18	2.25	
FCV-19S Score Total	16.29	(5.03)	14.63	(5.41)	15.13	5.34	
PCL-5 Total Score	<i>n</i>	%	<i>n</i>	%	<i>N</i>	%	
≥ 31	3	(1.72)	20	(11.49)	23	(13.22)	
PSQ-OP Total Score	<i>n</i>	%	<i>n</i>	%	<i>N</i>	%	
< 2	24	(13.8)	9	(17.3)	15	(12.3)	
≥ 2	19	(36.5)	33	(27.0)	52	(29.9)	
≥ 3.5	23	(42.2)	72	(59.0)	95	(54.6)	

FCV-19S Fear of Covid 19 Scale. T0=pré lockdown; T1 = During lockdown

Posttraumatic Stress Disorder Checklist for DSM-5 (Blevins et al. 2015; Portuguese Version: Silva et al. 2018)

We accessed the posttraumatic stress disorder using the PCL-5. This questionnaire is a 20-item self-reported measurement to assess the PTSD symptoms. The PCL-5 assesses on a 5-point Likert scale (0=not at all; 4=extremely) a total score varying from 0 to 80. Higher scores indicate a more severe PTSD symptomatology. The Portuguese version (Silva et al. 2018) demonstrated great internal consistency: $\alpha = 0.94$. The internal consistency for the present study was also excellent Cronbach's $\alpha = 0.96$.

Analytical Strategy

To assess the Fear of Covid-19 Scale psychometric properties, we analyzed the psychometric sensibility, the

construct validity, and the concurrent validity. Additionally, we also tested the invariance of the factorial model in pre-lockdown (T0) and during-lockdown (T1) groups and the internal consistency measure. There was no missing data, as the questions on the survey were all mandatory. Since we had responses from over 10 participants per item, we considered our sample size adequate for the employment of an accurate Confirmatory Factor Analysis (Field 2018).

Statistical analyses were performed using SPSS and AMOS v.27 (Arbuckle 2020, United States, New York, IBM Corporation). The CFAs were performed using a maximum likelihood estimation with robust standard errors using R (Version 4.0.3) and R studio Desktop (Version 1.4.1103) with the R packages “Lavaan” (Rossee 2012), “nFactors” (Raiche and Magis 2020), “Parameters” (Lüdtke et al. 2020) and “Psych” (Revelle 2018).

Descriptive Statistics

Descriptive statistics were calculated to characterize the participants and the study variables, for instance, fear of Covid-19, PTSD, and operational stressors. Additionally, t-tests for independent samples (T0-T1) were performed to compare the participants in relation to the study variables.

Psychometric Sensibility

We examined the psychometric sensibility of the scale, using the skewness and kurtosis [$sk < |3|$ and $ku < |10|$] to evaluate the normal distribution of responses for each item (Kline 2015a, b).

Construct Validity

Analysis of factorial validity, convergent, and discriminant validities were performed to assess the construct validity.

Factorial Validity

For the CFA, items with factor loadings above 0.3 were considered good to include (Brown and Moore 2012). Following the recommendation from (Bentler and Bonett 1980; Marôco 2021) to evaluate the quality of the models' adjustment, we used the following indexes and reference values: χ^2/df (reason between the Chi-Square statistic and the degrees of freedom), CFI (Comparative Fit Index), RMSEA (Root Mean Square Error of Approximation), the Standardized Root Mean Square Residual (SRMR) and AIC (Akaike Information Criterion). According to Tabachnick and Fidell (2012) a model was considered to have an acceptable fit if it presented values of: $\chi^2/df < 2$; $CFI \geq 0.95$; $RMSEA \leq 0.05$; $SRMR \leq 0.08$ (Kline 2015a, b; Tabachnick and Fidell 2012), and AIC the lower, the better (Bentler and Bonett 1980; Marôco 2021). To compare nested models, the scaled chi-square difference ($\Delta S-B\chi^2$) we used, following Satorra and Bentler's recommended algorithm (Satorra and Bentler 2001).

Convergent and Discriminant Validities

Average Variance Extracted (AVE) of the factors and the comparison between these and the square of the correlation between these factors were performed to analyze the convergent and discriminant validities. These validities are demonstrated if the values are equal or greater than 0.05 (convergent) or if the AVE of the factors is greater or equal to the square of the correlation between these factors (discriminant) (Marôco 2021). Furthermore, the heterotrait-monotrait ratio of correlations (HTMT) is a novel approach to determine discriminant validity (Henseler et al. 2015), so we also use the HTMT to access the discriminant validity. According to Henseler and

colleagues (2015) discriminant validity can be established when the HTMT value is inferior to 0.85.

Criterion Validity

To assess the validity of the criterion, concurrent validity was performed.

Concurrent Validity

The concurrent validity was analyzed through the estimation of the correlations between the results of the Operational Police Stress Questionnaire (PSQ-Op) (Queirós et al. 2020) and the results of the Posttraumatic Stress Disorder Checklist (Silva et al. 2018). In the exploratory analysis we verified that the requirements for the use of parametric tests were violated. Thus, we should use nonparametric tests. However, according to (Field 2018) these tests are generally considered to be less powerful and robust than parametric tests. The same author argues that if parametric and nonparametric tests present equal results on the same data, it is justifiable and preferable to use parametric tests (Field 2018). In our sample, parametric (Pearson) and nonparametric (Spearman) correlation analysis presented the same significant results. Therefore, we opted to use always the parametric tests.

Internal Consistency

Finally, the internal consistency was estimated for the total scale and the subscales of the Fear of Covid-19 (Ahorsu et al. 2020) and the two groups. The Cronbach's alpha coefficient (α), McDonald's omega (Ω) and the composite reliability (CR), a measure of reliability especially appropriate for the CFA (Marôco 2021) were performed. Good internal consistency is shown when Cronbach's alpha and McDonald's omega coefficient are higher than 0.70, the item-total correlation is over 0.30, and the mean-item correlation is higher than 0.15 (Field 2018).

Measurement Invariance

A Multigroup Confirmatory Factor Analysis was performed to assess the pre and during measurement invariance. The stepwise strategy of growth restrictions was used. For that, equality restrictions were imposed to the factorial weights of the model adjusted to the groups simultaneously. The statistics tests were the difference of the adjustment chi-square (ΔX^2) and the difference of the Comparative Fit Index (ΔCFI) between the model with fixed parameters and the basal model with free parameters. Some authors have been used (ΔX^2) since X^2 is sensitive to sample size (Marôco 2021). To outline this limitation, Cheung and Rensvold (2002) suggest the use (ΔCFI) since it is not affected by the model's specification and whose value of ($CFI < 0.01$) indicates the model's invariance.

Results

Descriptive Statistics

Fear of Covid-19 scale findings regarding the total sample and the groups pre-lockdown (T0) and during lockdown (T1) are presented in Table 1. According to the cut-off point of Nikopoulou and colleagues (2020), about 35% of the total sample fulfilled the impact of fear of Covid-19 and 14% and 21% of pre-lockdown and during the lockdown, respectively.

PTSD Symptoms

The mean of the total PTSD symptoms was 15.79 ($SD=15.86$), ranged between 1 and 80. The results revealed that 13% ($n=23$) of the sample reported a total score equal to or higher than 31. If we analysed according to time of evaluation of pandemic the participants reported the 2% ($n=3$) and 12% ($n=20$) pre lockdown and during lockdown respectively.

Operational Stressors

The results revealed that 85% ($n=147$) of the sample reported moderate to high stress (moderate stress 30%, $n=52$ and high stress 55%, $n=95$). In T0 (pre lockdown) the results showed that 17% ($n=9$) of the sample reported low, 37% ($n=16$) moderate, and 44% ($n=23$) high stress. In T1 (during lockdown) the results showed that 12% ($n=15$) of the sample reported low, 27% ($n=33$) moderate, and 59% ($n=72$) high stress.

Difference Tests

The 52 participants who belong to the pre lockdown – (T0) ($M=16.29$, $SD=5.03$) compared to the 122 participants in the lockdown group (T1) ($M=14.63$, $SD=5.41$) reported

a significant higher degree of fear of Covid-19 scores $t(172)=1.89$, $p=0.30$. There were no differences between T0 ($M=15.58$, $SD=14.62$) and T1 ($M=15.88$, $SD=16.41$) considering total score of PTSD $t(172)=-0.144$, $p=0.46$. Though, regarding the operational stressors the T0 participants ($M=3.32$, $SD=1.24$) reported significantly lower degree $t(172)=-0.207$, $p=0.020$ compared to the T1 participants ($M=3.79$, $SD=1.43$).

Psychometric Sensitivity

The distribution of FCV-19S items is shown in Table 2. Skewness and kurtosis were evaluated for each item, as well as their adherence to a normal distribution. The results showed non-normal distribution with Kolmogorov–Smirnov test $D(174)=0.096$, $p<0.001$.

Construct Validity

Factorial Validity – Confirmatory Factor Analysis

Two CFA models were conducted: Model A (unifactorial) and B (bifactorial model). Model B present best fit indices ($\chi^2(10)=23.232$; $\chi^2/df=2.323$; $p<0.001$), with highest CFI=0.980; GFI=0.963, lower RMSEA=0.087; SRMR=0.032; and AIC=73.232 for the total sample. Comparing nested models using the Satorra-Bentler chi-square difference, the results showed that the bi-factorial model (Model B) was the best fitting model with significantly better values than the unifactorial model (Model A). Table 3 (see supplemental material) shows the loadings and the descriptive statistics of the items and subscale in the Portuguese version of the fear of Covid-19 scale among police officers. The Cronbach alpha was above the minimum considered satisfactory (0.70) for Covid-19 total score and each subscale. The FCV-19S subscale showed high loadings on latent factors (>0.30).

Table 2 Descriptive statistics of the 7 items that make up the FCV-19S (stander-error of Skewness=0.0184; stander-error of Kurtosis=-0.366, $N=174$)

Items	Mean	Stander deviation	Skewness	Kurtosis	Minimum	Maximum
1	2.84	1.10	0.034	-0.872	1	5
2	2.45	1.09	0.241	-0.961	1	5
3	1.68	0.80	0.923	0.039	1	4
4	2.37	1.15	0.537	-0.559	1	5
5	2.28	1.00	0.425	-0.560	1	5
6	1.64	0.78	1.014	0.315	1	4
7	1.86	0.96	0.879	-0.231	1	4
Total (FCV-19S)			0.374	-0.625	7	28
Emotional (FCV-19S)			0.140	-0.865	4	18
Cognitive (FCV-19S)			0.728	-0.470	3	12

FCV-19S Fear of Covid 19 Scale

Table 3 Loading for the structure, and descriptive statistics and reliability

	Mean item scored (<i>SD</i>)	Corrected item-total correlation	Mean subscale score (<i>SD</i>)	α	Ω
Fear of covid emotional scale			9.94 (3.53)	.83	.83
Item 1 – Fear of covid-19	2.84 (1.10)	0.693			
Item 2 – Uncomfortable	2.45 (1.09)	0.721			
Item 4 – Fear of dying	2.37 (1.15)	0.565			
Item 5 – News anxiety	2.28 (1.00)	0.648			
Fear of covid cognitive scale			5.18 (2.25)	.86	.87
Item 3 – Clammy hands	1.68 (0.80)	0.686			
Item 6 – trouble sleeping	1.64 (0.78)	0.804			
Item 7 – Tachycardia	1.86 (0.96)	0.739			
Total scale			15.15 (5.34)	.89	.89

N = 174

Convergent and Discriminant Validities of Fear of Covid-19 Scale

The Average Variance Extracted (AVE) was adequate for the subscale “FCV-19S emotional scale” (0.564) as well as for the subscale “fear of Covid-19 cognitive scale” (0.824). For the total scale the Average Variance Extracted was adequate too (0.824).

The Heterotrait-Monotrait Ratio of Correlations (HTMT) of 0.80 provides sufficient evidence of the discriminant validity (Table 4).

Criterion Validity

Concurrent Validity

The concurrent validity was analyzed through the estimation of the Pearson correlations. Table 5 shows Pearson correlations coefficients among fear of Covid-19, PTSD, and operational stressors. The results showed a significant positive correlation between fear of Covid-19 and all variables studied, with fear of Covid-19 and PTSD presenting the strongest correlation, with a medium effect ($r = 0.26$; $p < 0.001$) and fear of Covid-19 and operational stressors being the weakest correlation, with a small effect ($r = 0.23$ $p = 0.003$).

Internal Consistency

The fear of Covid-19 scale showed good results of Cronbach’s alphas and McDonald’s omega (Table 3). The results

showed that both the total scale ($\alpha = 0.89$, $\Omega = 0.89$) and the emotional ($\alpha = 0.83$, $\Omega = 0.83$) and cognitive ($\alpha = 0.86$, $\Omega = 0.87$) subscales have excellent internal consistency for the overall sample. The internal consistency at pre lockdown was $\alpha = 0.84$ and $\alpha = 0.80$ for the emotional and cognitive subscales, respectively, and at during lockdown, it was $\alpha = 0.82$ and $\alpha = 0.87$, respectively.

Measurement Invariance

The factorial model presented an acceptable adjustment ($\chi^2/df = 1.31$; RMSEA = 0.042; $P(\text{rmsea} \leq 0.05) = 0.644$; CFI = 0.978) (Table 6) by the simultaneous groups (pre lockdown and during lockdown), showing up the configural invariance of the factorial model (Table 7).

Table 4 Average extracted variance (AVE), Pearson’s correlation square between the factors (R^2) and composite reliability (FC)

Factor	AVE	R^2			FC
		Emotional	Cognitive	Total score	
Emotional	0.564	1	1.00	0.878	0.84
Cognitive	0.824	1.00	1	0.878	0.86
Total score	0.780	0.878	0.878	1	0.92
HTMT Adjustment criterion					
HTMT	0.80	< .85			

AVE Average Extracted Variance; Pearson’s correlation square between the factors (R^2) and Composite Reliability (FC); HTMT Heterotrait-Monotrait Ratio of Correlations

Table 5 Pearson's correlation coefficients

	Fear of covid emotional	Fear of covid cognitive	Total score fear of Covid-19 scale	PTSD total score	Stressor operational
Fear of covid emotional	1				
Fear of covid cognitive	.690***	1			
Total score fear of Covid-19 scale	.952***	.868***	1		
PTSD total score	.257***	.187*	.257***	1	
Stressor operational	.255***	.140	.228**	.550***	1

** $p < 0.01$

Table 7 shows the measurement model exhibits weak metric invariance. Thus, metric invariance is demonstrated ($\Delta X^2_{\chi}(5) = 9.289$; $p = 0.098$). Then, it was analyzed “assuming model measurements weights to be correct”, where we can conclude that the intercepts are invariant in the two moments ($\Delta X^2_i(7) = 9,800$; $p = 0.200$). In this case, the model is said to have strong measurement invariance. The next step, “assuming model measurement intercept to be correct,” compares the model with fixed weights and intercepts and free covariances with the model with fixed weights, intercepts, and covariances ($\Delta X^2_{cov}(3) = 0.503$; $p = 0.918$), thus confirming the scalar invariance. Finally, the invariance of residues was tested ($\Delta X^2_e(10) = 5,020$; $p = 0.890$), thus confirming the last level of the invariance of the measure – structural invariance. The measurement model is invariant in both groups (Fig. 1).

Discussion

This study analyzed the psychometric proprieties of Fear of Covid-19 scale among Portuguese police officers during the third and most severe wave of the COVID-19 pandemic in Portugal. Furthermore, it also explored the factorial model invariance in groups of pre-lockdown and during-lockdown. Researchers have noted the continued importance of the continued assessment of the psychological well-being in this population, especially during the COVID-19 pandemic (Stogner et al. 2020). In line with the original study (Ahorsu et al. 2020), and in subsequent research

(Alyami et al. 2021; Huarcaya-Victoria et al. 2020; Magano et al. 2021; Soraci et al. 2020; Tzur Bitan et al. 2020), our results provide support for the two-factor model as the best-fitting model. These results suggest that the FCV-19S is a multidimensional construct, and it allows the usage of a general factor and specific somatic and emotional factors (Chi et al. 2021; Huarcaya-Victoria et al. 2020). Compared to the univariate model, the two-factor model showed the best adjustment of CFI, TLI, RMSEA, and SRMR indices. In addition to the lower adjustment levels, one of the problems found in the one-factor model was a very high RMSEA. The same was found in the one-dimensional version as in the study by Alyami and colleagues (2021). One way to overcome this problem might be to use correlated errors, but that could artificially inflate the GFIs. Even correlating the errors, the model did not reach adjustment levels as satisfactory as the two-factor model.

Conversely, the emotional dimension had higher average values than the physiological dimension in the total sample. In that sense, it seems that the total sample of participants would experience more emotional symptoms associated with fear of Covid-19, such as (e.g., to feel uncomfortable; to fear dying) (Alyami et al. 2021; Masuyama et al. 2020; Reznik et al. 2021). Besides, our results also provide support that this is a good measure to assess fear of Covid-19 in professionals trained to deal with emergency and catastrophic situations such as police officers, as it presented structural invariance.

Regarding measurement invariance, to our knowledge, this is the first study to allow comparisons between groups regarding the pandemic evolution timing, used the FCV-19S scale

Table 6 AFCs adjustment indexes of the original factorial model of fear of covid-19 scale ($N = 174$)

Model	χ^2/df	X^2	df	p	CFI	TLI	RMSEA	SRMR	90% IC	p -close	AIC	$\Delta S-B\chi^2$ (df diff)
Model A	7.021	98.298	14	.000	.870	.805	.187	.066	[.153-.222]	<.001	140.298	
Model B	2.323	23,232	10	.010	.980	.957	.087	.032	[.041-.134]	.085	73.232	98.866 (14)***

Model A – Unifactorial model. Model B – bifactorial model. X^2 =test Chi-square; df =degrees of freedom; *CFI* Comparative Fit Index; *TLI* Tucker-Lewis Index; *RMSEA* Root Mean Square of Approximation; *SRMR* Standardized root mean square residuals; *CI* Confidence Interval; *AIC* Akaike information criterion

Table 7 Model's comparison for invariance test for FCV-19 Scale

Invariance level	Definition	Model	χ^2	df	$\Delta\chi^2$	Δ df	p	CFI	RMSEA	SRMR	Δ CFI	Δ RMSEA	Δ SRMR
Configural invariance	Same factor structure	M1	34.295	20	-	-	-	.978	0.064	0.0579	-	-	-
Metric invariance	Same factor structure and factor loadings	M2-M1	43.583	25	9.288	5	0.012	.971	0.066	0.0617	-.007	0.002	0.004
Scalar invariance	Same factor structure, factor loadings and intercepts	M3-M2	53.383	32	9.8	7	0.010	.966	0.062	0.0593	-.005	-0.004	-0.002
Error variance invariance	Same factor structure, factor loadings, and error variances	M4-M3	53.886	35	0.503	3	0.022	.970	0.056	0.0621	.004	-0.006	0.003
Structural invariance	Same factor structure, factor loading, error variances and factors' covariance	M5-M4	58.906	45	5.02	10	0.080	.978	0.042	0.0684	.008	-0.014	0.006

χ^2 Chi-square, df degrees of freedom, $\Delta \chi^2$ difference between model's χ^2 , Δ df difference between models' df, p p value, CFI comparative fit index, RMSEA root mean square error of approximation, Δ CFI difference between model's CFI's, Δ RMSEA difference between model's RMSEA, Δ SRMR difference between model's standardized root mean square residuals, M1 to M5 models tested

Confirmatory Factor Analysis

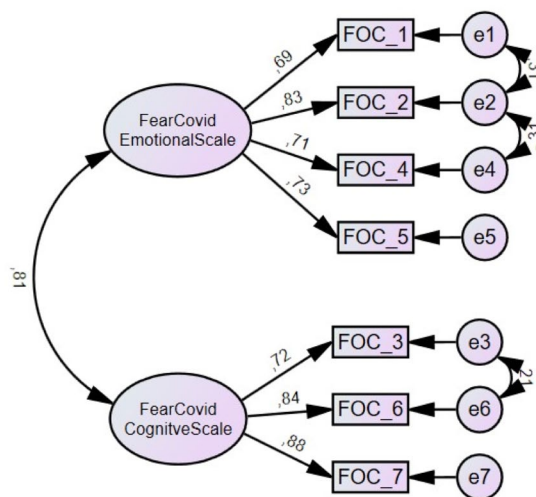


Fig. 1 Confirmatory factor analysis. Note. The fear of covid-19 Scale measurement model for the two moments pre 3rd wave and during 3rd wave of the covid-19 pandemic ($\chi^2/df=1.31$, CFI=0.978, PCFI=1.048; RMSEA=0.042; I.C. 90%]0.00;0.70[. The measurement model is invariant in both groups. $\Delta\chi^2_{\lambda}(5)=9.289$; $p=0.098$; $\Delta\chi^2_{i}(7)=9.800$; $p=0.200$; $\Delta\chi^2_{cov}(3)=0.503$; $p=0.918$; $\Delta\chi^2_e(10)=5.020$; $p=0.890$)

with sample of police officers. Previous research that evaluated measurement invariance by comparing groups such as gender (Caycho-Rodríguez et al. 2020; Huarcaya-Victoria et al. 2020), adult/non-adult (Chi et al. 2021), and participants from different professions (Huarcaya-Victoria et al. 2020).

Regarding the level of fear of Covid-19, our results indicated that the participants in time 0 (pre-lockdown) reported a higher fear of COVID-19. Nevertheless, this does not seem to undermine the measurement invariance. We argue that this result may be because risk perception and fear of Covid-19 may appear different in distinct pandemic evolution phases, and the measure manages to capture these oscillations while maintaining sensitivity and factor structure. Another explanation may be due the fact of that during the lockdown phase, police officers may have felt safer. Since most of the population was at home, this may have resulted in a lower level of exposure perception of individuals and their families. Another explanation could be that police officers believe that before the lockdown (T0), the pandemic would be more uncontrolled, which could trigger high levels of uncertainty and greater anxiety compared to the lockdown period (T1) when they could believe that the pandemic would be more controlled or contained, increasing their sense of control, which for these professionals is an important dimension that helps them stay safe, thus reducing levels of fear of covid-19 (Frenkel et al. 2021). Overall, the findings confirm that FCV19-S is a good measurement to assess the impact of

Covid-19 pandemic among Portuguese police officers, even in different phases of the pandemic evolution.

The results show that there are no significant differences between pre-lockdown and during lockdown considering total score of PTSD. One plausible explanation may be due to the traumatic events reported (e.g., threat to life, death or serious injury to children, death, or serious injury to colleagues and/or families, and suicide death) do not seem to be directly related to the Covid-19 pandemic, since the average time to which the traumatic event reported was 7.44 years ($SD=6.88$). However, it is important to consider the late manifestation of the psychological effects of covid-19, which are no different from the traumatic events mentioned, but may have triggered and/or exacerbated them. Additionally, the results show that the operational stressors level were higher during the lockdown (T1). One possible explanation may be that during this time, police officers had to adapt to a series of changes in their job demands, such as no rest time, overtime demands, a high number of infections, adjustments in work shifts and reallocation police officers from operational and administrative services, control the entry and exit of cities and the country, crowd control, social distance enforcement, wearing of masks, and etc. In addition, the need to isolate oneself and find the ability to do this with family when returning home after service during the isolation period was an added stressor, such as having to find a safe space to be alone. This may not seem like an operational stressor at first, but we believe that this extends to the operational area and the fear of Covid-19. All of which have been linked to an increase in operational stressors (Guo et al. 2020; Luchetti et al. 2020).

This study also revealed several implications for police practitioners. First and foremost, it adds to the limited body of knowledge on the impact of COVID-19 pandemic on officer wellbeing (Fleming and Brown 2021; Frenkel et al. 2021; Stogner et al. 2020). Second, this research highlighted that the perception of risk varied across time period among officers, but the long-term psychological effects (beyond the pandemic) are currently unknown. As such, we call for police practitioners to recognize the potential long term psychological effects of the COVID-19 which may be delayed in their manifestation as noted by Drew and Martin (2020). Therefore, law enforcement officials should take a proactive stance in educating their officers on the potential delayed effects and the proper coping mechanisms for managing the stressors, along with developing specialized mental health strategies for those at risk for greater trauma exposure (Drew and Martin 2020).

This study also revealed work-related stressors. As such, operationally, we offer recommendations in line with Stogner and colleagues' (2020) suggestions. We call for agencies to be logistically prepared for repeated virus outbreaks by resourcing equipment and supplies (e.g., personal protective equipment) to keep officers, their families and the public safe. Police leaders also should continue to plan, develop, and

refine strategies on how conduct police operations during a pandemic (e.g., balanced work schedules, officer education on health and safety precautions, remote work options, policing the immediate needs of the community, cross agency collaboration, and etc.) since recent research has revealed that the mental stresses of frontline officers have been exacerbated by work (Elliott-Davies 2021; Newiss et al. 2022). In addition, we also believe that the higher hierarchies should, not only in these moments of crisis, but especially in these moments of crisis, foster the feeling of appreciation of the lower hierarchies, increasing the feeling of appreciation. Because it is known that when professionals feel valued and listened to and supported by the organization, police officers tend to have better mental and emotional health, which can help reduce the fear of COVID-19, as well as creating a healthier working environment. While on the other hand, police officers do not feel valued or supported by the organization, this can increase their fear of the virus, as they may feel helpless and vulnerable, also increasing their vulnerability to developing or exacerbating psychopathological symptoms (Hameed et al. 2022). As recommendations, we highlight i) Prioritize transparent and regular communication between the organization's leadership and police officers, providing up-to-date information; ii) Publicly recognize and value the hard work and sacrifice of police officers during the pandemic, but not only and showing gratitude and recognition for their service; and iii) Implement psychological and emotional support programs for police officers, including access to counseling and mental health resources on a routine and generalized basis (Geoffrion et al. 2023). The previous recommendation is especially important for maintaining organizational commitment among officers, as the policing profession continues to experience issues with hiring and retention (Charman and Bennett 2022; Fleming and Brown 2021).

Limitations and Strengths

Some limitations need to be mentioned, essentially related to the methodology.

First, although in the total sample we have enough participants to perform confirmatory factor analysis, when we divide the sample into pre-lockdown (T0) and during lockdown (T1). The sample size of Time 0 (pre-lockdown) does not reach the number required by the most demanding authors (Field 2018). However, if we follow less strict criteria, the sample has the minimum size required (Kass and Tinsley 1979). Still, these data need to be generalized with caution. Second, we cannot guarantee that participants have not filled in the questionnaires more than once. However, we checked the socio-demographic data, and no repeated data were found to suggest participant repetition. Third, since this is a cross-sectional study, it was

not possible to obtain the test–retest results, and it is not possible to determine the causality between fear of Covid-19, PTSD, and operational stressors. Finally, this study relied on retrospective self-report measures, and we know that this can lead to reporting bias from participants.

As for the strengths, in addition to its being relevant and innovation already mentioned regarding to the time of pandemic development, it's important to mention that this is a population with difficult access in Portugal and that this was the first study carried out with the fear of Covid-19 scale in this population and between two different moments of the pandemic.

Future Recommendations

As previously mentioned, it is important to deepen the study of the long-term impact of the Covid-19 pandemic on mental health, especially of those professionals who have been on the front line of this struggle. In addition, the literature has indicated that these professionals, due to the inherent demands of their profession, are more likely to have to respond to more emergency and catastrophic situations in the future, as well as more vulnerable, due to the cumulative exposure to develop PTSD and/or other psychological and emotional disorders. It would also be important future studies to assess the invariance of this measure by taking into consideration other comparison groups within police forces as well as in the community, such as women vs. men, having been infected vs. not having been infected, and having lost someone due to Covid-19 vs. not having lost anyone significant due to Covid-19 pandemic to name a few. Lastly, future longitudinal studies and large sample sizes are also needed to overcome some limitations of the present study.

Acknowledgements [redacted for peer review] The authors express appreciation to the police forces and the Institutions from the North of Portugal. Finally, the authors are grateful to the police officers who, generously and patiently, participated in this research.

Funding Open access funding provided by FCTIFCCN (b-on). This study was conducted at the Psychology Research Centre (CIPsi/UM) School of Psychology, University of Minho, supported by the Foundation for Science and Technology (FCT) through the Portuguese State Budget (UIDB/01662/2020), as well as through the funding of a research grant awarded to the first author; Foundation for Science and Technology [2021.05085.BD].

Data Availability The data supporting this study's findings are available from the corresponding author, BS, upon reasonable request.

Declarations

Ethical Approval This study was conducted in accordance with the Declaration of Helsinki (59th Amendment) and was approved by local ethics review boards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interests The authors declare no conflict of interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Ahorsu DK, Lin CY, Imani V, Saffari M, Griffiths MD, Pakpour AH (2020) The fear of COVID-19 scale: development and initial validation. *Int J Ment Health Addict*. <https://doi.org/10.1007/s11469-020-00270-8>
- Alyami M, Henning M, Krägeloh CU, Alyami H (2021) Psychometric evaluation of the Arabic version of the fear of COVID-19 scale. *Int J Ment Heal Addict* 19(6):2219–2232. <https://doi.org/10.1007/s11469-020-00316-x>
- Andersen JP, Papazoglou K, Koskelainen M, Nyman M, Gustafsberg H, Arnetz BB (2015) Applying resilience promotion training among special forces police officers. *Sage Open*. <https://doi.org/10.1177/2158244015590446>
- Arbuckle JL (2020) Amos (Version 26.0) (No. 26). Chicago: IBM SPSS. https://www.google.com/search?q=cite+ibm+spss+amos+apa+style&sxsrf=AOaemvLk50AtXu4npA2_mtd9sJSSlvln1A%3A1636304805864&ei=pQeIYa6SNIWulwTluqqgCA&oeq=cite+ibm+spss+amos+apa+style&gs_lcp=Cgdnd3Mtd2l6EAM6BwgAEEcQsANKBAhBGABQkwhYgw5gvhFoAXACeAC AAXGIAdeBkgEDMS4x
- Bentler PM, Bonett DG (1980) Significance tests and goodness of fit in the analysis of covariance structures. *Psychol Bull* 88(3):588. <https://doi.org/10.1037/0033-2909.88.3.588>
- Blevins CA, Weathers FW, Davis MT, Witte TK, Domino JL (2015) The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *J Traum Stress* 28(6):489–498. <https://doi.org/10.1002/jts.22059>
- Brown TA, Moore MT (2012) Confirmatory factor analysis. *Handbook of structural equation modeling*, 2nd edn. Guilford, pp 261–266
- Cavalheiro FRS, Sticca MG (2020) Adaptation and validation of the Brazilian version of the fear of COVID-19 scale. *Int J Ment Heal Addict*. <https://doi.org/10.1007/s11469-020-00415-9>
- Caycho-Rodríguez T, Vilca LW, Cervigni M, Gallegos M, Martino P, Portillo N, Barés I, Calandra M, Burgos Videla C (2020) Fear of COVID-19 scale: Validity, reliability and factorial invariance in Argentina's general population. *Death Stud* 0(0):1–10. <https://doi.org/10.1080/07481187.2020.1836071>
- Charman S, Bennett S (2022) Voluntary resignations from the police service: the impact of organisational and occupational stressors on organisational commitment. *Polic Soc* 32(2):159–178. <https://doi.org/10.1080/10439463.2021.1891234>

- Cheung GW, Rensvold RB (2002) Evaluating goodness-of-fit indexes for testing measurement invariance. *Struct Equ Modeling* 9(2):233–255. https://doi.org/10.1207/S15328007SEM0902_5
- Chi X, Chen S, Chen Y, Chen D, Yu Q, Guo T, Cao Q, Zheng X, Huang S, Hossain MM, Stubbs B, Yeung A, Zou L (2021) Psychometric evaluation of the fear of COVID-19 scale among Chinese population. *Int J Ment Heal Addict*. <https://doi.org/10.1007/s11469-020-00441-7>
- Drew JM, Martin S (2020) Mental health and well being of police and a health pandemic: Critical issues for police leaders and a post COVID-19 environment. *J Commun Safety Well-Being* 5(2):31–36. <https://doi.org/10.35502/jcswb.133>
- Elliott-Davies M (2021) Demand, capacity and welfare survey 2020, Retrieved from https://www.polfed.org/media/16557/dcw_prrb-report-13-01-2021-v20.pdf. Refstyled
- Field A (2018) *Discovering statistics using IBM SPSS*, 5th edn. Sage Publications, London, England
- Fleming J, Brown J (2021) Policewomen's experiences of working during lockdown: Results of a survey with officers from England and Wales. *Policing* 15(3):1977–1992. <https://doi.org/10.1093/police/paab027>
- Frenkel MO, Giessing L, Egger-Lampl S, Hutter V, Oudejans RRD, Kleygrewe L, Jaspaert E, Plessner H (2021) The impact of the COVID-19 pandemic on European police officers: Stress, demands, and coping resources. *J Crim Just* 72:101756. <https://doi.org/10.1016/j.jcrimjus.2020.101756>
- García-Reyna B, Castillo-García GD, Barbosa-Camacho FJ, Cervantes-Cardona GA, Cervantes-Pérez E, Torres-Mendoza BM, Fuentes-Orozco C, Pintor-Belmontes KJ, Guzmán-Ramírez BG, Hernández-Bernal A, González-Ojeda A, Cervantes-Guevara G (2020) Fear of COVID-19 Scale for hospital staff in regional hospitals in Mexico: A brief report. *Int J Ment Health Addic* 1–12. <https://doi.org/10.1007/s11469-020-00413-x>
- Geoffrion S, Leduc MP, Bellemare F (2023) A feasibility study of psychological first aid as a supportive intervention among police officers exposed to traumatic events. *Front Psychol* 14:912. <https://doi.org/10.3389/fpsyg.2023.1149597>
- Guo H, Zhou Y, Liu X, Tan J (2020) The impact of the COVID-19 epidemic on the utilization of emergency dental services. *J Dent Sci* 15(4):564–567. <https://doi.org/10.1016/j.jds.2020.02.002>
- Hameed W, Avan BI, Feroz AS, Khan B, Fatmi Z, Jafri H, Siddiqi S (2022) Impact of COVID-19 on mental health of primary health-care workers in Pakistan: lessons from a qualitative inquiry. *BMJ open* 12(12):e065941
- Henseler J, Ringle CM, Sarstedt M (2015) A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J Acad Mark Sci* 1(43):115–135. <https://doi.org/10.1007/s11747-014-0403-8>
- Huarcaya-Victoria J, Villarreal-Zegarra D, Podestà A, Luna-Cuadros M (2020) Propiedades psicométricas de una versión en español de la escala de miedo al COVID-19 en población general de Lima. Perú. *Int J Ment Health Addic* 1(1):1–14. <https://link.springer.com/content/pdf/10.1007/s11469-020-00354-5.pdf>
- Jennings W, Perez M (2020) The immediate impact of COVID-19 on law enforcement in the United States. *Am J Crim Justice* 45(4):690–701. <https://doi.org/10.1007/s12103-020-09536-2>
- Jiang Q (2021) Stress response of police officers during COVID-19: A moderated mediation model. *J Invest Psychol Offender Profiling* 18(2):116–128. <https://doi.org/10.1002/jip.1569>
- Kass A, Tinsley A (1979) Factor analysis. *J Leis Res* 11:120–138
- Kline RB (2015a) *Principles and practice of structural equation modeling*, (2nd ed). New Your Guilford
- Kline T (2015b) Classical test theory: Assumptions, equations, limitations, and item analyses. *Psychol Test: A Practical Approach to Design and Evaluation* 91–106. <https://doi.org/10.4135/9781483385693.n5>
- Luchetti M, Lee JH, Aschwanden D, Sesker A, Strickhouser JE, Terracciano A, Sutin AR (2020) The trajectory of loneliness in response to COVID-19. *Am Psychol* 7(75):897–908. <https://doi.org/10.1037/amp0000690>
- Lüdecke D, Ben-Shachar M, Patil I, Makowski D (2020) Extracting, computing and exploring the parameters of statistical models using R. *J Open Source Softw* 5(5):2445
- Magano J, Vidal D, Sousa H, Leite Â (2021) Validation and psychometric fear of COVID-19 Scale (FCV-19S) and associations with travel, tourism and hospitality. *Int J Environ Res Public Health* 18(427):2–12. <https://doi.org/10.3390/ijerph18020427>
- Marôco J (2021) *Análise de Equações Estruturais - Fundamentos Teóricos, Software & Aplicações* (3rd ed). ReportNumber, Lda
- Martínez-Lorca M, Martínez-Lorca A, Criado-Álvarez JJ, Armesilla MDC, Latorre JM (2020) The fear of COVID-19 scale: Validation in Spanish university students. *Psychiatry Res* 293:113350. <https://doi.org/10.1016/j.psychres.2020.113350>
- Masuyama A, Shinkawa H, Kubo T (2020) Validation and psychometric properties of the Japanese version of the fear of COVID-19 scale among adolescents. *Int J Ment Health Addic* 1–11. <https://doi.org/10.1007/s11469-020-00368-z>
- Mccreary DR, Fong I, Groll DL (2017) Measuring policing stress meaningfully : Establishing norms and cut-off values for the operational and organizational police stress questionnaires. *Police Pract Res* 18(6):612–623. <https://doi.org/10.1080/15614263.2017.1363965>
- Newiss G, Charman S, Ilett C, Bennett S, Ghaemmaghami A, Smith P, Inkpen R (2022) Taking the strain? Police well-being in the COVID-19 era. *Police J: Theory, Practice Principles* 95(1):88–108. <https://doi.org/10.1177/0032258X21104470>
- Nikopoulou VA, Holeva V, Parlapani E, Karamouzi P, Voitsidis P, Porfyri GN, Diakogiannis I (2020) Mental health screening for COVID-19: A proposed cutoff score for the Greek version of the Fear of COVID-19 Scale (FCV-19S). *Int J Ment Health Ad*. <https://doi.org/10.1007/s11469-020-00414-w>
- Observador (2021) Cerca de 13% do efetivo da PSP já esteve infetado com covid-19. Há uma vítima mortal, <https://observador.pt/2021/04/07/cerca-de-13-do-efetivo-da-psp-ja-esteve-infetado-com-covid-19-ha-uma-vitima-mortal/>
- Queirós C, Passos F, Bártole A, Marques AJ, da Silva CF, Pereira A (2020) Burnout and stress measurement in police officers: Literature review and a study with the operational police stress questionnaire. *Front Psychol* 11:1–23. <https://doi.org/10.3389/fpsyg.2020.00587>
- Raiche G, Magis D (2020) Parallel analysis and other non graphical solutions to the cattell scree test, <https://mirror.las.iastate.edu/CRAN/web/packages/nFactors/nFactors.pdf>
- Revelle W (2018) Procedures for psychological, psychometric, and personality research. The Comprehensive R Archive Network. <https://www.yumpu.com/en/document/view/37948493/package-psych-the-personality-project>
- Reznik A, Gritsenko V, Konstantinov V, Khamenka N, Isralowitz R (2021) COVID-19 fear in Eastern Europe: Validation of the fear of COVID-19 scale. *Int J Ment Health Addic* 5(19):1903–1908. <https://doi.org/10.1007/s11469-020-00283-3>
- Rosseel Y (2012) Lavaan: An R package for structural equation modeling. R package version 0.5–15. *J Stat Softw* 2(48):1–36
- Satorra A, Bentler PM (2001) A scaled difference chi-square test statistic for moment structure analysis 4(66):507–514. [sci-hub.st/10.1007/bf02296192](https://doi.org/10.1007/bf02296192)
- Sener H, Arıkan I, Gündüz N, Gülekcı Y (2021) Detecting the relationship between the stress levels and perceived burnout in law-enforcement officers during the COVID-19 outbreak: A cross-sectional study. *Soc Work Pub Health* 36(4):486–495. <https://doi.org/10.1080/19371918.2021.1915910>
- Silva J, Teixeira F, Santos R, Sousa B, Pinto R, Maia A (2018) Posttraumatic stress disorder checklist for DSM-5 (PCL-5): Validity and measurement invariance in a Portuguese Volunteer Firefighters'

- sample. (master's thesis, University of Minho) from <https://repositorium.sdum.uminho.pt/handle/1822/55699>
- Soraci P, Ferrari A, Abbiati FA, Del Fante E, De Pace R, Urso A, Griffiths MD (2020) Validation and psychometric evaluation of the Italian version of the fear of COVID-19 scale. *Int J Ment Health Addic* 1–10. <https://doi.org/10.1007/s11469-020-00277-1>
- State University of New York – Institute for Disaster Mental Health (SUNY-IDMH) (2020) COVID-19: managing stress in this anxious time. Institute for Disaster Mental Health. <https://www.newpaltz.edu/media/idmh/covid-19/IDMH%20COVID19%20Community%20Stress%20Management%20Tip%20Sheet%202020%20Final.pdf>
- Stogner J, Miller BL, McLean K (2020) Police stress, mental health, and resiliency during the COVID-19 pandemic. *Am J Crim Justice* 45(4):718–730. <https://doi.org/10.1007/s12103-020-09548-y>
- Tabachnick BG, Fidell LS (2012) *Using multivariate statistics*, 6th edn. Boston, MA
- Terrill W, Paoline EA III (2013) Examining less lethal force policy and the force continuum: Results from a national use-of-force study. *Police Q* 16(1):38–65. <https://doi.org/10.1177/1098611112451262>
- Tzur Bitan D, Grossman-Giron A, Bloch Y, Mayer Y, Shiffman N, Mendlovic S (2020) Fear of COVID-19 scale: Psychometric characteristics, reliability and validity in the Israeli population. *Psychiatry Res* 289. <https://doi.org/10.1016/j.psychres.2020.113100>
- World Health Organization (2020) World Health Organization, World Health Statistics 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200314-0Asitrep-54-covid-19.pdf?sfvrsn=dcd46351_2%0A
- Wu Y, Sun IY, Ivkovich SK, Maskaly J, Shen S, Neyroud P (2021) Explaining stress during the COVID pandemic among Chinese police officers. *Polic J Policy Pract* 00:1–14. <https://doi.org/10.1093/police/paab053>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.