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RESEARCH ARTICLE

Psychometric properties of COVID-19 Exhaustion Scale in Italian context

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Abstract: The aim of this study was providing a validated scale in the Italian context, for the assessment of the symptoms of mental, physical, and psychological exhaustion that can result from thinking about COVID-19, starting from Burnout Measure of Pines and Aronson. Four studies were conducted. In Study 1, we conducted an exploratory factor analysis. A 2-factor factorial structure—Mental Exhaustion (ME) and Physical and Emotional Exhaustion (PEE)—was shown. In Study 2, we tested the structure of COVID-19 Exhaustion Scale. The two-factor structure with 8 items was the best factorial solution. In Study 3, we tested the concurrent validity of the COVID-19 Exhaustion Scale. The two dimensions were significantly and positively related to physical symptoms and negatively related to life satisfaction. In Study 4, we showed the stability of the COVID-19 Exhaustion Scale using the test-retest method after 3 weeks.

Keywords: COVID-19; exhaustion; psychometric properties; life satisfaction

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1. Introduction

On 11 March 2020, the World Health Organization declared the COVID-19 pandemic[1]; it spread rapidly around the world, forcing governments to take strict preventative measures. This has blocked the economy of many countries. In fact, the pandemic has been defined as "the worst recession since the Great Depression to date"[2].

The COVID-19 pandemic has also had a major impact on people's lives. During the pandemic, individuals experienced symptoms of fear, worry, depression, and other psychological symptoms[3–5].

Although the COVID-19 pandemic has now taken a less critical form than it did during its peak years, it remains in terms of possible consequences a knot to be unravelled, and not all outcomes are yet known.

Some authors have referred to the set of clinical consequences on the physical field as "long-term COVID-19" which is a persistent or prolonged illness, such as fatigue, dyspnoea, cough, head-

ache, brain fog, anosmia, and dysgeusia, that COVID-19 patients continue to experience even in the post-healing phase[6]. Along with physical symptoms, however, serious psychological repercussions associated with COVID-19 have also been reported, which would act as a risk factor for psychiatric sequelae such as anxiety, depression, and post-traumatic stress disorder[7].

In addition, psychological manifestations could be linked to both infected and uninfected individuals due to pandemic-related experiences, including stress in both core workers and healthcare workers[8] or the occurrence of burnout-related symptoms; these last ones, although the scientific literature has dealt with respect to the health professions[9,10], have been neglected on workers in general. For example, emotional exhaustion is one of the symptoms caused by the pandemic[11]; it is also included among the dimensions that characterize the burnout syndrome.

There is extensive literature on burnout, and diverse definitions are provided. For example, Maslach and Leiter[12] define burnout as a syndrome linked to the work context that is developed subsequently to a prolonged stressful situation. According to Maslach and Leiter[13], burnout includes emotional exhaustion, depersonalization, and reduced professional fulfillment[12,14]; among these, emotional exhaustion is the distinguishing feature[15]. Emotional exhaustion occurs due to working or personal challenges that cause the individual to feel mentally, emotionally, and physically tired[13,16]. Emotional exhaustion is linked to a series of negative outcomes both from a personal[17,18] and professional[19,20] point of view. The dimension of depersonalization refers to negative attitudes towards the people involved in work activities (e.g., clients) and includes feelings of irritability and withdrawal. Reduced professional achievement refers to decreased productivity and low motivation[12].

Freudenberger[21] described burnout as a state of fatigue or frustration linked to high commitment in a purpose, in a lifestyle, or in a relationship, receiving low gratification.

According to Pines and Aronson[22], burnout is a state of physical, emotional, and mental exhaustion caused by the individual feeling involved for a long period of time in a challenging situation. Therefore, the authors refer to the dimension of the emotional exhaustion of burnout, distinguishing: physic-type exhaustion, which implies feeling sick or having trouble sleeping; emotional exhaustion, which is related to feelings of depression or lack of hope; and mental exhaustion, which includes the feeling of being helpless or trapped.

The Burnout Measure (BM), developed by Pines and Aronson[22], is based on this model of burnout. Initially, the authors developed a 21-item scale measuring three types of exhaustion: physical, emotional, and mental. However, the authors have never published studies confirming this factorial structure but have emphasized the internal consistency of the scale which is quite high (0.91 to 0.93). Subsequent studies[23] have deduced that the lack of the scale's factorial structure's confirmation was due to the one-dimensional structure of the scale or the high correlation between the three types of exhaustion.

The BM is the second most frequently used self-report measure of burnout[23–25]. The one-dimensional structure of the scale has not been confirmed by later research. Indeed, further studies have emphasised a two[26] or three[27,28] factors' structure.

Malach-Pines[29] developed a reduced version of the scale, consisting of 10 items that refer to

emotional, physical, and mental exhaustion. According to the author, the core of burnout lies in the exhaustion of the individual as such, rather than from exhaustion from work[29]. This is the construct evaluated by the scale.

To support research on COVID-19, Yıldırım and Solmaz[30] validated the COVID-19 Burnout Scale (COVID-19-BS) by adapting it from the Burnout Measure-Short Version[29]. The authors removed the contextualization to "work" and replaced it with the reference to "COVID-19". In their original study, Yıldırım and Solmaz[30] demonstrated good psychometric properties of the scale: a one-dimensional factorial structure, with a good internal consistency (Cronbach's alpha value was 0.92) and a good fit indexes ($\chi^2(32) = 89.71$, CFI = 0.96, RMSEA = 0.10, and SRMR = 0.05). The Polish version of the scale also reported good internal consistency and good fit indices ($\chi^2(31) = 116.521$, CFI = 0.96, RMSEA = 0.80, and SRMR = 0.04). Also, in this version of the scale, the one-dimensional structure of the instrument was confirmed.

We are convinced that when burnout is taken into account, referring to working situations, conditions and contexts is essential. Much literature confirms this hypothesis[31]. However, similar emotions can occur in other challenging situations or conditions, producing negative effects on the individual. Following this reflection, the COVID-19 pandemic, due to the fear of contagion and the social restrictions, could cause the exhaustion from COVID-19, which can be defined as a set of more or less serious symptoms, related to the physical, psychic or mental sphere of the individual and which derive from thinking about COVID-19.

The study presented is aimed to provide a validated scale in the Italian context, for the assessment of the symptoms of mental, physical, and psychological exhaustion that can result from thinking about COVID-19. To achieve this purpose, we decided to validate the BM scale proposed by Malach-Pines[29], following the suggestions of Yıldırım and Solmaz[30]. Differently from Yıldırım and Solmaz[30], we have named the new Italian scale as COVID-19 Exhaustion Scale, emphasizing the focus on personal exhaustion[31].

As four studies have been conducted to evaluate the psychometric properties of the COVID-19 Exhaustion Scale, we have first presented each study separately, discussing the overall results at the end of the four studies. Study 1 examines the dimensionality of the COVID-19 Exhaustion Scale. Study 2 tests the factorial structure. Study 3 investigates the convergent and concurrent validity of the COVID-19 Exhaustion Scale. Study 4 examines the test-retest reliability.

All the four studies have been conducted according to the ICMJE guidelines on the Protection of Research Participants and to the indications of the ethical code of the Italian Association of Psychology. The research survey was approved by the internal review board for research in psychology of one of the universities involved (number of approval: UKE-IRBPSY-04.21.04). All subjects have provided informed consent to participate in the studies.

2. Study 1: Cultural adaptation and dimensionality of the scale

The dimensionality of the Italian version of the COVID-19 Exhaustion Scale was tested in Study 1.

2.1. Cultural adaptation of COVID-19 Exhaustion Scale

To carry out the cultural adaptation of the COVID-19 Exhaustion Scale, we followed the procedures indicated by Beaton *et al*.[32]. First we carried out a direct translation of the items. The authors of the article proceeded with this translation, separately. The translated versions were compared with each other, and any differences found were resolved. In this way, we have drawn up the final version of the scale.

After this, the Italian version was translated back into English by a person outside the research team. The translated version corresponded with the original items. This first version of the scale was administered to 30 adult participants, who were also asked to give an overall opinion on the comprehensibility of the scale.

Given the positive feedback, the scale thus obtained was used in subsequent studies.

2.2. Method

2.2.1. Participants and procedure

Participants in Study 1 were 297 Italian adults, 61 males (20.5%) and 236 females (79.5%), aged between 22 and 67 years (M = 46.83; SD = 10.19). Most of them had a university degree (163, 54.9%), the others had a high school diploma (58, 19.5%) or a postgraduate degree (76, 25.6%).

The participants were invited to take part in the research in a completely voluntary way, through the compilation of an online survey (advertised through social networks). The survey included some demographic questions and asked the participant to fill in the 10 items of the scale. Anonymity was guaranteed at any time; those who participated in the research could abandon the compilation. All the indications contained in the code of ethics of the Italian Association of Psychology[33] have been respected.

2.2.2. Data analysis

We used exploratory factorial analysis to verify the dimensionality of the scale, using SPSS 25.0.

First, an item descriptive analysis was carried out; in this case, we also reported an analysis of normal univariate distributions (skewness and kurtosis).

To determine the number of factors, we used multiple criteria: parallel analysis[34] using 100 random datasets[35], which is one of the most accurate methods to determine the number of factors[36,37], eigenvalues of greater than 1 (Kaiser's criterion) and scree plot (inflection point).

An exploratory factor analysis (EFA) was conducted to examine the factor structure of the 10-item scale. The EFA was conducted with the Principal Axing Factoring method and Promax rotation. We first checked the Kaiser-Mayer-Olkin (KMO) test and Bartlett's sphericity test. A significant value of Bartlett's sphericity test and a high Kaiser-Meyer-Olkin value (>0.70), support the use of EFA[38]. Items were considered part of a factor with a factor-loading coefficient minimum of 0.45[39].

Reliability was studied with Cronbach's alphas, considering acceptable minimum value of 0.70[40].

2.2.3. Results

Table 1 shows the 10 items of the scale and associated descriptive statistics. Skewness and kurtosis demonstrated that the distribution of the items' scores is normal[41].

Table 1. Descriptive statistics of the COVID-19 ES

Item	M	DS	Skewness	Kurtosis
Tired	3.67	1.28	−0.734	−0.460
Disappointed with people	3.60	1.19	−0.234	−0.702
Hopeless	2.22	1.13	−0.522	−0.726
Trapped	2.66	1.32	−0.221	−1.03
Helpless	2.80	1.37	−0.009	−1.14
Depressed	2.09	1.17	0.761	−0.339
Physically weak	2.13	1.15	0.679	−0.542
Worthless	1.68	0.95	1.31	1.09
Difficulties sleeping	1.97	1.28	0.835	−0.433
"I've had it"	1.87	1.21	1.19	0.266

Notes: N = 297. COVID-19 ES = COVID-19 Exhaustion Scale

Table 2. Parallel analysis results

Variable	Real-data eigenvalues	Mean of random eigenvalues	95% of random eigenvalues
1	5.194	1.298	1.385
2	1.210	1.206	1.262
3	0.751	1.131	1.180
4	0.589	1.075	1.114
5	0.496	1.018	1.057
6	0.459	0.968	1.000

Parallel analysis suggested that two factors can be extracted. Results are reported in **Table 2**.

In the first EFA, the item 3 (hopeless) showed a significant cross-loadings on two factors; we decided to eliminate item 3 and proceed with a second EFA with 9 items.

In the second EFA, the Kaiser-Mayer-Olkin (KMO) value was 0.887 and Bartlett's test was significant ($\chi^2 = 1214.484$; $p < 0.001$). This means that the data are good for factor analysis. Communality values ranged between 0.408 (item 1) and 0.685 (item 6). The factorial analysis extracted two factors. The eigenvalues of the two factors were 4.62 and 1.21. They accounted for 64.78% of the variance. **Figure 1** shows the scree plot.

Looking at factor loadings (>0.40), the two factors' structure showed a good convergent validity. There are not significant cross-loadings, so all 9 items were retained[30]. We named the first factor Mental Exhaustion (ME) as it is formed by items that describe disorders related to the mental sphere. We named the second factor Physical and Emotional Exhaustion (PEE) as it includes the items containing physical or emotion-related symptoms. The first factor consists of four items (items 1, 2, 4, and 5) and the second factor consists of five items (items 6, 7, 8, 9, and 10). **Table 3** summarises the results of this analysis.

Cronbach's alpha values were 0.80 for Mental Exhaustion (ME) and 0.86 for Physical and Emotional Exhaustion (PEE). The total point of COVID-19 Exhaustion Scale showed a Cronbach's alpha value of 0.88.

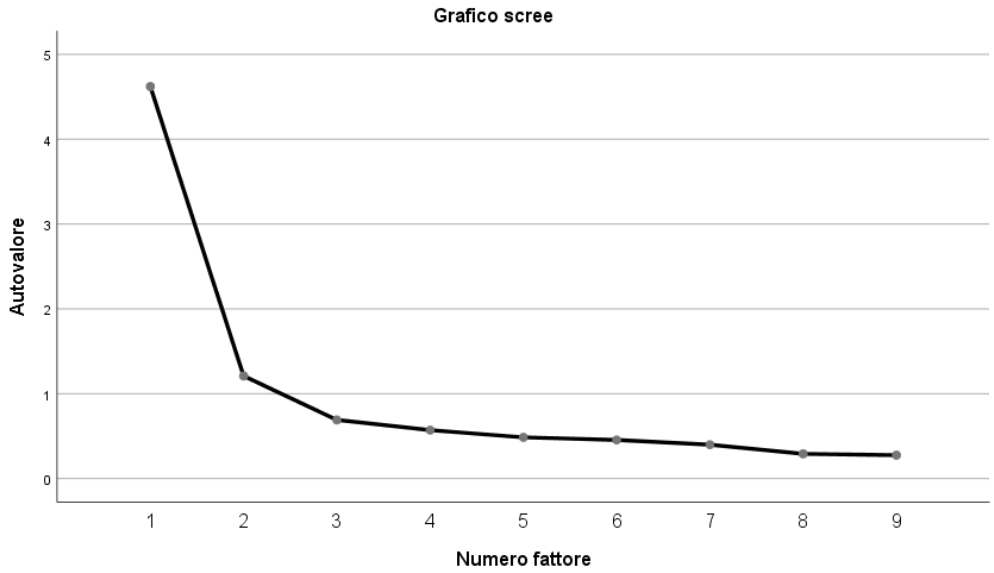

Figure 1. Scree plot.

Table 3. Factor loadings for the 9 items of COVID-19 ES

Item	Factor 1	Factor2
Tired	0.736	
Disappointed with people	0.673	
Trapped	0.688	
Helpless	0.713	
Depressed		0.742
Physically weak		0.705
Worthless		0.816
Difficulties sleeping		0.637
"I've had it"		0.756

Note: N = 297. Factor loadings <0.25 are not showed. COVID-19 ES = COVID-19 Exhaustion Scale

3. Study 2: Confirmatory factor analysis (CFA)

Study 2 is aimed to confirm the factorial structure of the COVID-19 ES through the CFA.

3.1. Method

3.1.1. Participants and procedure

The same procedures described in Study 1 were used in data collection. Participants were 277 Italian adults (32 males, 11.6%; 245 females, 88.4%) aged from 22 to 67 years (M = 45.69; SD = 10.36). The percentage of education level was thus distributed: 28.5% (n = 79) high school graduation; 49.5% (n = 137) university degree; 22 % (n = 61) post-graduate degree. The respondents lived in different Italian regions.

3.1.2. Data analysis

We used LISREL 8.80 to conduct CFA[42]. First, we tested two models: Model 1, with only two factors (Mental Exhaustion, Physical and Emotional Exhaustion); Model 2, with two factors (Mental Exhaustion, Physical and Emotional Exhaustion) organised under a higher-order factor of General Exhaustion (GE).

Confirmatory factor analysis was conducted to validate the factorial structure derived from EFA[43]. To verify the validity of the model, we took into consideration the values of the Satorra-Bentler Scaled Chi square test ($SB\chi^2$)[44], Comparative Fit Index (CFI)[45], Root Mean Square Error of Approximation (RMSEA)[46], Standardised Root Mean Square Residual (SRMR)[47] and a commonly used χ^2 statistic (χ^2/degree of freedom ratio). The minimum recommended values are: RMSEA $\leq$ 0.08, SRMR $\leq$ 0.10, CFI $\geq$ 0.9, $\chi^2/df \leq 3$[48–50].

To determine the percentage of variance that the independent variable can explain the dependent variable, we considered the values of R2. As this index is used in many disciplines, there are no standard benchmarks that can indicate the acceptable threshold. However, very low values are considered weak[51].

To verify which model was the best, we considered the Akaike Information Criterion (AIC)[52]. Values of AIC closer to zero indicate a better model fit[53]. As a reliability measure, we used Composite reliability (CR). The minimum value must be 0.70[48]. Convergent validity is achieved if the average variance extracted (AVE) estimates for all constructs are all greater than 0.50, but lower values are acceptable if CR is greater than 0.70[45]. Discriminant validity was evaluated with the square roots of average variance extracted (AVE) which must be superior to correlations between constructs[54,55]. Cronbach's alpha values were used to determine the internal consistency.

3.1.3. Results

Model 1 (9 items, 2 factors, 1 high-order factor solution) showed the following fit indexes: $SB\chi^2(26) = 83.177$, CFI = 0.97, RMSEA = 0.084 (C.I. 90% 0.06–0.11), SRMR = 0.05, AIC = 114.380. Model 2 (9 items, 2 factors solution) showed the following fit to the data: $SB\chi^2(25) = 74.763$, CFI = 0.97, RMSEA = 0.085 (C.I. 90% 0.06–0.11), SRMR = 0.05, AIC = 114.763).

Both solutions seem acceptable. The AIC value of Model 1 was lower than that of Model 2.

However, the ratio of chi-square to degrees of freedom of the first model is >3. Furthermore, in both solutions, item 2 (disappointed with people) showed a low R^2 value (<0.2). Furthermore, in both cases, the RMSEA was slightly above 0.08. For this reason, we have decided to eliminate item 2 and proceed with the verification of two other 8-item models. An iterative procedure that involves CFA fit indices, eliminating the item with the lowest item-total correlation at each iterative step[56], can help to optimize a scale's parsimony through a comparison between the item and construct[57].

The fit indices for Model 3 (8 items, 2 factors, 1 high-order factor solution) were as follows: $SB\chi^2(18) = 45.295$, CFI = 0.98, RMSEA = 0.074 (C.I. 90% 0.0–0.1), SRMR = 0.04, AIC = 81.295. The fit indices for Model 4 (8 items, 2 factors solution) were as follows: $SB\chi^2(19) = 45.912$, CFI = 0.98, RMSEA = 0.072 (C.I. 90% 0.05–0.09), SRMR = 0.04, AIC = 79.912. Finally, we tested a unidimensional model with 8 items (Model 5). This model provided the following fit indices: $SB\chi^2(20)$

Table 4. Fit statistics for confirmatory factor analyses

	SBχ^2	df	CFI	RMSEA (C.I.)	SRMR	AIC
Model 1 (9 items, 2 factors, 1 high-order factor)	74.763	25	0.97	0.085 (0.06–0.11)	0.05	114.763
Model 2 (9 items, 2 factors)	83.117	26	0.97	0.084 (0.06–0.11)	0.05	114.380
Model 3 (8 items, 2 factors, 1 high-order factor)	45.295	18	0.98	0.074 (0.05–0.1)	0.04	81.295
Model 4 (8 items, 2 factors)	45.912	19	0.98	0.072 (0.05–0.09)	0.04	79.912
Model 5 (8 items, unidimensional)	93.117	20	0.94	0.129 (0.11–0.15)	0.07	143.265

Table 5. Convergent and discriminant validity of COVID-19 ES

	AVE	CR	F1	F2
F1. Mental Exhaustion (ME)	0.54	0.76	(0.73)	
F2. Physical and Emotional Exhaustion (PEE)	0.49	0.82	0.568**	(0.7)

*Notes. ** p < 0.000; N = 277; AVE = Average Variance Extracted; CR = Composite Reliability Coefficient; COVID-19 ES = COVID-19 Exhaustion Scale*

= 93.117, CFI = 0.94, RMSEA = 0.129 (C.I. 90% 0.11–0.15), SRMR = 0.07, AIC = 143.265.

The lowest AIC is shown in Model 4 (8 items, 2 factors solution). In this model, the ratio between chi-square and degrees of freedom is 2.41 and all R2 are between 0.21 (item 1: tired) and 0.82 (item 4: trapped).

All results are summarised in **Table 4**.

We estimated convergent validity for each factor through CR and the AVE. The values for these indices were as follows: Mental Exhaustion (ME), CR = 0.76, and AVE = 0.54; Physical and Emotional Exhaustion (PEE), CR = 0.82, and AVE = 0.49. These values confirmed a very good convergent validity.

To determine the discriminant validity, we verified that the square roots of the AVE values were being higher than the correlations. This type of validity assumes that items should correlate with each other to a greater extent than they can correlate with other items of other constructs[58]. Discriminant validity tests, therefore, whether the items do not unintentionally measure something else. In our scale, discriminant validity for the items has been confirmed. **Table 5** shows AVE and CR values, correlations between factors, and, in parentheses, the square roots of the AVE.

In this study, Cronbach's alpha value was 0.74 for Mental Exhaustion (ME) and 0.82 for Physical and Emotional Exhaustion (PEE).

4. Study 3: Convergent and discriminant validity of the scale

In Study 3, we examined the convergent and discriminant validity of COVID-19 ES.

4.1. Method

4.1.1. Participants and procedure

The participants were 296 Italian adults (Male = 95, 32.1%; Female = 201, 67.9%) aged between 24 and 68 years (M = 48.74; SD = 10.04). About half of them had a university degree (128, 43.2%); the remaining portion had graduated high school (91, 30.7%) or were post-graduate (77, 26%).

The same procedures described in Study 1 and 2 were used in data collection.

4.1.2. Data analysis

The convergent and discriminant validity was assessed by correlating the scores of the COVID-19 Exhaustion Scale with Satisfaction With Life Scale[59] and Physical Symptoms Inventory[60]. Pearson's r coefficient was used. Data were analysed using SPSS 25.0.

4.1.3. Measures

COVID-19 Exhaustion Scale (COVID-19 ES). The final version of the scale, with 8 items, was used here. Cronbach's alpha values were 0.76 for Mental Exhaustion (ME) and 0.87 for Physical and Emotional Exhaustion (PEE).

Satisfaction With Life Scale (SWLS)[59] is a 5-item scale that evaluates satisfaction with life. The items require the participant to declare their degree of agreement on a 7-point Likert scale (1 = strongly agree, 7 = strongly disagree). A sample item from this measure is "In most ways my life is close to my ideal". Cronbach's alpha value was 0.93.

Physical Symptoms Inventory (PSI)[60]. Participants were asked how in the last month they have presented a list of 12 symptoms (for example, "headache", "stomach pain", and "dizziness"). For each of the symptoms, the responses varied on a scale of 1 (never) to 5 (every day). Cronbach's alpha value was 0.89.

4.1.4. Results

Regarding the correlations between the COVID-19 Exhaustion Scale and descriptive statistics of participants, positive correlations emerged with gender. Gender is positively correlated also with physical symptoms. No relationship is shown between age and education level with the dimensions assessed. The correlations between the COVID-19 Exhaustion Scale, Satisfaction With Life Scale and Physical Symptoms Inventory are reported in **Table 6**. Mental Exhaustion (ME) and Physical and Emotional Exhaustion (PEE) is negatively related to satisfaction and positively with Physical Symptoms.

Table 6. Correlations between gender, age, educational level, the dimensions of COVID-19 Exhaustion Scale, Physical Symptoms and Satisfaction

	1	**2**	**3**	**4**	**5**	**6**
1. Gender	-					
2. Age	0.052	-				
3. Education level	0.149*	−0.026	-			
4. Mental Exhaustion (ME)	0.213**	−0.007	0.042	-		
5. Physical and Emotional Exhaustion (PEE)	0.270**	−0.056	0.083	0.675**	-	
6. Physical Symptoms	0.202**	0.022	−0.077	0.642**	0.445**	-
7. Satisfaction	−0.046	0.003	0.091	−0.250**	−0.174**	−0.356**

** $p < 0.05$; ** $p < 0.01$*

5. Study 4: Test-retest reliability

The purpose of the fourth study was to evaluate the stability of COVID-19 Exhaustion Scale using the test-retest method.

5.1. Method

5.1.1. Participants and procedure

The participants were 40 Italian adults, 15 males (37.5%) and 25 females (62.50%), aged between 21 and 63 years (M = 32.10; SD = 12.66). 19 of them (47.5%) graduated from high school, 15 had a university degree (37.5%), 5 (12.5%) were post-graduate and one had a junior high school degree (2.5%).

The same procedures described in the other studies were used in data collection; however, in this case, the participants were asked to be available to be contacted after 3 weeks for a second administration of the scale. To this aim, participants were asked to provide an email address. To pair the protocols, in the second administration, the participants were asked to indicate the email address at which they had received the invitation.

5.1.2. Data analysis

Test-retest reliability of the COVID-19 ES was verified using intraclass correlation coefficients after 3 weeks. Cronbach's alpha values were used to determine the internal consistency. All the analyses were conducted using SPSS 25.0.

5.1.3. Results

Cronbach's alpha values were 0.87 and 0.85 for the Mental Exhaustion (ME) in the first and in the second administration and 0.83 and 0.84 for the Physical and Emotional Exhaustion (PEE) in the first and in the second administration respectively. Intraclass correlation coefficients for the Mental Exhaustion (ME) was 0.84 (95% CI [0.69, 0.91]). Intraclass correlation coefficients for the Physical and Emotional Exhaustion (PEE) was 0.94 (95% CI [0.88, 0.97]). For the total score, Cronbach's alpha values were 0.88 and 0.92 respectively in the first and in the second administration. In this case, intraclass correlation coefficient was 0.88 (95% CI [0.79, 0.94]). This means that the test-retest reliability of the scale was demonstrated.

6. Overall discussion

The COVID-19 pandemic has created profound changes at the individual and public levels[61,62]. COVID-19 has been a unique topic of general discussion proposed by the mass media and between people. Iinformation about the pandemic, the deaths, the contagion, and the restrictions have stressed our routines in the last three years.

The world and the dynamic changes to face are, today, much faster than in the past, and this has not only favoured the rapid spread of COVID-19 but has led to everyone's awareness that the risk of viral epidemics is not averted even for the future.

Moreover, in addition to the physical repercussions following recovery from COVID-19, several studies have highlighted associations between COVID-19 and negative mental health consequences, such as anxiety, depression, and post-traumatic stress disorder, both acute and long-term.

Some studies on the psychological consequences of COVID-19 have focused on burnout for some specific categories of workers employed in the health professions, but the general effect of the impact of the COVID-19 pandemic has encompassed the entire population, not just the health professional workers. Each individual, in almost every part of the world has had to deal with the stress dictated by an extraordinary and unexpected situation.

Some people have lost their work, and others have faced work overload; the most part has been obliged to remain at home, alone or with the nuclear family. All these challenging conditions have caused high levels of exhaustion in a great part of individuals, in Italy and all over the world. A new measure for this type of exhaustion is needed, to improve the research on the medium- and long-term consequences of the pandemic on the mental health of the population. The COVID-19 ES seems to respond to this requirement, as it is short and easy to administer.

Therefore, the aim of the study was to verify the psychometric properties of the COVID-19 Exhaustion Scale in the Italian context. The results demonstrated a bi-dimensional structure and high internal consistency of the scale. Evidence for the reliability and validity of the scale was shown. The two factors of the scale were named Mental Exhaustion (ME) and Physical and Emotional Exhaustion (PEE).

The first factor, Mental Exhaustion (ME), has to do with mental symptoms. The first of these is fatigue, declaring that the thought of something can produce fatigue, in fact, can be interpreted as mental fatigue and not a strictly physical one. Mental fatigue has been described as "a general sensation of weariness, feelings of inhibition, and impaired mental performance"[63]. The second item that belonged to this dimension refers to the feeling of being trapped. In the version of Pines and Aronson[22], this item is representative of mental exhaustion. Finally, the helpless item belongs to this dimension. These last two items in the original version of the scale are saturated on the same factor[29].

The second factor, Physical and Emotional Exhaustion (PEE), comprises five items. Two of these refer to physical exhaustion: "physically weak" and "sleeping difficulties". Even in the reduced version of the scale, these items are saturated on the same factor[29] and refer to symptoms of a physical nature. Two other items refer to emotional exhaustion: feeling depressed and useless. The statement "I feel as if I have had it" was also part of this factor. This statement can be interpreted as a constant worry about having contracted the disease. Since fear is an emotion, it falls for this reason among the items of emotional exhaustion.

The correlational analysis indicated that exhaustion symptoms positively correlate with stress symptoms and negatively with life satisfaction. This is consistent with previous literature[64,65], confirming the convergent validity of the scale.

Finally, the reliability of the scale was confirmed both through the internal consistency and the test-retest method, providing adequate indexes for both analyses.

7. Conclusions and limitations

The health emergency and the subsequent restrictive measures issued by governments to contain it have caused unexpected, rapid, and radical changes in people's lives, eliciting feelings and experiences of fear, uncertainty, and anxiety[5]. Research on the consequences on affects in response to quarantine on the general population agree in indicating fear, nervousness, sadness, guilt, confusion, anger, numbness, and anxiety-induced insomnia as prevalent emotional responses[66]. Moreover, the pandemic has exposed individuals to a complex combination of stressors blocking, at the same time, their access to protective factors such as social support[67]. During these highly stressful last two years, the new reality has been dominated by fear of viral spread and contagion; being at the mercy of stressful events causes very likely emotional exhaustion[68].

Improving research to deepen the consequences of these conditions is highly recommended, as it allows to intervene in a preventive way through the strengthening of the protective factors and the containment interventions. The results of our study provide a new, short, and psychometrically reliable and valid measure of emotional exhaustion due to COVID-19; it is easy to administer and could be useful to a brief assessment of the emotional state in response to the pandemic, allowing to discriminate two different types of the experience of emotional exhaustion due to COVID-19, mental or physical-emotional.

The results support the use of the COVID-19 Exhaustion Scale in the Italian context. However, the participants to the study showed a very wide age range, were mostly female, and had a high level of education, and the generalizability of the results may be limited due to the convenience sampling method used.

Another limitation of the study is related to the self-report nature of the measures. This can cause bias due to social desirability[69].

The third limit regards the fact that the study is cross-sectional, and this does not allow to consider the possibility of evaluating causal relationships between the variables and to exclude the risk of reverse causality.

Another limitation concerns the fact that the incremental validity has not been calculated. Future studies could test this kind of validity as well. Furthermore, future studies could use the COVID-19 Exhaustion Scale in more representative samples or establish cut-off criteria to identify different levels of exhaustion. Longitudinal studies are needed to verify the long-term consequences of emotional exhaustion due to COVID-19.

Social, economic, and individual costs of exhaustion due to COVID-19 are high, and it is important to develop psychological support actions for all ages. Indeed, it is possible to lower the levels of concern for COVID-19 as early as adolescence[70]. Psychological support could be essential in reducing the impact of negative emotions. The COVID-19 Exhaustion Scale can be used to carry out screenings that would allow to identify the most at-risk situations and build customised interventions.

Abbreviation

BM: Burnout Measure; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; SRMR: Standardised Root Mean Square Residual; ICMJE: International Committee of Medical Journal Editors; EFA: Exploratory Factor Analysis; KMO: Kaiser-Mayer-Olkin; ME: Mental Exhaustion; PEE: Physical and Emotional Exhaustion; CFA: Confirmatory Factor Analysis; GE: General Exhaustion; AIC: Akaike Information Criterion; CR: Composite Reliability; AVE: Average Variance Extracted; SB: Satorra-Bentler; COVID-19 ES: Covid-19 Exhaustion Scale; SWLS: Satisfaction With Life Scale; PSI: Physical Symptoms Inventory.

Author contributions

AZ and PM designed the research study. AZ, RZ, AR, and PM performed the research. AZ analysed the data. AZ and PM wrote the manuscript. All the authors contributed to the revisions and the editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The research was approved by the Internal Review Board for Research in Psychology of the Kore University of Enna, number of approval: UKE-IRBPSY-04.21.04.

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Conflict of interest

The authors declare no conflict of interest.

References

1. World Health Organization. Timeline of WHO's response to COVID-19 [Internet]. Geneva: World Health Organization; 2020 [updated 2021 Jan 29]. Available from: https://www.who.int/news-room/detail/29-06-2020-covidtimeline.
2. Gopinath G. The great lockdown: Worst economic downturn since the great depression [Internet]. Washington D.C.: IMFBlog; 2020 [updated 2020 Apr 14]. Available from: https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-downturn-since-the-great-depression/.
3. Ahorsu DK, Lin CY, Imani V, *et al*. The Fear of COVID-19 Scale: Development and initial validation. International Journal of Mental Health and Addiction 2020; 20: 1537–1545. doi: 10.1007/s11469-020-00270-8.

4. Trzebiński J, Cabański M, Czarnecka JZ. Reaction to the COVID-19 pandemic: The influence of meaning in life, life satisfaction, and assumptions on world orderliness and positivity. Journal of Loss and Trauma 2020; 25(6–7): 544–557. doi: 10.1080/15325024.2020.1765098.
5. Zammitti A, Imbrogliera C, Russo A, *et al*. The psychological impact of coronavirus pandemic restrictions in Italy. The mediating role of the fear of COVID-19 in the relationship between positive and negative affect with positive and negative outcomes. European Journal of Investigation in Health, Psychology and Education 2021; 11(3): 697–710. doi: 10.3390/ejihpe11030050.
6. Garg M, Maralakunte M, Garg S, *et al*. The conundrum of 'long-COVID-19': A narrative review. International Journal of General Medicine 2021; 14: 2491–2506. doi: 10.2147/IJGM.S316708.
7. Thye AYK, Law JWF, Tan LTH, *et al*. Psychological symptoms in COVID-19 patients: Insights into pathophysiology and risk factors of long COVID-19. Biology 2022; 11(1): 61. doi: 10.3390/biology11010061.
8. Greenberg N, Docherty M, Gnanapragasam S, *et al*. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. BMJ 2020; 368. doi: 10.1136/bmj.m1211.
9. Morgantini LA, Naha U, Wang H, *et al*. Factors contributing to healthcare professional burnout during the COVID-19 pandemic: A rapid turnaround global survey. PLOS ONE 2020; 15(9): e0238217. doi: 10.1371/journal.pone.0238217.
10. Sung CW, Chen CH, Fan CY, *et al*. Burnout in medical staffs during a coronavirus disease (COVID-19) pandemic [Internet]. New York: SSRN; 2020 [updated 2020 Jun 9]. Available from: https://ssrn.com/abstract=3594567.
11. Chen H, Eyoun K. Do mindfulness and perceived organizational support work? Fear of COVID-19 on restaurant frontline employees' job insecurity and emotional exhaustion. International Journal of Hospitality Management 2021; 94: 102850. doi: 10.1016/j.ijhm.2020.102850.
12. Maslach C, Leiter MP. Understanding the burnout experience: Recent research and its implications for psychiatry. World Psychiatry: Official Journal of the World Psychiatric Association (WPA) 2016; 15(2): 103–111. doi: 10.1002/wps.20311.
13. Maslach C, Leiter MP. Early predictors of job burnout and engagement. Journal of Applied Psychology 2008; 93(3): 498–512. doi: 10.1037/0021-9010.93.3.498.
14. Maslach C, Jackson SE. The measurement of experienced burnout. Journal of Organizational Behavior 1981; 2(2): 99–113. doi: 10.1002/job.4030020205.
15. Schaufeli WB, Taris TW. The conceptualization and measurement of burnout: Common ground and worlds apart. Work & Stress 2005; 19(3): 256–262. doi: 10.1080/02678370500385913.
16. Maslach C, Schaufeli WB, Leiter MP. Job burnout. Annual Review of Psychology 2001; 52(1): 397–422. doi: 10.1146/annurev.psych.52.1.397.
17. Peterson U, Demerouti E, Bergstrom G, *et al*. Burnout and physical and mental health among Swedish healthcare workers. Journal of Advanced Nursing 2008; 62(1): 84–95. doi: 10.1111/j.1365-2648.2007.04580.x.
18. Tokunaga RS. Social networking site or social surveillance site? Understanding the use of interpersonal electronic surveillance in romantic relationships. Computers in Human Behavior 2011; 27(2): 705–713. doi: 10.1016/j.chb.2010.08.014.
19. Karatepe OM, Karatepe T. Role stress, emotional exhaustion, and turnover intentions: Does organizational tenure in hotels matter? Journal of Human Resources in Hospitality & Tourism 2009; 9(1): 1–16. doi: 10.1080/15332840903323364.
20. Rathi N, Lee K. Emotional exhaustion and work attitudes: Moderating effect of personality among frontline hospitality employees. Journal of Human Resources in Hospitality & Tourism 2016; 15(3): 231–251. doi:

10.1080/15332845.2016.1147935.
21. Freudenberger HJ. Staff burn-out. Journal of Social Issues 1974; 30(1): 159–165. doi: 10.1111/j.1540-4560.1974.tb00706.x.
22. Pines A, Aronson E. Career burnout: Causes and cures. New York: Free Press; 1988.
23. Enzmann D, Schaufeli WB, Janssen P, *et al*. Dimensionality and validity of the Burnout Measure. Journal of Occupational and Organizational Psychology 1998; 71(4): 331–351. doi: 10.1111/j.2044-8325.1998.tb00680.x.
24. Glass DC, McKnight JD. Perceived control, depressive symptomatology, and professional burnout: A review of the evidence. Psychology & Health 1996; 11(1): 23–48. doi: 10.1080/08870449608401975.
25. Schaufeli W, Enzmann D. The burnout companion to study and practice: A critical analysis. London: CRC Press; 1998.
26. Ray EB, Miller KI. The influence of communication structure and social support on job stress and burnout. Management Communication Quarterly 1991; 4(4): 506–527. doi: 10.1177/08933189910040040.
27. Enzmann D, Kleiber D. HclJer-ikiden: Jtnp und burnout in pychosorialen berujn (German) [Helpers' ordeals: Stress and burnout in psycho-social professions]. Heidelberg: Asanger; 1989.
28. Schaufeli WB, Van Dierendonck D. The construct validity of two burnout measures. Journal of Organizational Behavior 1993; 14(7): 631–647. doi: 10.1002/job.4030140703.
29. Malach-Pines A. The burnout measure, short version. International Journal of Stress Management 2005; 12(1): 78. doi: 10.1037/1072-5245.12.1.78.
30. Yıldırım M, Solmaz F. COVID-19 burnout, COVID-19 stress and resilience: Initial psychometric properties of COVID-19 Burnout Scale. Death Studies 2022; 46(3): 524–532. doi: 10.1080/07481187.2020.1818885.
31. Leiter MP, Bakker AB, Maslach C (editors). Burnout at work: A psychological perspective. London: Psychology Press; 2014.
32. Beaton DE, Bombardier C, Guillemin F. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine 2000; 25(24): 3186–3191. doi: 10.1097/00007632-200012150-00014.
33. Associazione Italiana di Psicologia (AIP). Codice etico (Italian) [Ethical code] [Internet]. Available from: https://www.aipass.org/sites/default/files/Codice%20Etico_marzo%202015.pdf.
34. Horn JL. A rationale and test for the number of factors in factor analysis. Psychometrika 1965; 30: 179–185. doi: 10.1007/BF02289447.
35. O'connor BP. SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. Behavior Research Methods, Instruments, & Computers 2000; 32(3): 396–402. doi: 10.3758/BF03200807.
36. Velicer WF, Eaton CA, Fava JL. Construct explication through factor or component analysis: A review and evaluation of alternative procedures for determining the number of factors or components. In: Goffin RD, Helmes E (editors). Problems and solutions in human assessment. Boston, MA: Springer; 2000. p. 41–71.
37. Zwick WR, Velicer WF. Factors influencing five rules for determining the number of components to retain. Psychological Bulletin 1986; 99: 432–442.
38. Field AP. Discovering statistics using SPSS. 2nd ed. London: Sage Publications, Inc; 2005.
39. Tabachnick B, Fidell L. Using multivariate statistics. 7th ed. London: Pearson; 2019.
40. George D, Mallery P. IBM SPSS statistics 26 step by step: A simple guide and reference. New York: Routledge; 2019.
41. Kim HY. Statistical notes for clinical researchers: Assessing normal distribution (2) using skewness and kurtosis. Restorative Dentistry & Endodontics 2013; 38(1): 52–54. doi: 10.5395/rde.2013.38.1.52.
42. Jöreskog KG, Sörbom D. LISREL 8.80 for Windows. Lincolnwood, IL: Scientific Software International,

Inc; 2006.
43. Hinkin TR. A brief tutorial on the development of measures for use in survey questionnaires. Organizational Research Methods 1998; 1(1): 104–121. doi: 10.1177/109442819800100106.
44. Satorra A, Bentler PM. A scaled difference chi-square test statistic for moment structure analysis. Psychometrika 2001; 66(4): 507–514. doi: 10.1007/BF02296192.
45. Bentler PM. Comparative fit indexes in structural models. Psychological Bulletin 1990; 107(2): 238. doi: 10.1037/0033-2909.107.2.238.
46. Steiger JH. Structural model evaluation and modification: An interval estimation approach. Multivariate Behavioral Research 1990; 25(2): 173–180. doi: 10.1207/s15327906mbr2502_4.
47. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal 1999; 6(1): 1–55. doi: 10.1080/10705519909540118.
48. Hair JF, Black WC, Babin BJ, *et al*. Multivariate data analysis: A global perspective. 7th ed. Upper Saddle River, NJ: Pearson Education; 2010.
49. Bentler PM, Bonett DG. Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin 1980; 88(3): 588–606. doi: 10.1037/0033-2909.88.3.588.
50. Hoe SL. Issues and procedures in adopting structural equation modelling technique. Journal of Quantitative Methods 2008; 3(1): 76–83.
51. Henseler J, Ringle C, Sinkovics RR. The use of partial least squares path modeling in international marketing. New Challenges to International Marketing 2009; 20: 277–319. doi: 10.1108/S1474-7979(2009)0000020014.
52. Burnham KP, Anderson DR. Multimodel inference: Understanding AIC and BIC in model selection. Sociological Methods & Research 2004; 33(2): 261–304. doi: 10.1177/0049124104268644.
53. Hair JF, Anderson RE, Tatham RL, *et al*. Multivariate data analysis. 5th ed. Upper Saddle River, NJ: Prentice Hall; 1998.
54. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 1981; 18(1): 39–50. doi: 10.1177/002224378101800010.
55. Koufteros XA. Testing a model of pull production: A paradigm for manufacturing research using structural equation modeling. Journal of Operations Management 1999; 17(4): 467–488. doi: 10.1016/S0272-6963(99)00002-9.
56. Voss KE, Spangenberg ER, Grohmann B. Measuring the hedonic and utilitarian dimensions of consumer attitude. Journal of Marketing Research 2003; 40(3): 310–320. doi: 10.1509/jmkr.40.3.310.19.
57. Wieland A, Durach CF, Kembro J, *et al*. Statistical and judgmental criteria for scale purification. Supply Chain Management: An International Journal 2017; 22(4): 321–328. doi: 10.1108/SCM-07-2016-0230.
58. Zaiţ A, Bertea PSPE. Methods for testing discriminant validity. Management & Marketing Journal 2011; 9(2): 217–224.
59. Diener ED, Emmons RA, Larsen RJ, *et al*. The satisfaction with life scale. Journal of Personality Assessment 1985; 49(1): 71–75. doi: 10.1207/s15327752jpa4901_13.
60. Spector PE, Jex SM. Development of four self-report measures of job stressors and strain: Interpersonal conflict at work scale, organizational constraints scale, quantitative workload inventory, and physical symptoms inventory. Journal of Occupational Health Psychology 1998; 3(4): 356–367. doi: 10.1037/1076-8998.3.4.356.
61. Rajkumar RP. COVID-19 and mental health: A review of the existing literature. Asian Journal of Psychiatry 2020; 52: 102066. doi: 10.1016/j.ajp.2020.102066.

62. Necho M, Tsehay M, Birkie M, *et al*. Prevalence of anxiety, depression, and psychological distress among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. International Journal of Social Psychiatry 2021; 67(7): 892–906. doi: 10.1177/00207640211003121.
63. Borghini G, Astolfi L, Vecchiato G, *et al*. Measuring neurophysiological signals in aircraft pilots and car drivers for the assessment of mental workload, fatigue and drowsiness. Neuroscience & Biobehavioral Reviews 2014; 44: 58–75. doi: 10.1016/j.neubiorev.2012.10.003.
64. Boekhorst JA, Singh P, Burke R. Work intensity, emotional exhaustion and life satisfaction: The moderating role of psychological detachment. Personnel Review 2017; 46(5): 891–907. doi: 10.1108/PR-05-2015-0130.
65. Gopala N, Culbertson SS, Leiva PI. Explaining emotional labor's relationships with emotional exhaustion and life satisfaction: Moderating role of perceived autonomy. Universitas Psychologica 2013; 12(2): 347–356. doi: 10.11144/Javeriana.UPSY12-2.eelr.
66. Talevi D, Socci V, Carai M, *et al*. Mental health outcomes of the CoViD-19 pandemic. Rivista Di Psichiatria 2020; 55(3): 137–144. doi: 10.1708/3382.33569.
67. Gruber J, Prinstein MJ, Clark LA, *et al*. Mental health and clinical psychological science in the time of COVID-19: Challenges, opportunities, and a call to action. American Psychologist 2020; 76: 409–426. doi: 10.1037/amp0000707.
68. Lyu Y, Yu Y, Chen S, *et al*. Positive functioning at work during COVID-19: Posttraumatic growth, resilience, and emotional exhaustion in Chinese frontline healthcare workers. Applied Psychology: Health and Well-Being 2021; 13(4): 871–886. doi: 10.1111/aphw.12276.
69. Arnold HJ, Feldman DC. Social desirability response bias in self-report choice situations. Academy of Management Journal 1981; 24(2): 377–385. doi: 10.5465/255848.
70. Zammitti A. Career planning during the COVID-19 pandemic. Training for strengthening courage and career adaptability and lowering fear levels of COVID-19. Psychology Hub 2021; 38(3): 37–46. doi: 10.13133/2724-2943/17586.

Appendix

Italian version of COVID-19 Exhaustion Scale

Quando pensa al coronavirus, in generale, quanto spesso si sente…	
1.	… stanco/a?
2.	… intrappolato/a?
3.	… impotente?
4.	… depresso/a?
5.	… fisicamente debole, spossato/malato/a?
6.	… inutile, un fallimento?
7.	… di avere difficoltà a dormire?
8.	… come se lo avesse avuto?