Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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The development and initial tests for the psychometric properties of the COVID-19 Phobia Scale (C19P-S)

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ABSTRACT

Researchers predict that the negative effects of the novel coronavirus 2019 (COVID-19) pandemic will continue . These negative effects are not solely limited to psycho-pathological problems. Serious physiological, social, and economical difficulties due to COVID-19 have already been observed in various nations. In this study, we suggest a new type of specific phobia, which may be categorized under DSM-V 300.29. The current study developed a self-report instrument whose items address the specific phobia diagnosis criteria of the DSM-V and tested its initial psychometric properties. Results show that the scale has initial evidence of construct, convergent, and discriminant validity, and internal consistency reliability. The scale should be further tested; however, the COVID-19 Phobia Scale (C19P-S) items provide support for assessing the levels of phobia reactions among a wide range of age groups.

1. Introduction

Coronavirus 2019 (COVID-19) entered the world's agenda as a deeply shaking worldwide pandemic. COVID-19 first appeared in Wuhan, China, on December 2019 and has quickly spread in other provinces of China and in many countries and continents (Hui et al., 2020). As the spread of the virus expanded geographically, increases in the number of deaths multiplied(Wu & McGoogan, 2020). On January 30th, 2020, the outbreak of a new strain of coronavirus was designated a “public health emergency of international concern” by the World Health Organization (WHO). On March 11th, it was declared as a “pandemic.” According to the data of the World Health Organization (WHO), COVID-19 spread to 187 countries, confirmed cases were 294.110; and confirmed deaths were recorded as 12.944 (WHO, 2020). The virus is still affecting large populations from various aspects including psychological, social, political, and economical.

The number of death due to COVID-19 is still increasing and the virus is not yet fully controlled. During epidemics, people usually experience various psychological difficulties such as fear, panic, or phobia. It has been reported that similar epidemics such as H1N1, SARS, MERS, Ebola, and Zika have previously had serious negative effects and caused fear and anxiety disorders (e.g., Ibrahim, 2016; Kim & Song, 2017; Liu, Zhang, & Lu, 2005; Tausczik, Faasse, Pennebaker, & Petrie, 2012; Theresa, Christian, & Nnadi, 2014). Similarly, the frequent exposure to COVID-19 in written, visual, and social media increases the levels of anxiety and fear among the public.

It is already reported that the COVID-19 pandemic is increasing the risk of mental disorders including schizophrenia, anxiety, depression, and acute stress disorder among both the healthcare personnel and the public (e.g., Hu, Su, Qiao, Zhu, & Zhou, 2020; Huang et al., 2020; Huang & Liu, 2020; Kang et al., 2020; Li et al., 2020; Liu, Yang, et al., 2020; Liu, Zhang, et al., 2020; Sun et al., 2020; Xiang et al., 2020). At the same time, researchers predict that the negative effects of the COVID-19 pandemic lead to increases in extreme fear of illness, anger, alcohol/tobacco abuse, divorce, and suicide (Dai, Hu, Xiong, Qiu, & Yuan, 2020).

1.1. Theoretical background

Phobias are special forms of anxiety disorders defined by a persistent and excessive fear of an object or a situation and are classified into three groups (APA, 2013): Social phobia, agoraphobia, and specific phobia. Five specific phobia types are listed in DSM-V: Natural-environment, animal, blood-injection-injury (fear of injections and transfusions, fear of blood, fear of injury, fear of medical care), situational, and others. Thus, we purpose “corona phobia” as a persistent and excessive fear of the novel coronavirus, which can be classified as a particular type of the DSM-V specific phobia.

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Research indicates that specific phobias are the most frequently observed psychiatric disorders worldwide (Bandelow & Michaelis, 2015; Wardenaar et al., 2017). According to the DSM-V criteria, the main characteristic of specific phobias is fear or anxiety limited by the phobia source. If the individual occasionally feels anxious when encountering a particular object or situation, s/he is not to be diagnosed with specific phobia. Additionally, the response must be different from the usual and temporary fears that are common in society. At the same time, the level of fear or anxiety must be intense. The level of fear may vary depending on the proximity to the object or the situation. However, individuals do not have to show an extreme and meaningless anxiety response in order to be diagnosed with specific phobia. Considering the situation and the environment, the individual's "disproportionate" fear and anxiety response is sufficient for diagnosis (APA, 2013). Specific phobias can trigger other anxiety disorders and are reported to comorbid with suicidal tendency, major depression, anxiety disorders, and physical, mental, or mood disorders (Ausín, Muñoz, Castellanos, & García, 2020; Corchs et al., 2006; Keyes, Deale, Foster, & Veale, 2020; Witthauer et al., 2016).

Specific phobias may emerge depending on the temperamental, genetic, and physiological antecedents as well as the influence of the environmental conditions (APA, 2013). In this sense, major man-made catastrophes or natural disasters, such as the COVID-19 pandemic, can be the environmental trigger of phobic conditions. People develop disproportional cognitive, affective, or behavioral responses to the objects and situations that they associate with the COVID-19 pandemic and severe deteriorations may occur in the physiological and psychological functionalities. Accordingly, because the COVID-19 pandemic causes extreme fear, anxiety, and reactions, we purpose it as another type of "specific phobia."

The COVID-19 pandemic disrupts people's routines and therefore elicits anxiety and phobic reactions (Li et al., 2020; Duan & Zhu, 2020; Wang, Cheng, Yue, & McAleer, 2020; Xiao, 2020). On the other hand, it is often noted in anecdotal experiences that people are afraid of being infected with COVID-19. Previous studies show that natural disasters such as earthquakes or tsunamis; man-made catastrophes such as explosions, wars, or terrorism; or epidemics such as MERS, SARS, or Ebola lead to detrimental emotions such as phobia, anxiety, depression, hopelessness, and hostility in the short and long terms (Colorado, 2017; Hossain, Sultana, & Purohit, 2020; Qi, Yang, Tan, Wu, & Zhou, 2020; Steinberg & Daniel, 2020). Therefore, as expected, people have already started experiencing phobic reactions in the face of the COVID-19 pandemic. As the pandemic spreads quickly, COVID-19 is expected to lead to increased psycho-pathological problems due to the potential for easy transmission, lack of treatment, and higher levels of the virus-related deaths (Duan & Zhu, 2020; Gao et al., 2020; Rothan & Byrareddy, 2020).

Serious negative physiological, social, and economical effects of the COVID-19 pandemic have already been observed in many nations. These negative effects are causing conditions including stress, depression, psycho-somatic, and psycho-social disorders. It is important to detect early sings of COVID-19 phobia in order to provide timely psychological support for individuals who display higher levels of it (Duan & Zhu, 2020; Qiu et al., 2020). However, because it is a relatively novel problem, no psychometrically sound assessment is found in the literature to assess the levels of phobia on COVID-19. As The American Psychiatric Association (APA) recommends the development of assessment tools adapted to DSM-V criteria for specific phobia disorders, Therefore, the current study aimed to develop a COVID-19 phobia scale (i.e., C19P-S), whose items correspond to the specific phobia (300.29, formerly known as simple phobia) diagnosis criteria of the DSM-V and whose psychometric properties are empirically supported. The C19P-S aims to both contribute to research and enrich future studies on coronavirus.

Table 1
Descriptive statistics of the participants in Study 1.

		Frequency	Percent
Marital status	Married	619	49.5
	Single	589	47.1
	Other	42	3.4
Educational attainment	Uneducated	66	5.3
	Primary school	265	21.2
	Secondary school	83	6.6
	High school	121	9.7
	Undergraduate	477	38.2
	Graduate	177	14.2
	MSc/PhD	42	3.4
	Missing	19	1.5
Socio-economic status (SES)	High	23	1.8
	Middle-high	266	21.3
	Middle	719	57.5
	Middle-low	183	14.6
	Low	59	4.7
Chronic disease	Yes	244	19.5
	No	1006	80.5
Covid 19 diagnosis	Positive	5	0.4
	Negative	1245	99.6

2. Method

2.1. Study 1

2.1.1. Sample

The sample of the first study, used for EFA, consisted of 1250 participants (765 women, 61.2%) with a mean age of 37.53 years (SD = 16.94, range = 17–89 years). Descriptive statistics calculated for this sample are reported in Table 1.

2.2. Procedure

Informed consents were obtained before data collection via Qualtrics. Instructions informed the participants about the study and asked to indicate their level of agreement on the statements from 1 "strongly disagree" to 5 "strongly agree" on a five-point Likert scale.

Various exploratory and confirmatory steps were used in the item development phase. Relevant literature, including the existing specific phobia scales, and the DSM-V specific phobia criteria (300.29) were analyzed. DSM-V specific phobia diagnosis criterion states that persistent fear of coronavirus is excessive or unreasonable (A); exposure to coronavirus provokes immediate anxiety which may exhibit panic (B); person recognizes that the fear of coronavirus is excessive or unreasonable (C); coronavirus is avoided or else anxiety experienced (D); and people avoid, coronavirus but if they cannot then they feel anxious and such anxiety interferes significantly with their regular routine in various environments (E).

A total of 102 initial items that correspond to the above-mentioned criteria were generated independently by the three researchers and rated independently by a panel of six specialists. Among the specialists, there were two psychologists, two psychiatrists, and two psychometricians. Specialists' ratings ranged from 1 to 10, where 1 indicated that the item did not assess corona phobia at all and should be omitted and 10 indicated that the item measured corona phobia adequately and should be retained.

Items with similar content were combined or redundant items were eliminated. In additions, items which were rated lower than 0.80 (on average) by the panel were dropped from further investigations. Resulting 70 items were administered online and 1250 participants responded to these items. Collected data were subjected to exploratory factor analysis (EFA) and items whose loadings were < 0.40 on any of the factors or loaded on more than a single factor were eliminated and the final 20 items were achieved. Finally, 2143 participants responded

to 20 items (no one from the first study was included in study 2) and data were subjected to confirmatory factor analyses (CFA) for the evidence of construct validity. In addition, differences between coronavirus positive and negative groups were compared by multivariate analysis of variance (MANOVA) as the evidence of the scale's discriminant validity. As an evidence of reliability, internal consistency coefficients were computed.

3. Results

3.1. Face validity

A total of 102 items generated independently by the researchers were reviewed and rated independently by six specialists (i.e., 2 psychiatrists, 2 psychologists and 2 psychometricians) on a 10-point Likert scale. Specialists' average ratings ranged from 2.14 to 9.83 (mean = 9.16, SD = 1.28). Items rated higher than 0.80 on average were considered to have adequate face validity. There were 70 such items retained for exploratory factor analysis.

3.2. Exploratory factor analysis

We conducted EFA with maximum likelihood and varimax rotation to identify the factor structure of the C19P-S. EFA results showed that 50 items were either loaded on more than a single factor and the loading difference was smaller than 0.20 or failed to load on any single factor (loading < 0.40). After omitting such 50 items, the final run resulted in a four-factor solution, which accounted for 61.65% of the total variation. The four factors accounted for 16.97%, 16.30%, 16.19%, and 12.19% of the explained variance, respectively. Kaiser measure of sampling adequacy for EFA was 0.926 and Bartlett test of sphericity was significant, $\chi^2_{(df=190)} = 14{,}396.195$, $p < .001$. All communalities were higher than the threshold of 0.40. Table 2 shows the rotated factor matrix.

3.3. Internal consistency

Tests of normality suggested that kurtosis and skewness coefficients ranged within the threshold values of ± 3, and therefore, the data was normally distributed (Table 3). Cronbach alpha coefficient of the 20 items was 0.925 and subscale reliabilities ranged from 0.851 to 0.903 (Table 3). Further, correlations among the factors were significant ($p < .01$) but not so high as to cause concern for multicollinearity (i.e., > 0.90).

Table 2
Rotated factor matrix.

Factors	Items	Communalities	1	2	3	4
1. Psychological	Psy1	0.626	0.753			
	Psy2	0.658	0.726			
	Psy3	0.385	0.710			
	Psy4	0.702	0.696			
	Psy5	0.698	0.673			
	Psy6	0.656	0.446			
2. Psyho-somatic	Som1	0.749		0.866		
	Som2	0.634		0.838		
	Som3	0.776		0.750		
	Som4	0.799		0.680		
	Som5	0.636		0.638		
3. Economic	Eco1	0.689			0.846	
	Eco2	0.802			0.809	
	Eco3	0.788			0.643	
	Eco4	0.618			0.558	
4. Social	Soc1	0.547				0.786
	Soc2	0.651				0.727
	Soc3	0.564				0.515
	Soc4	0.737				0.505
	Soc5	0.687				0.488

3.4. Study 2

3.4.1. Sample

The sample of the second study, used for CFA, consisted of 2143 participants (1292 women, 60.3%) with a mean age of 39.66 years (SD = 16.87, range = 12–92 years). Descriptive statistics calculated for the second sample are reported in Table 4.

3.5. Internal reliability

The subscales showed sufficient internal consistency ($0.853 < \alpha < 0.897$), and Cronbach alpha for the overall scale was 0.926. Descriptive statistics, skewness, kurtosis, and reliability coefficients are reported in Table 5.

3.6. Convergent and discriminant validity

Convergent validity was investigated by composite reliability (CR) and average variance extracted (AVE) values. The results show that AVE and CR are higher than the thresholds of 0.50 and 0.70, respectively (Fornell & Larcker, 1981). Thus, convergent validity of the C19P-S evidenced. The results also show that each factor significantly correlated with the other factors ($p < .01$). Further, all square roots of the AVE values (reported in off-diagonal, Table 6) are higher than the cross-correlations; therefore, discriminant validity of the C19P-S is established. Table 6 shows inter-item correlations along with convergent and discriminant validity coefficients.

3.7. Construct validity

Confirmatory factor analysis (CFA) was conducted by SPSS-AMOS (v.23) to verify how well the four-factor structure fit the data. Multiple criteria including goodness of fit index (GFI), adjusted goodness of fit (AGFI), comparative fit index (CFI), normed fit index (NFI), incremental fit index (IFI), Tucker-Lewis fit index (TLI), and root mean squared error of approximation (RMSEA) were used to assess the fit of the model to data (Tabachnick & Fidell, 2007). The results evidenced adequate model fit: $\chi^2_{(df=125)} = 446.930$, $\chi^2/df = 3.575$, $p < .001$, GFI = 0.979, AGFI = 967, NFI = 0.981, IFI = 0.986, TLI = 0.981, CFI = 0.986, and RMSEA = 0.035 [90% confidence interval = 0.031 and 0.038]. Further, standardized item factor loadings ranged from 0.63 to 0.81. Fig. 1 shows the measurement model.

3.8. Discriminant validity

One-way MANOVA was used to determine whether there was a significant difference in each factor between infected (COVID-19 positive) and randomly selected non-infected groups of subjects. Results showed that there was a statistically significant difference in corona phobia between infected ($n = 14$) and non-infected subjects ($n = 20$, randomly selected form n of 2133), $F(4, 29) = 4.971$, $p = .004$; Wilk's $\Lambda = 0.593$, partial $\eta^2 = 0.41$, power = 0.93. One-way MANOVA was repeated to identify the differences between 14 infected (COVID-19 positive) and randomly selected 200 non-infected subjects (randomly selected form n of 2133 with replacement). Again, the results showed that there was a statistically significant difference in corona phobia between infected ($n = 14$) and non-infected subjects ($n = 200$), $F_{(4, 209)} = 10.85$, $p < .001$; Wilk's $\Lambda = 0.979$, partial $\eta^2 = 0.021$, power = 0.99. Finally, there was significant differences in the psychological factor, $F_{(1)} = 3.989$, $p < .05$, partial $\eta^2 = 0.002$, psychosomatic factor, $F_{(1)} = 12.728$, $p < .001$, partial $\eta^2 = 0.006$, and social factor, $F_{(1)} = 8.327$, $p < .01$, partial $\eta^2 = 0.004$ between infected and non-infected subjects, where infected subjects scored higher than the non-infected.

Table 3
Descriptive statistics and reliability.

Factors	1.	2.	3.	Mean	S.D.	Cronbach alpha	Skewness (SE = 0.069)	Kurtosis (SE = 0.138)
1. Psychological				20.458	5.551	0.876	−0.150	−0.587
2. Psycho-somatic	0.368*			10.039	4.012	0.899	1.176	1.881
3. Economic	0.473*	0.478*		9.569	3.757	0.903	0.743	0.359
4. Social	0.625*	0.469*	0.476*	15.337	4.652	0.851	0.295	−0.541

* $p < .01$.

Table 4
Descriptive statistics of the participants in Study 2.

		Frequency	Percent
Marital status	Married	1263	58.9
	Single	812	37.9
	Other (divorced or widowed)	68	3.2
Educational attainmentdducation level	No formal schooling	119	5.6
	Primary school	440	20.5
	Secondary school	199	9.3
	High school	264	12.3
	Undergraduate	531	24.8
	Graduate	435	20.3
	MSc/PhD	116	5.4
	Missing	39	1.8
Socio-economic status (SES)	High	32	1.5
	Middle-high	432	20.2
	Middle	1288	60.1
	Middle-low	272	12.7
	Low	118	5.5
Chronic disease	Yes	448	20.9
	No	1694	79.0
COVID 19 diagnosis	Positive	14	0.5
	Negative	2133	99.5
International travel	Yes	20	0.9
	No	2123	99.1
Contact with travelers	Yes	110	5.1
	No	2033	94.9
COVID-19 positive contact	Yes	191	8.9
	No	1952	91.1
Relative/friend dead from COVID-19	Yes	45	2.1
	No	2098	97.9

Table 5
Descriptive statistics and reliability.

Factors	C19P-S items	Mean	SD	Skewness (SE = 0.053)	Kurtosis (SE = 0.106)	α
Psychological	Psy1 Psy2 Psy3 Psy4 Psy5 Psy6	16.02	5.49	0.012	−0.567	0.876
Psycho-somatic	Som1 Som2 Som3 Som4 Som5	20.09	3.89	−1.178	1.999	0.897
Economic	Eco1 Eco2 Eco3 Eco4	14.45	3.74	−0.742	0.285	0.880
Social	Soc1 Soc2 Soc3 Soc4 Soc5	14.85	4.61	−0.288	−0.580	0.853

Table 6
Convergent and discriminant validity.

	CR	AVE	Economic	Psychological	Psycho-somatic	Social
Economic	0.875	0.637	**0.798***			
Psychological	0.878	0.548	0.549*	**0.740***		
Psycho-somatic	0.892	0.623	0.633*	0.424*	**0.790***	
Social	0.858	0.549	0.568*	0.729*	0.568*	**0.741***

* $p < .01$.

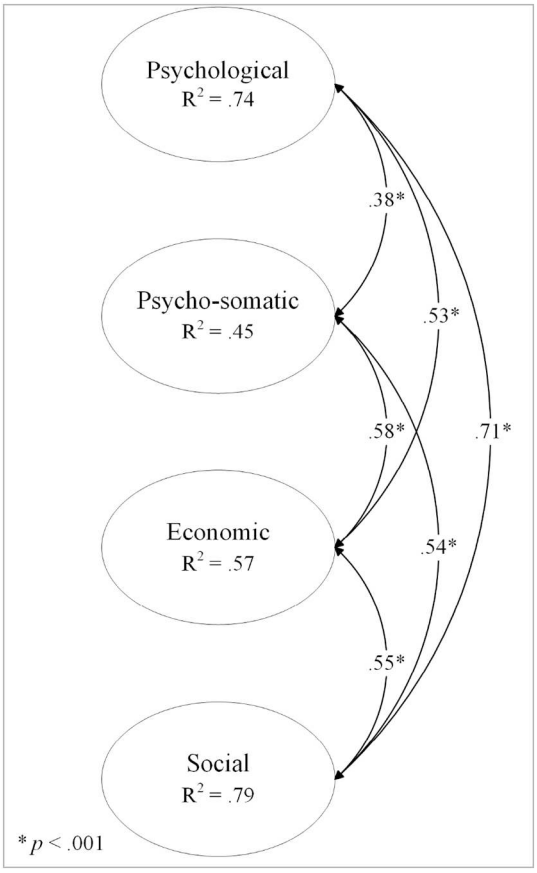

Fig. 1. The measurement model.

4. Discussion

The present study purposed corona phobia as persistent and excessive fear of the novel coronavirus and developed and validated a 20-item, self-report instrument with a 5-point Likert-scale to assess the levels of corona phobia (COVID-19) among individuals of wide age range. All items in the scale are rated on a 5-point scale from “strongly disagree (1)” to “strongly agree (5)” (see Appendix A for C19P-S items and scoring).

Findings show initial evidences that the C19P-S may be used to

assess the severity of corona phobia. CFA suggests 20 items with four-factors: Psychological, Psycho-somatic, Economic, and Social. The four-factor structure found in sample 1 (n = 1250) subsequently confirmed in sample 2 (n = 2143). Additionally, results show that the scale demonstrate convergent and discriminant validity and internal consistency. Internal consistency coefficients for the sub-scales range from 0.85 to 0.90. Further, null hypothesis testing results show that the C19P-S differentiate the infected (COVID-19 positive) and non-infected subjects; however, the effect size of the differences are minimal (Ferguson, 2009) and should be interpreted with caution.

In conclusion, findings provide initial evidence that the scale has promising reliability and validity properties. Nonetheless, the study has some limitations that should be addressed at this point. First, even though the samples were heterogonous, we assume that subjects in both samples are mostly non-diagnosed individuals in terms of any phobia. These measurements should also be tested with clinically diagnosed phobic cases that show the symptoms of clinical phobia. The instrument is named "corona phobia scale" and appropriately, its items should be further tested with clinical diagnostics information which may evidence the diagnostic accuracy of the items for classifying cases as clinically phobic. Finally, the base-rate of infected cases (14/2147 = 0.65%) did not allow us to conduct any method of classification analysis (i.e., a logistic regression or CART analysis). Future studies should replicate the results with culturally more diverse populations as well as clinically diagnosed patients. Classification analysis should be conducted to evidence classification power of the C19P-S.

CRediT authorship contribution statement

Ibrahim Arpaci: Conceptualization, Formal analysis, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing. **Kasım Karataş:** Investigation, Resources, Writing - original draft, Writing - review & editing. **Mustafa Baloğlu:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

Appendix A. C19P-S items and scoring

Coronavirus 19 Phobia Scale (C19P-S) items
Psychological factors
1. The fear of coming down with coronavirus makes me very anxious.
2. I am extremely afraid that someone in my family might become infected by the coronavirus.
3. News about coronavirus-related deaths causes me great anxiety.
4. Uncertainties surrounding coronavirus cause me enormous anxiety.
5. The pace that coronavirus has spread causes me great panic.
6. I argue passionately (or want to argue) with people I consider to be behaving irresponsibly in the face of coronavirus.
Psycho-somatic factors
1. I experience serious stomachaches out of the fear of coronavirus.
2. I experience serious chest pain out of the fear of coronavirus.
3. I experience tremors due to the fear of coronavirus.
4. I experience sleep problems out of the fear of coronavirus.
5. Coronavirus makes me so tense that I find myself unable to do the thing I previously had no problem doing.
Economic factors
1. The possibility of food supply shortage due to the coronavirus pandemic causes me anxiety.
2. The possibility of shortages in cleaning supplies due to the cornavirus pandemic causes me anxiety.
3. I stock food with the fear of coronavirus.
4. After the coronavirus pandemic, I do not feel relaxed unless I constantly check on my supplies at home.
Social factors
1. After the coronavirus pandemic, I feel extremely anxious when I see people coughing.
2. After the coronavirus pandemic, I actively avoid people I see sneezing.
3. Following the coronavirus pandemic, I have noticed that I spend extensive periods of time cleaning my hands.
4. The fear of coming down with coronavirus seriously impedes my social relationships.
5. I am unable to curb my anxiety of catching coronavirus from others.

Scoring of the C19P-S

The C19P-S is a self-report instrument with a five-point Likert-type scale to assess the levels of coronavirus (COVID-19) phobia. All items are rated on a 5-point scale from "strongly disagree (1)" to "strongly agree (5)." The scores on the scale can range between 20 and 100 and a higher score indicates a greater phobia in the respected subscales and total scale. In the present study total scale scores ranged from 20 to 100 (mean = 65.42, SD = 14.09).

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