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Development of a COVID-19 Disease Risk Perception Scale

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Abstract

Background: The COVID-19 pandemic has affected several areas of society, such as social life, the economy, education, and the provision of health services. The need to evaluate individuals' risk perception has assumed particular importance in this situation in which people find themselves.

Objectives: This study aimed to develop a "COVID-19 Disease Risk Perception Scale" for determining COVID-19 risk perceptions in the adult patient group during the COVID-19 pandemic.

Methods: The proposed scale form was established once the content validity of the item pool created by the research team had been evaluated by experts. Exploratory and confirmatory factor analysis for construct validity, item-total correlation, Cronbach alpha coefficients, and the test-retest method were employed to determine criterion-dependent validity and reliability in a group of 564 individuals aged 18-73.

Results: Following exploratory factor analysis, a nine-factor structure explaining 61.733% of variance was established. Confirmatory factor analysis results were found within the values defined in the literature. The Cronbach alpha coefficient of the scale was 0.906, with an intraclass correlation coefficient of 0.881 (P<0.001).

Conclusion: The developed scale is a valid and reliable inventory capable of using in the examination and evaluation of risk perception of COVID-19 disease in the adult age group.

Keywords: COVID-19, Reliability and validity, Risk perception, Scale, SARS-CoV-2

1. Background

COVID-19 first reported in China on December 31, 2019, created a serious public health problem that spread rapidly worldwide (1, 2). Strict precautions have been implemented in almost all countries to contain the spread of SARS-CoV-2, reducing COVID-19 case numbers and mortalities. These measures include social distancing, isolation and quarantine, and work-related changes, such as staggered hours in public and private institutions or working from home, the closure of some workplaces and schools, the cancellation of sporting and artistic activities, and prohibitions on international and inter-city travels. However, this has led to major disruptions in such areas as social life, economy, tourism, trade and health service provision (3). These global disruptions have highlighted the risk and threat to which individuals are exposed, and the need for risk perception evaluation (4).

Risk perception is defined as a subjective judgment made concerning risk characteristics and severity or the individual's perceived susceptibility to a given danger. This definition is most employed in the context of risks concerning human health and the environment (4-6). Slovic (1987) argues that the perception of risk is expected to be against certain types of threats, such as terrorism and war. Therefore, it is understandable that there is a significant relationship between exposure to a certain level of risk and negative psychological and physiological responses to it (7, 8). In the related literature, there is an increasing number of studies on how risk perception is formed. Perceptions of risk can be optimistic (i.e., low) or pessimistic (i.e., high). However, the findings show that individuals in societies can distinguish each threat at different levels and qualities while creating a risk perception (6). Recent studies show that risk perception is a subjective psychological structure affected by cognitive, emotional, social, cultural, and individual differences between individuals and countries (9). The risk perceived by the individuals is one of the most important factors that form the basis of behaviors that positively or negatively affect the health of themselves, their family, close environment, and society (10). In particular, the rapid spread of the COVID-19 pandemic impacted the perception of individuals, social risks, and the resulting behaviors. For example, wearing a mask, keeping a distance, full compliance or non-compliance with hygiene rules, and vaccination are the most basic behaviors that cause an increase or decrease in the number of cases. Individuals with low perceived risk in the face of an encountered situation may be less likely to minimize the risk severity and engage in information acquisition and protective behaviors. However, individuals with a high-risk perception are more likely to take the situation seriously, exhibit protective behaviors, and encourage protective behavior and compliance with precautionary measures among others around them (6, 11). However, recommended precautions can also trigger obsessive behaviors among some individuals, resulting in a more problematic environment for both the individual and others. However, the way in which individuals perceive risks associated with COVID-19 or how the situation encountered and the perceived risk affect protective behaviors is unclear (12).

2. Objectives

The present study aimed to develop a COVID-19 Disease Risk Perception Scale (CRP-S) for the determination of COVID-19 risk perceptions in adults.

3. Methods

3.1. Research Design

This research consisted of a methodological study involving validity and reliability studies for developing a CRP-S (13). The technique developed by Slavec and Drnovsek and adapted to Turkish by Geçkil and Tikici was used. Thus, the scale was developed in ten steps and three phases (14, 15). The model employed was as follows;

First phases; Theoretical importance and the existence of the construct

1. Content domain specification (a literature review, interviews with a relevant audience, and a focus group)
2. Item pool generation
3. Content validity evaluation (expert judges, relevant audience)

Second phases; Representativeness and appropriateness of data collection

4. Questionnaire development and evaluation
5. Translation and back-translation
6. Pilot study
7. Sampling and data collection

Third phases; Statistical analysis and statistical evidence of the construct

8. Dimensionality assessment
9. Reliability assessment
10. Construct validity assessment (convergent and discriminant validity)

3.2. Research Sampling

Different approaches are available for sampling sizes in factor analysis. A figure of at least 200 is generally recommended, with a sample size of 100 being described as weak, 200 as adequate, 300 as good, 500 as very good, and 1,000 or more as perfect (15, 16). According to another perspective, 4-10 individuals per item has been described as an acceptable sample size (16-18). Since our candidate scale form consisted of 40 questions, we planned a figure of 12 individuals, increasing the maximum limit per item by 20%, with a target figure of at least 480 individuals. Responses were received from 556 individuals between 9 and 11 February 2021 within three days (72 hours) of the publication of an online questionnaire produced using Google Forms. The inclusion and exclusion criteria for the individuals responding are shown below.

Inclusion criteria:

- ✓ Living within the borders of the Republic of Turkey
- ✓ Being 18 years old and above
- ✓ Willingness to participate in the study
- ✓ Complete responses to the items in the questionnaire

Exclusion criteria:

- ✓ Not living within the borders of the Republic of Turkey
- ✓ Age<18
- ✓ Inability to use electronic communication tools for the completion of the questionnaire
- ✓ Incomplete responses to the items in the questionnaire

Following examination, the data for 22 individuals were excluded from the study, 15 of whom lived abroad and seven of whom were aged 17 or under. A total of 30 people were included in the pilot study. Since no changes were made to the questions following the pilot study, the pilot study data were included, and the final analysis involved 564 individuals. The flow chart of the scale development study is shown in Figure 1.

3.3. Characteristics of the Data Collection Tool

The questionnaire employed in the research consisted of five sections.

The first section inquired into sociodemographic and personal characteristics, such as sex, age, and education.

The second section contained the CRP-S intended for development and consisted of 40 Likert-type questions. The scale was prepared on a four-point Likert-type basis, and responses to the statements contained were scored (3) I Completely Agree, (2) I Agree, (1) I Disagree, and (0) I Completely Disagree. Questions 11, 12, 13, 17, 18, 21, 22, and 27 were reverse scored (0) I Completely Agree, (1) I Agree, (2) I Disagree, and (3) I Completely Disagree.

The third section contained the Perceived Stress Scale (PSS)-10. The PSS was developed by Cohen et al. in 1982 to measure the extent to which individuals perceive certain situations occurring in their lives as stressful (19). The validity and reliability of the Turkish-language version of the scale were investigated by Eskin et al. in 2013 and Baltaş et al. in 1998 (20, 21). Eskin et al. calculated an internal consistency coefficient of 0.82 for PSS-10 and a test-retest reliability coefficient of 0.88. The PSS consists of 10 items on a five-point Likert-type scale ranging from "Never" (0)" to "Very Frequently" (4). Four items containing positive statements (4, 5, 7, and 8) are reverse-scored. Possible score range between 0 and 40, which higher scores indicating higher stress perception (20). The Cronbach alpha value of the PSS-10 in this study was 0.830.

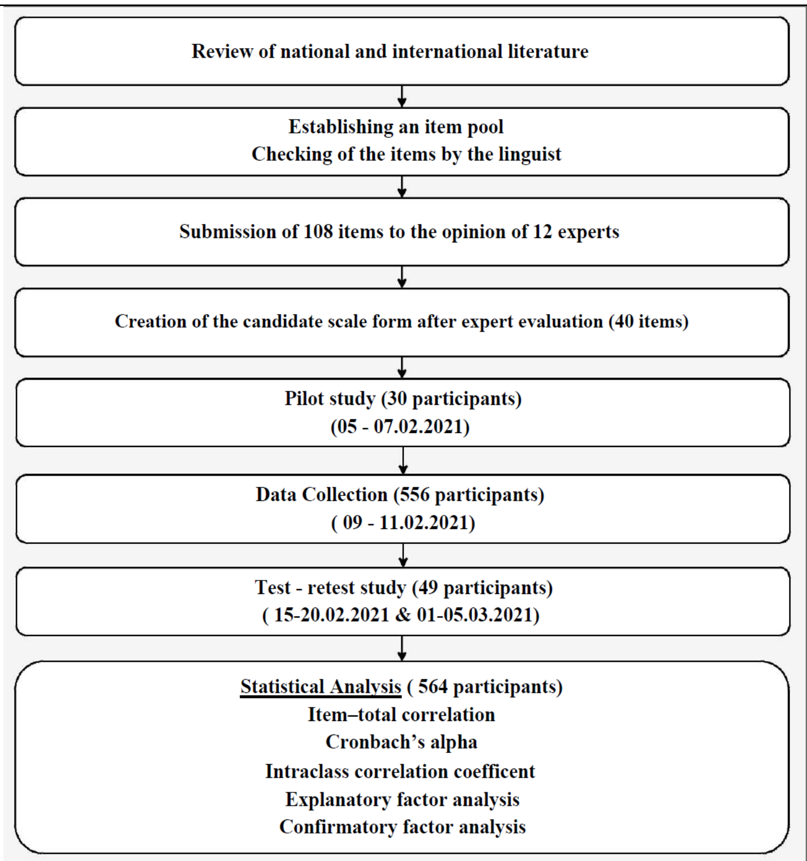

Figure 1. Flowchart of the Scale Development Study

The fourth section contained the Coronavirus Anxiety Scale (CAS). The CAS was developed by Lee to identify probable cases of dysfunctional anxiety associated with the COVID-19 crisis (22). The Turkish-language version of the scale was validated by Biçer et al. (23). The CAS consists of five questions and a single dimension in a five-point Likert-type scale. The questions are scored "0" Never, "1" Rarely, less than a day or two," "2" Several days, "3" More than seven days, and "4" Nearly every day over the last two weeks. The scale's Cronbach α reliability coefficient was calculated at 0.832. The Cronbach α value in the present study was 0.900.

The fifth section contained the COVID-19 Phobia Scale (CP19-S). This was developed by Arpacı et al. for evaluating coronavirus (COVID-19) phobia levels. This Likert-type scale consists of 20 questions and four sub-dimensions – psychological, psychosomatic, economic, and social. All items are scored between 1 "I definitely agree" and 5 "I definitely disagree." Possible scores range between 20 and 100, with higher sub-dimension and total scores indicating greater phobia. The Cronbach α reliability values for the psychological, psychosomatic, economic, and social sub-dimensions have been calculated at 0.876, 0.897, 0.880, and 0.853 (24). The Cronbach α value of the CP19-S in this study was 0.934.

3.4. Validity and Reliability Studies

3.4.1. Validity

Validity is defined as "the degree to which the tool measures what it was prepared in order to measure" and is a concept associated with "what" it measures and how correctly/accurately. There are three criteria for evaluating the validity of a measurement tool (25-27):

- ✓ Content validity
- ✓ Construct validity and
- ✓ Convergent-divergent validity

3.4.1.1. Content validity

This stage involves the determination of the ability of the items to be included in the measurement tool to actually measure the desired characteristics. The opinions of experts and the literature relevant to the scale are generally employed to determine its scope (25). Content validity was studied using the method known as the Lawshe technique, consisting of six steps at this stage. At this stage, content validity was studied using the method known as the Lawshe technique, which consists of six steps. According to the Lawshe technique, the minimum Critical Content Validity Index (CVRcritical) values required for the items to be included in the scale were calculated according to the number of experts (28).

For the content validity of the candidate scale, the opinions of 12 experts were obtained using an "Expert Evaluation Form." Each expert was asked to score each item between 1 and 4 based on the suitability of the item for measuring the desired characteristic. A score of 1 indicated that the item was "unsuitable," a score of 2 indicated that it was "somewhat suitable but needs to be made more appropriate," a score of 3 indicated that it was "suitable, although small changes are required", and a score of 4 indicated that it was "highly suitable." The opinions of experts awarding scores of 3 or 4 to an item were regarded as "necessary." The Content Validity Index (CVI) of the items was calculated by dividing the numbers of experts describing the item as "necessary" by the total number of experts. Items with a CVI of 0.83 or higher and awarded a total score of 43 or more were included in the study, and the other items were removed. Sixty-eight of the 108 items were accordingly deleted from the scale, and a candidate scale form of 40 items was thus established. The accepted items were given their final form in the light of minor changes recommended by the experts (Figure 2).

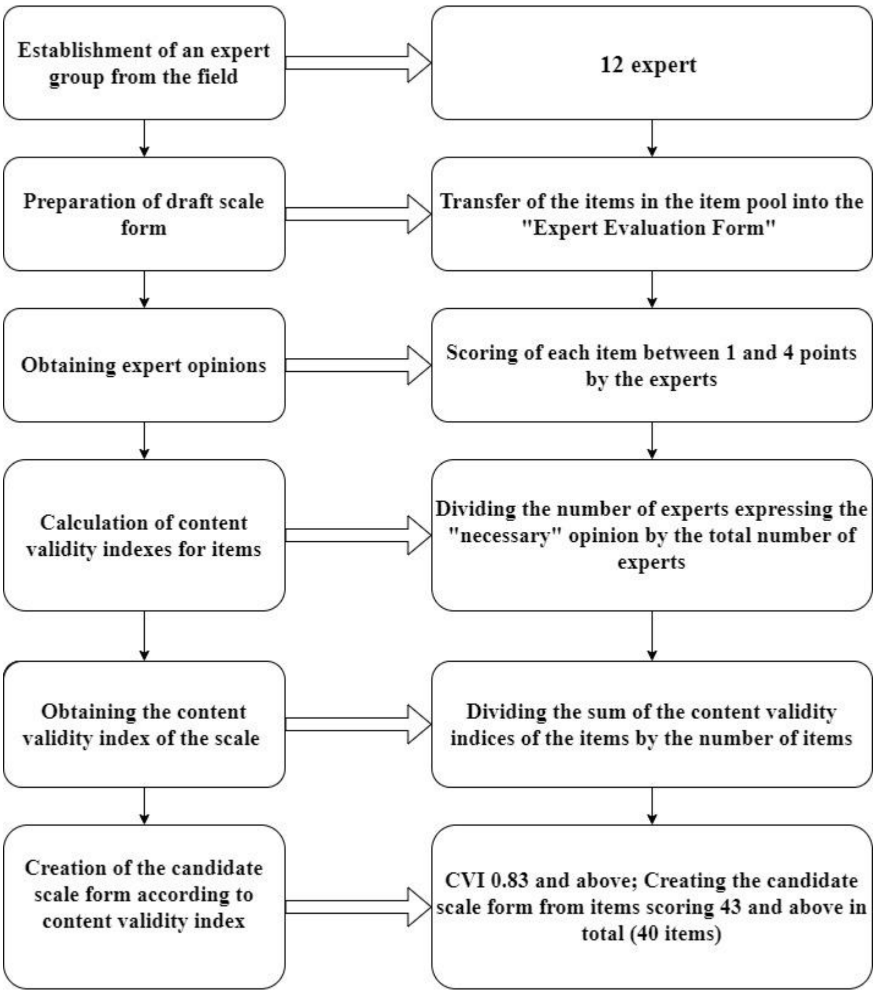

Figure 2. Content/Scope Validity Using the Lawshe Technique

3.4.1.2. Construct validity

Construct validity refers to the process of determining the ability of the scale to measure the concept or the entire conceptual structure (construct) and also the meaning of the score obtained from the scale (25, 26). The construct validity of the scale was tested using exploratory factor analysis (including Varimax rotation with Kaiser normalization) and confirmatory factor analysis). Data suitability in terms of construct validity was analyzed using the Kaiser Meyer-Olkin (KMO) value and Bartlett's test (16). The line chart is the result of combining the items" eigenvalues. Rapid falls (break points) in the chart are reported to yield the factor number. An item is regarded as overlapping when it has a load value higher than the acceptance level in more than one factor or if the difference between the load values in two or more factors is smaller than 0.1 (16-18).

3.4.1.3. Convergent-divergent Validity

In evaluating convergent-divergent validity, the relationship between scale scores and various external criteria (with similar scales) is investigated. A scale with previously confirmed validity is used as an external criterion (25, 26). Three scales were employed for that purpose in the present study, the PSS, the CAS, and CP19-S. Following application of the scales to the same sample group, differences between scale scores were subjected to Pearson's correlation analysis.

3.4.2. Reliability

Reliability is defined as "the power of a scale to provide consistent and stable measurement results" or as "stability between independent measurements of the same variable; a specific variable for which measurement is desired constantly receiving the same symbols." In brief, it refers to the ability of a measurement tool to produce a repeatable result (25, 26). "Internal consistency" and "Stability" tests were employed for reliability in the present study.

3.4.2.1. Internal Consistency/ Homogeneity

This is the first recommended item analysis for calculating correlations between each item and the scale score. If an item exhibits a low correlation with the total score, this shows that this item measures a different property to the other items in the test. Items with a total correlation coefficient that is negative, zero, or close to zero should be removed (25, 27). The coefficient in the present study was 0.20. Items 35 and 37, with total correlation coefficients lower than 0.20, were deleted from the scale.

The α coefficient developed by Cronbach (1951) is used for determining the reliability of a Likert-type scale (28). The Cronbach α coefficient is a measure of the internal consistency and homogeneity of the items constituting the scale (29). The Cronbach α for the scale and the sub-dimensions, and the Cronbach α when the scale item was deleted were calculated.

3.5. Stability

Test-retest reliability was used for stability. Test-retest reliability is defined as "the power of a measurement tool to provide consistent results from application to application and to exhibit stability over the course of time." (25, 26). The intraclass correlation coefficient (ICC) between scores obtained from two applications was calculated for the reliability of the scale developed (26). The analysis was performed using a two-way random effects model, reported to be the most appropriate for the purpose (27).

For the test-retest application, the candidate scale was applied to 49 individuals twice, at a two-week interval, on 15-20 February 2021 and 1-5 March, 2021. At this stage we planned to contact individuals using a different method since no ID capable of identifying participants had been elicited in our previous online application. Therefore, data was collected under observation through a questionnaire applied to individuals known not to have participated in the online application (who contacted the researchers by e-mail or GSM (Global System for Mobile Communications) when the system was closed after the three-day application, or who were capable of being contacted individually), who were confirmed by these, and who met the study inclusion and exclusion criteria.

3.6. Data Analysis

The candidate CRP-S initially consisted of 40 items. However, following item-total correlations, two items with a correlation coefficient less than 0.20 (items 35 and 37), and two items with standardized regression coefficients less than 0.40 at explanatory factor analysis (items 28 and 29), were removed from the scale. Once these had been deleted, the remaining items were re-numbered, and the analysis was performed again with 36 items. The floor ceiling effect was calculated using the total scale score. The floor effect was calculated by dividing the scores of participants who got the minimum score from the scale by the total number of people to whom the scale was applied, and the ceiling effect was calculated by dividing the scores of participants who got the maximum score by the total number of participants to whom the scale was applied.

Descriptive and statistical analyses (Exploratory Factor Analysis, Corrected Item-Total Correlation, Cronbach's α if Item Deleted, Cronbach's α, ICC, and Pearson Correlation) were performed on IBM SPSS 22 and confirmatory factor analysis on IBM SPSS AMOS software. A *P* value of less than 0.05 was considered statistically significant.

4. Results

4.1. Participants

Examination of the 564 individuals participating in the study revealed a mean age of 37.5 ± 13.6 (min: 18–max: 73) years. Moreover, 349 (61.9%) participants were women and 215 (38.1%) were men. In terms of education, 3.9% were elementary school graduates, 23.6% were high school graduates, 43.8% were university graduates, and 28.7% held postgraduate qualifications such as master's or doctoral degrees. In terms of places of residence, 49.5% (n=279) individuals took part from the Black Sea region, 18.1% (n=102) from Marmara, 15.4% (n=87) from Central Anatolia, 8.2% (n=46) from the Aegean region, 5.1% (n=29) from the Mediterranean region, 2.4% (n=13) from Eastern Anatolia, and 1.4% (n=8) from Southeast Anatolia.

4.2. Validity and Reliability Studies

4.2.1. Validity

4.2.1.1. Content validity

The Critical Content Validity Index (CVRcritical) values calculated according to the Lawshe technique are presented in Table 1. Expert opinions regarding the items and Content Validity Index values are shown in Table 2.

4.2.1.2. Construct validity

A KMO coefficient of 0.890 and a Bartlett test *P*<0.001 (Chi-Square: 8571,213; df: 630) were calculated for data suitability before explanatory factor analysis to appraise the scale's content validity.

Table 1. Minimum Content Validity Indexes according to the Lawshe Technique

Number of experts	Minimum value	Number of experts	Minimum value
5	0.99	13	0.54
6	0.99	14	0.51
7	0.99	15	0.49
8	0.78	20	0.42
9	0.75	25	0.37
10	0.62	30	0.33
11	0.59	35	0.31
12	*0.56*	40+	0.29

Table 2. Expert Opinions regarding the Items and Content Validity Index Values

	Scores of experts				CVI		Scores of experts				CVI
Item	**4**	**3**	**2**	**1**		**Item**	**4**	**3**	**2**	**1**	
I1	12	-	-	-	1	I19	11	-	1	-	0.92
I2	11	1	-	-	1	I20	8	3	1	-	0.92
I3	12	-	-	-	1	I21	8	3	1	-	0.92
I4	12	-	-	-	1	I22	8	3	1	-	0.92
I5	12	-	-	-	1	I23	11	1	-	-	1
I6	12	-	-	-	1	I24	10	1	1	-	0.92
I7	12	-	-	-	1	I25	9	1	2	-	0.83
I8	11	1	-	-	1	I26	11	1	-	-	1
I9	11	-	-	1	0.92	I27	9	2	-	1	0.92
I10	11	-	-	1	0.92	I28	9	2	1	-	0.92
I11	10	1	-	1	0.92	I29	12	-	-	-	1
I12	10	1	-	1	0.92	I30	11	1	-	-	1
I13	9	3	-	-	1	I31	11	1	-	-	1
I14	11	1	-	-	1	I32	10	-	1	1	0.83
I15	11	1	-	-	1	I33	12	-	-	-	1
I16	11	1	-	-	1	I34	11	-	1	-	0.92
I17	10	1	1	-	0.92	I35	10	1	1	-	0.92
I18	10	2	-	-	1	I36	9	3	-	-	1
Number of experts									12		
Critical Content Validity Index									0.56		
Scale Content Validity Index									0.96		

Notes: 4= highly suitable
3= suitable, although small changes are required;
2= somewhat suitable but needs to be made more appropriate
1= unsuitable CVI: Content validity index

The variance percentages explained by the factors (Table 3) and the line chart (shown in Supplementary File, Figure 3) were considered when deciding on the factor number. A construct consisting of nine factors with eigenvalues greater than 1 explaining 61.733% factors of the total variance emerged following factor analysis. Factor 1 explained 8.908% of the total variance, Factor 2-8.295%, Factor 3-7.732%, Factor 4–7.389%, Factor 5–7.095%, Factor 6–6.264%, Factor 7–6.194%, Factor 8–5.113%, and Factor 9– 4.743%.

As shown in the Supplementary File (Figure 3), the components with high-acceleration rapid decreases were factors 1-8. Since the chart assumes a more horizontal appearance from factor number 9, the number of significant factors contained in the scale was determined as nine.

The nine factors remerging as a result of AFA (Exploratory Factor Analysis) performed using the Varimax rotation technique and the factor loads collected within these items are shown in Table 3. A low factor load for an item shows that this item does not exhibit a sufficiently powerful association with the factor in question. The factor load of an item is taken into account in its removal. A factor load of 0.30 was adopted in the present research. Two items with overlapping factor loads were removed from the scale. Overlapping of an item may be associated with two conditions.

As shown in Table 3, the first factor consists of four items, with factor loads ranging between 0.869 and 0.678. (All the factor loadings of each item are presented in Appendix-2) The items in this factor were named "Anxiety Regarding Catching the Disease". Four items with factor loads ranging between 0.722 and 0.669 were also clustered in the second factor, and these were given the name "Social Precautions." The third factor consisted of three items with loads ranging between 0.799 and 0.774. The items in this factor were defined as "Personal Precautions." The fourth factor consisted of six items with loads ranging between 0.693 and 0.487 and were defined as "Contamination Risk." The fifth factor consisted of four items with loads between 0.732 and 0.482 and was defined as "Social Sanctions." The sixth factor consisted of six items with loads between 0.712 and 0.378 and was defined as "COVID-19 Public Health Anxiety." The seventh factor consisted of three items with loads ranging between 0.714 and 0.633

Table 3. Scale Factor Structure, Exploratory Variance Values, Eigenvalues, and Cronbach alpha (n=564)

Factors		Scale items	Factor loadings	Eigenvalue	Variance (%)	Cronbach's alpha
Factor 1	Anxiety Regarding Catching the Disease	I31 I30 I32 I29	0.869 0.818 0.770 0.678	3.207	8.908	0.832
Factor 2	Social Precautions	I6 I4 I7 I5	0.722 0.719 0.718 0.669	2.986	8.295	0.845
Factor 3	Personal Precautions	I15 I16 I14	0.799 0.796 0.774	2.784	7.732	0.886
Factor 4	Contamination Risk	I22 I21 I13 I11 I27 I12	0.693 0.672 0.593 0.587 0.569 0.487	2.660	7.389	0.697
Factor 5	Social Sanctions	I23 I24 I25 I26	0.732 0.718 0.657 0.482	2.554	7.095	0.755
Factor 6	COVID-19 Public Health Anxiety	I19 I20 I3 I2 I28 I1	0.712 0.560 0.526 0.512 0.386 0.378	2.255	6.264	0.783
Factor 7	Common Items and Surfaces Risks	I8 I10 I9	0.714 0.680 0.633	2.230	6.194	0.737
Factor 8	Anxiety for the Future	I35 I36 I34 I33	0.795 0.708 0.549 0.369	1.841	5.113	0.634
Factor 9	Restrictions on Specific Age Groups	I18 I17	0.831 0.799	1.707	4.743	0.772
COVID-19 Disease Risk Perception Scale					61.733	0.906

and were defined as "Common Items and Surfaces Risks." The eighth factor contained four items with loads ranging between 0.795 and 0.369 defined as "Anxiety for the Future." The final factor consisted of two items with loads of 0.831 and 0.799 defined as "Restrictions on Specific Age Groups."

4.2.1.3. Convergent-divergent Validity

The correlation coefficients between the CRP-S developed in this study and the PSS-10, the Coronavirus Anxiety Scale, and CP19-S used as similar scales for the assessment of convergent-divergent validity are shown in Table 4.

A correlation was found between CRP-S and PSS-10 (r=.169, *P*<0.001), Coronavirus Anxiety Scale (r=.154, *P*<0.001) and CP19-S (r=.325, *P*<0.001).

4.2.2. Reliability

4.2.2.1. Internal Consistency/ Homogeneity

The mean and standard deviation values of the items in the scale, item-total correlation, and Cronbach α coefficients when the item is deleted are shown in Table 5. The total Crnobach α coefficient of the scale was 0.906, with values for the sub-dimensions ranging between 0.634 and 0.886 (Table 3).

The scores that can be obtained from the scale range from 0 to 108. When the ceiling-to-floor effect is evaluated over the total scale score, it has been identified that there is no floor effect, and the ceiling effect is 0.4%. These results show that there is no floor-to-ceiling effect for the scale.

4.2.2.2. Stability

The scale was applied twice, at an interval of two weeks, to a 49-member group for test-retest purposes. The ICC of the scores obtained from both applications was 0.881 (*P*<0.001).

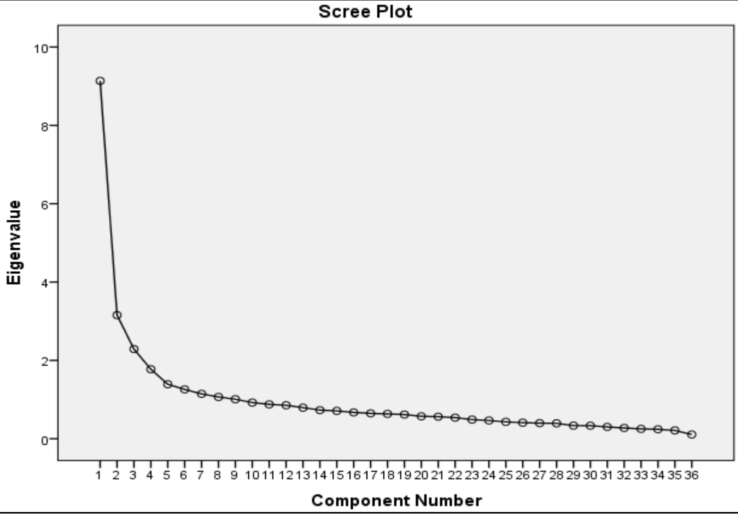

Figure 3. The COVID-19 Disease Risk Perception Scale Eigenvalue Line Chart

Table 4. Relationships between the COVID-19 Disease Risk Perception Scale and the Other Scales and Min-Max Values Obtained or Potentially Obtained from these Scales

Scales (min-max values that can be obtained from the scales)		1	2	3	Mean ± SD	Median	Min-Max
1. COVID-19 Disease Risk Perception Scale (0–108)	r *P*	1 .			78.8 ± 13.8	80.5	7-108
2. Perceived Stress Scale-10 (0–40)	r *P*	.169** <0.001	1 .		19.5 ± 5.8	19	2-37
3. COVID-19 Phobia Scale (20–100)	r *P*	.325** <0.001	.315** <0.001	1 .	47.5 ± 15.1	46	20-92
4. Coronavirus Anxiety Scale (0–20)	r *P*	.154** <0.001	.277** <0.001	.424** <0.001	1.6 ± 3.0	0	0-18

Table 5. Item Analysis Values of the COVID-19 Disease Risk Perception Scale (n=564)

Items	Mean	SD	Skewness	Kurtosis	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I1	2,65	0,61	-1,85	3,66	0,553	0,892
I2	2,10	0,77	-0,74	0,49	0,498	0,892
I3	2,55	0,68	-1,70	3,33	0,530	0,892
I4	1,97	0,95	-0,60	-0,58	0,523	0,891
I5	2,38	0,77	-1,14	0,83	0,605	0,890
I6	1,96	0,96	-0,54	-0,74	0,531	0,891
I7	2,27	0,81	-1,00	0,55	0,624	0,890
I8	2,01	0,88	-0,62	-0,32	0,443	0,893
I9	2,52	0,67	-1,42	2,04	0,594	0,891
I10	2,15	0,82	-0,68	-0,19	0,491	0,892
I11	1,80	1,05	-0,40	-1,06	0,244	0,897
I12	1,40	0,95	0,17	-0,89	0,267	0,896
I13	2,19	0,92	-0,96	-0,01	0,225	0,897
I14	2,76	0,52	-2,58	8,18	0,418	0,894
I15	2,78	0,57	-2,94	9,22	0,612	0,891
I16	2,80	0,52	-3,10	10,84	0,594	0,892
I17	1,61	1,00	-0,15	-1,03	0,383	0,894
I18	1,79	0,98	-0,36	-0,88	0,272	0,896
I19	2,36	0,77	-1,26	1,50	0,459	0,893
I20	2,30	0,84	-1,13	0,73	0,525	0,891
I21	2,36	0,96	-1,36	0,65	0,237	0,897
I22	2,41	0,83	-1,28	0,80	0,285	0,895
I23	2,52	0,79	-1,74	2,53	0,382	0,894
I24	2,64	0,68	-2,21	4,94	0,546	0,892
I25	2,51	0,77	-1,74	2,70	0,518	0,892
I26	2,38	0,77	-1,17	0,90	0,450	0,893
I27	2,05	0,83	-0,59	-0,24	0,243	0,896
I28	2,43	0,74	-1,24	1,18	0,663	0,890
I29	1,56	0,94	-0,05	-0,90	0,433	0,893
I30	1,73	0,93	-0,28	-0,77	0,412	0,893

Table 5. Continue						
I31	1,66	0,97	-0,22	-0,92	0,398	0,894
I32	1,38	0,99	0,19	-0,98	0,260	0,896
I33	2,05	0,76	-0,52	-0,02	0,447	0,893
I34	1,96	0,89	-0,43	-0,67	0,283	0,896
I35	2,40	0,69	-1,12	1,46	0,359	0,894
I36	2,41	0,76	-1,27	1,30	0,313	0,895
TOTAL	**78,8**	**13,8**	**-1,08**	**2,96**		

Analysis of the goodness of fit in the model established as a result of CFA (Confirmatory Factor Analysis) performed for the CRP-S revealed a CMIN/df (Minimum Discrepancy Function by Degrees of Freedom divided) value of 2.470, Root Mean Square Error of Approximation (RMSEA) (Root Mean Square Error of Approximation) of 0.051, Goodness of Fit Index (GFI) (Goodness of Fit) of 0.88, Normed Fit Index (NFI) (Normed Fit Index- Tucker Lewis index), 0.84, and a Comparative Fit Index (CFI) (Comparative Fit Index) value of 0.90. Modification indices were examined for the improvement of the values obtained, and a covariance structure was recommended between e16 and e17, and between e30 and e31. The relevant construct was applied and the model was redrawn. Accordingly, the CMIN/df value was calculated at 2.238, RMSEA at 0.049, GFI at 0.89, NFI at 0.85, and CFI at 0.91. The scale CFA results and goodness of fit indices are presented in Table 6.

A route path for the CRP-S is shown in Supplementary File (Figure 4). The error variance values for the CRP-S were 0.24-0.53 for the "Anxiety Regarding Catching the Disease" sub-dimension, 0.15-0.53 for the "Social Precautions" sub-dimension, 0.03-0.14 for "Personal Precautions," "0.35-0.85 for "Contamination Risk," 0.12—0.47 for "Social Sanctions," 0.24-0.46 for "COVID-19 Public Health Anxiety," 0.16-0.53 for "Common Items and Surfaces Risks," 0.34-0.58 for COVID-19-Related Anxiety for the Future," and 0.24-0.46 for the "Age Restriction for COVID-19" sub-dimension. As shown in the diagram, examination of the standardized parameter values shows figures of 0.66-0.86 for the "Anxiety Regarding Catching the Disease" sub-dimension, 0.65-0.88 for "Social Precautions," 0.68-0.94 for the "Three Basic Rules" sub-dimensions, 0.45-0.70 for the "Contamination Risk" sub-dimension, 0.46-0.86 for "Social Sanctions," 0.52-0.73 for "COVID-19 Public Health Anxiety," 0.57-0.80 for "Common Items and Surfaces Risks," 0.38-0.65 for "Anxiety for the Future," and 0.72-0.87 for the "Age Restriction for COVID-19" sub-dimension.

Table 6. Goodness of fit criteria and the scale CFA results

Sample	**N>250**			**Calculated values**
Number of observed variables	**I≤ 12**	**12< I <30**	**I ≥ 30**	
CMIN (χ2)	Non-significant *P*-value	Significant *P*-value even if the fit is good	Significant *P*-value	<0.001
CMIN/df		χ2 /df<5		2.338
GFI	> 0.90	> 0.90	> 0.90	0.89
CFI	> 0.95	> 0.92	> 0.90	0.91
NFI- TLI	> 0.95	> 0.90	> 0.80	0.85-0.90
RMSEA	< 0.07	< 0.07	< 0.07	0.049

5. Discussion

The aim of this study, performed at a time when the fight against COVID-19 had been waged for a year, was to develop a CRP-S. The item pool consisting of 108 items produced by the research team was submitted for expert appraisal, and CVIs were calculated. The recommended CVI for the items in the scale was below 0.78, and the CVI of the items in the candidate scale was 0.83. The scale CVI was calculated at 0.96. A CVI for a total scale of 0.80 or more is regarded as acceptable (17, 18, 30, 31). Accordingly, the candidate scale total and item CVI values were at acceptable levels. In terms of construct validity, a pre-factor analysis KMO value exceeding 0.50 and a significant Bartlett test result are expected (*P*<0.05). The KMO values of 0.50-0.70 are regarded as average, 0.70-0.80 as good, 0.80-0.90 as very good, and 0.90 and above as perfect. The KMO value in the present study, 0.890, shows that the same size is very good, and the Bartlett test result being statistically significant (*P*<0,001) reveals the presence of correlation among the scale items, and that the data set obtained is appropriate for Explanatory Factor Analysis (16). A construct of nine factors with eigenvalues above one explaining 61.733% of the total variance emerged following factor analysis for construct validity. An explanation of variance value at factor analysis of 0.50-0.70 is regarded as satisfactory (32). The CFA results for the scale determined a CMIN/df (minimum discrepancy) value of 2.238. Values of 0-2 are regarded as perfect fit, and values of 2-3 as good fit, and a size less than 5 is acceptable in case of a sample size greater than 250 (15, 33, 34). The CMIN/df value in this study was within the acceptable range. An RMSEA value less than 0.05 is regarded as good fit, and a value of 0.05-0.08 is considered acceptable (16, 35). It has also been suggested that values smaller than 0.07 can be regarded as good fit in case of a sample size larger

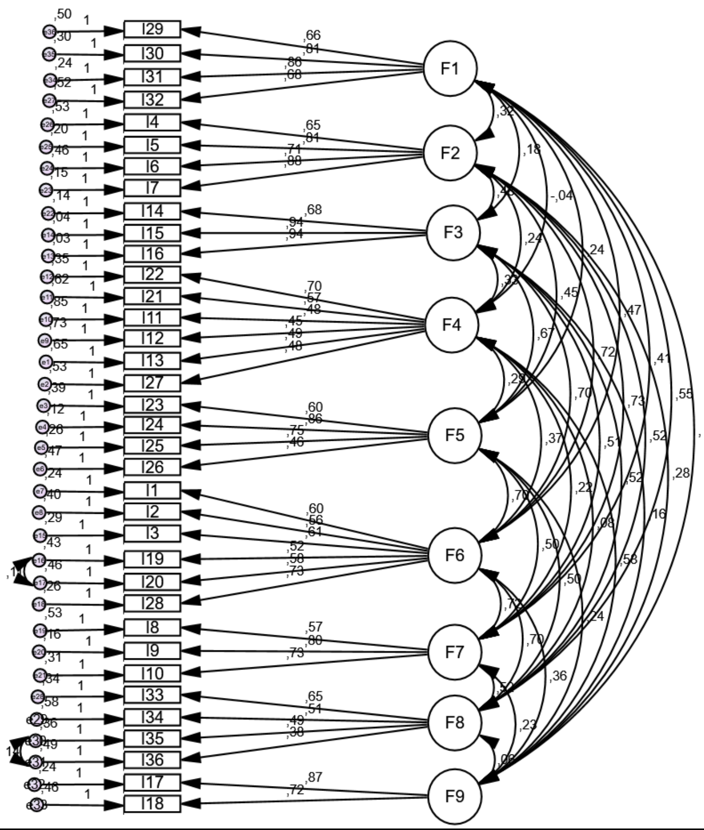

Figure 4. Confirmatory Factor Analysis Results for the Scale

than 250 (32). In the present study, the scale RMSEA value was 0.049, indicating good fit. A GFI value between 0 and 1 indicates no fit, while a value of 1 indicates perfect fit. The GFI values of 0.95, and above are regarded as perfect fit and values above 0.90 as good fit. The GFI value for our scale was 0.89 (16-18, 33, 34). In case of a sample size greater than 250, NFI and TLI (Tucker lewis indexvalues) of 0.80 or above and a CFI value of 0.90 are regarded as good fit. The NFI value in the present study was 0.85, TLI was 0.90, and CFI was 0.91 (30). These values were all within desired ranges. The total Cronbach α coefficient of the scale was 0.906, with sub-dimension Cronbach α values ranging between 0.634 and 0.886. A Cronbach α coefficient of approximately 0.90 is generally regarded as "perfect," approximately 0.80 as "very good," and approximately 0.70 as "satisfactory," and the value should be as close to 1 as possible (25, 26, 28, 36, 37). With the exception of two sub-dimension, our scale's Cronbach α coefficients were satisfactory. The ICC of the scores obtained following test-retest was 0.881. The ICC values > 0.75 are regarded as perfect, between 0.60 and 0.74 as good, between 0.40 and 0.59 as average, and below 0.40 as weak (27, 38). The scale exhibits a perfect intraclass correlation coefficient.

The point to be considered concerning the risk is the negative situations arising from the presence of the hazard. It is stated that risks no longer stay where they have been raised in terms of the effects they create, and they pose a threat at a global level. For this reason, it is stated that today"s modern society has evolved into a risky society (39).

One of the most important steps of outbreak management in public health practice is risk analysis and assessment. Risk analysis and assessment is a dynamic process and starts with the detection of the event and continues until it is brought under control. Its success is possible with the participation of the society (40). In the risk analysis and assessment of the pandemic at the societal and national level, individuals' perception of risk and their behaviors accordingly play a key role. However, the current pandemic brings with it many problems. One of them is the psychological effects. Psychological reactions during the pandemic can range from extreme fear to apathy or fatalism (41). Similarly, people infected with SARS-Cov2 may be asymptomatic, as well as may have mild flu infection, severe pneumonia, hospitalization, need intensive care and even may die (42). Differences in the clinical spectrum of COVID-19 may cause different levels of risk perception in humans (43). This perception also affects attitudes and behaviors positively or negatively.

In studies, it is stated that infectious disease outbreaks and pandemics cause different effects in humans. These effects are fear of getting sick and dying, not being able to protect their loved ones, fear of infecting them and losing their loved ones due to the virus, refraining from applying to health institutions due to fear of contracting the disease when treatment is required, being excluded by the society due to being associated with the disease, fear of being diagnosed with a disease or being evaluated as a contact and quarantined, quarantine application, fear of being separated from loved ones and caregivers due to quarantine, fear of being separated from family members due to quarantine, fear of infecting children and especially disabled or elderly people in their family when the disease is infected, feeling helpless, distressed, lonely and depressed due to isolation conditions, losing their livelihood, being in isolation and unwillingness to go to work, shopping for the needs of the family, fear of being fired due to not being able to go to work because of isolation and quarantine, exaggerating the measures taken by the authorities and overreacting to those who do not comply. On the other hand, there may be reactive behaviors such as denying this disease, finding the measures taken unnecessary, and opposing the restrictions. However, social measures taken can also have negative effects on people. For example, physical restrictions, quarantine, and isolation situations can also cause psychosocial effects such as a decrease or break in social relations in individuals and societies, not being able to get enough support, and exclusion. As a result, whether the disease is perceived as a risk or not shows a wide spectrum (41, 44, 45). In this sense, the headings of the sub-dimensions of the CRP-S and their questions' content have been assigned as Anxiety Regarding Catching the Disease, Social Precautions, Personal Precautions, Contamination Risk, Social Sanctions, COVID-19 Public Health Anxiety, Common Items, and Surfaces Risks, Anxiety for the Future, and Restrictions on Specific Age Groups completely overlap with the risk perception and psychological effects described in the literature (Table 3). In the COVID-19 pandemic, Restrictions on Specific Age Groups definition were made because there are restrictions for < 20 years and > 65 years in many countries.

5.1. The Superiorities of the CRP-S Development Stages

- ✓ Being applied online to large numbers of people,
- ✓ Online administration caused no risk of COVID-19 for participants and researchers
- ✓ A higher number of participants than that recommended in the literature was reached, and in a shorter time, three days
- ✓ A high degree of participation, confirmation of the need for a scale measuring COVID-19 risk perception in society, and acceptance by society of the scale
- ✓ The test-retest stage being performed with the adoption of all precautions set out in guidelines regarding COVID-19 published by the Ministry of Health,
- ✓ The creation of a very large item pool, containing 180 items, in the first stage, the selection of 40 items in the light of the opinions of 12 experts, and only four items being deleted following the analysis
- ✓ The scale contains nine sub-dimensions capable of identifying risks in different areas associated with COVID-19 disease,
- ✓ The scale's Cronbach α, AFA, CFA, and ICC values meet the criteria required for a scale for scientific evaluation,

5.2. Limitations of the CRP-S Development Stages

- ✓ Since the questionnaire was applied online individuals not possessing electronic communication tools or incapable of using them were unable to participate in the study
- ✓ The possibility of selection bias due to online application
- ✓ When the scale's CFA results were evaluated, the minimum GFI value was 0.89, when the minimum value should be 0.90, and the minimum Cronbach α value of the Anxiety for the Future sub-dimension was 0.634, when the minimum value should be 0.70 (although these will not create a problem and were assessed as being at acceptable levels)
- ✓ Factor 9 was identified to have two items (I17 and I18) which may cause an under-identification problem, although the overall model is well-fitted (46). Factors with two items were acceptable when the two items are highly correlated with each other and uncorrelated with other items (47). As because correlation between I17 and I18 is very near to 0.70 (r=0.629), and almost all of the correlations between I17, I18, and other items are below (r<0.30, r=0.323 for I17 and I22, r=0.302 for I18 and I12), we chose to keep these two items in the model. Additionally, these two items had high factor loadings, and also they have distinctive meaning related to age which is an essential factor for COVID-19.

6. Conclusion

The research findings showed that the CRP-S developed in this study is a valid and reliable tool in the examination and evaluation of risk perception concerning COVID-19 disease in the adult age group. The scale consists of 36 items and 9 sub dimensions. Higher scores indicated an increased risk perception of COVID-19 disease.

It is expected that the use of this developed scale in studies among different groups and determining the risk perception for COVID-19 disease will contribute to health service providers and policy makers.

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Footnotes

Conflicts of Interest: None.

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