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Validity and Reliability of the Turkish Version of the Modified COVID-19 Yorkshire Rehabilitation Scale

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ABSTRACT

Objectives: Post-COVID syndrome (PCS) is defined as persistent or emerging symptoms after infection with the virus. The COVID-19 Yorkshire Rehabilitation Scale was developed to identify and measure the severity of PCS symptoms and was later modified. This study aimed to evaluate the validity and reliability of the modified COVID-19 Yorkshire Rehabilitation Scale.

Methods: Language validity, content validity, exploratory factor analysis, and confirmatory factor analysis were performed for construct validity of the scale. Guttman split-half coefficients obtained by the split-half method, Cronbach alpha values, and intraclass correlation coefficients (ICC) examined the reliability of the fit.

Results: The study included 202 patients with a mean age of 57.6±13.4 years. Construct validity results showed that factorial findings demonstrated the factorable structure (Bartlett's test of sphericity (χ^2=1554.8; p<0.001) and good model fit (NFI=0.88, GFI=0.85, root mean square error of approximation=0.10, root mean square residual=0.03) for the present data. For criterion validity, correlation coefficients were found to range from –0.22 to 0.57 (p<0.05, for all), indicating moderate relationships between sub-dimensions. In addition, a high level of reliability was found for the adaptation, as suggested by Guttman's split-half coefficients (0.90, 0.83, and 0.88 for symptom severity, functional ability, and the full scale, respectively), Cronbach's alpha (0.89, 0.83, 0.92), and ICC coefficients (0.88, 0.81, 0.90).

Conclusion: The Turkish version of C19-YRSm has 2 sub-dimensions such as symptom severity and functional ability and is a valid and reliable instrument for measuring patient assessment and monitoring in PCS in Turks.

Keywords: COVID19, post-COVID conditions, rehabilitation, reliability and validity

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INTRODUCTION

The SARS-CoV-2 virus first appeared in December 2019, in Wuhan, China. It spreads rapidly throughout the world, triggering a pandemic.[1] It is a disease that affects many systems besides the respiratory system. During the process, some persistent or recurrent symptoms were noted in patients who had COVID-19. Post-COVID syndrome (PCS) was first defined in March 2020; various terms such as prolonged COVID and post-acute COVID were used.[2] The National Institute for Health and Care Excellence defined ongoing COVID for symptoms that persist 4–12 weeks after infection and post-COVID for symptoms that persist or reappear 12 weeks or longer after infection, and no other diagnosis can be made.[3] The Centers For Disease Control and Prevention defines post-COVID as a set of new or persistent symptoms lasting weeks or months after infection with COVID-19.[4] The most frequent symptom is fatigue.[1] In addition, symptoms such as musculo-articular pain, mental complaints, loss of smell, cough, palpitations, and anxiety may also be observed.[5-7]

The incidence of prolonged symptoms in people who have had COVID-19 ranges from 31% to 69%.[5] While prolonged COVID symptoms can occur in any COVID-19 patient, the literature reports that they are more common in the elderly, female patients, patients with severe infec-

tions, and patients with underlying diseases.[8]

There is a need for comprehensive screening and multidisciplinary assessment to diagnose people being affected by PCS and to ensure their follow-up and aftercare.[9] The COVID-19 Yorkshire Rehabilitation Scale was the first known scale to detect symptoms of PCS and rate the severity of both PCS symptoms and functional disability.[10] The COVID-19 Yorkshire Rehabilitation Scale was then modified for additional symptoms (C-19 YRSm).[11] In Turkey, there is no screening or measurement method for post-COVID symptoms. The aim of this study is to determine the validity and reliability of the Turkish version of the C-19 YRSm.

METHOD

The study was initiated after we obtained permission from the researchers who developed the C-19 YRSm. This study was conducted between November 2022 and February 2023 in individuals who applied to the family medicine outpatient clinic and had COVID-19. The scale consisted of 17 questions. In validity and reliability studies, it is recommended that the number of participants is 5–10 times the number of items on the scale.[12,13] Increasing the sample size increases the convenience of factor analysis and the reliability of the scale.[14] Therefore, 202 people were included in the study.

Turkish individuals who were over 18 years of age were enrolled in the study. Individuals who had communication problems, did not have COVID, did not have symptoms that lasted longer than 4 weeks, were new or otherwise diagnosed, and were unvolunteered to participate in the study were excluded. A summary scheme for the first steps of the adaptation process is shown in Figure 1.

The scale was first translated into Turkish by two different translators. The researchers compared the translations and prepared the Turkish text. Two faculty members (lecturers in the Department of English Language and Literature) whose native language is Turkish translated the scale back into English. The English scale was reviewed by another linguist and found to be similar. The original and translated scales were checked for linguistic equivalence, and the final form of the scale has been achieved.

To determine the content validity of the Turkish version of the scale, the opinions of 6 experts were obtained. They were asked to score each item regarding comprehensibility and understandability on a three-point scale (1=appropriate, 2=useful but inadequate, 3=inappropriate) to evaluate the content validity. The content validity index (CVI) was calculated for each item, based on the scoring of experts. The assessment's content validity was confirmed as all the items received CVIs ranging from 0.90 to 1.00.

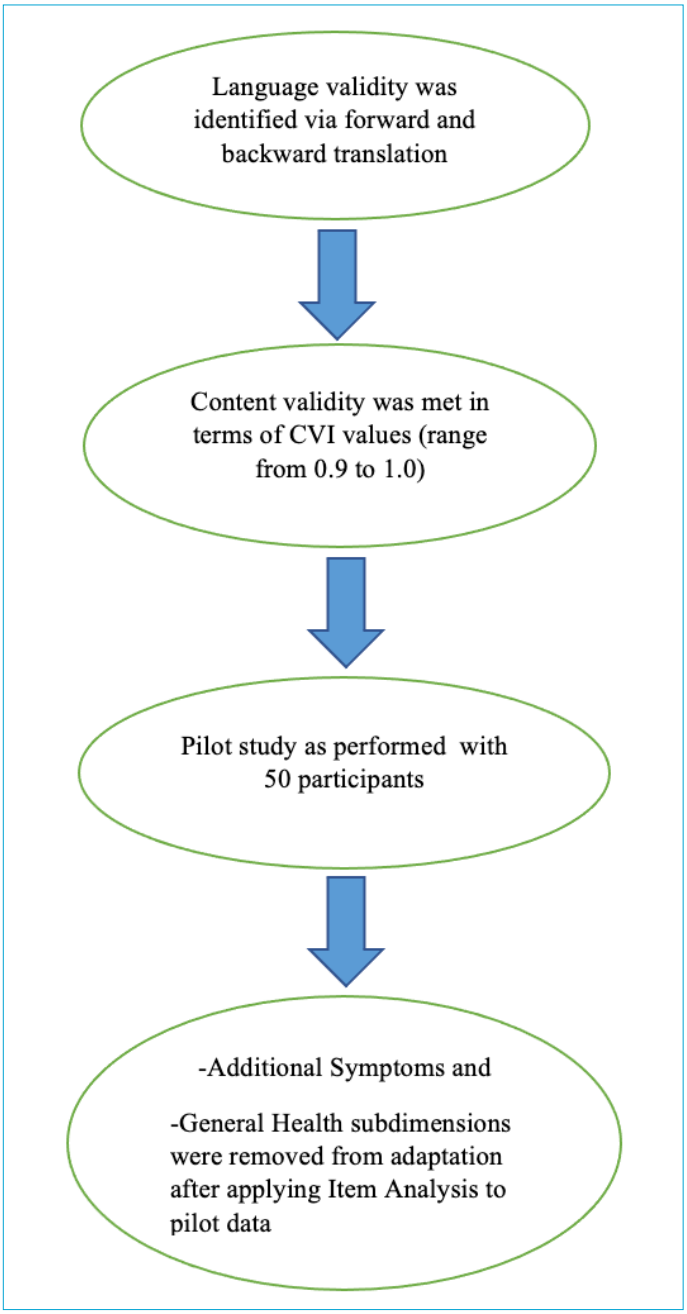

Figure 1. Summary scheme of the first steps of the adaptation process.

A pilot study was performed for the application of the adapted scale to 50 participants to assess the comprehensibility of the questions. For the analysis of the pilot study data, an item analysis was performed to detect the items that caused inconsistencies with the whole adaptation. Item-total correlation coefficients and Cronbach alpha coefficients (if an item was deleted) were used, and some items with higher inconsistencies were excluded from the adapted version.

The forms we used in this study were created online (Google Docs forms) and in hard copy. This form was sent to the participants online. For those who did not have on-

line access, the form was used during an in-person interview. "Descriptive Information Form" was prepared by the researchers and the Turkish version of the C19-YRSm was used. Validated versions of the Depression Anxiety Stress Scale-21 (DASS-21) and Short Form 36 Health Survey (SF-36) scales were used to assess criterion validity.

Descriptive Information Form

This form includes six questions about the individual characteristics of the participants (age, gender, education level, etc.).

DASS-21

DASS developed by Lovibond consists of a 42-item long form.[15] The Turkish adaptation of the DASS short form, which is called DASS-21 and consists of 21 items, was conducted by Yılmaz et al.[16] The scale is a 4-point Likert self-report form. There were no reversed items on the scale. The internal consistency coefficients of Cronbach's alpha of the 3 subdimensions of the scale were tested as 0.84 for anxiety, 0.91 for depression, and 0.90 for stress.

SF-36

The SF-36 quality of life scale was created by Ware in 1987.[17] Its adaptation into Turkish and validity-reliability study was performed by Acaray in 1995 in diabetes mellitus, hemodialysis, and cardiology patient groups.[18] The scale containing thirty-six statements is analyzed under 10 subdimensions. It is evaluated considering the last 4 weeks. Cronbach's alpha value for internal consistency was 0.91.

C-19 YRSm

The COVID-19 Yorkshire Rehabilitation Scale was the first patient-reported outcome measure developed and validated in the UK. The psychometric analyses of the original scale revealed high internal consistency (Cronbach's alpha=0.89).[10] The COVID-19 Yorkshire Rehabilitation Scale is divided into four subscales: Symptom severity, functional disability, additional symptoms, and general health with a total of 22 items. Each item is assigned a score between 0 and 10, both before and after infection (0=no symptoms, 10=extremely severe or life-threatening symptoms).[10,19] C-19 YRSm based on new evidence and feedback from patients and health-care professionals. The C-19 YRSm includes 17 items, each scored between 0 and 3, maintaining the same subscales as the original version (0=no symptoms, 1=mild, 2=moderate, and 3=severe).[11]

All the analyses were performed using R (v.4.2.2) statistical Programming Language (R Core Team, 2022, Vienna, Austria) and AMOS v.26.0. Mean, standard deviation, median, minimum, and maximum values were reported as basic descriptive statistics for numerical variables, while frequency (n) and percentage (%) were recorded for categorical ones. The Wilcoxon test was used to compare the pre-COVID and the current status of the participants. Language adaptation and content validity were investigated and determined to be valid in these fields. Cronbach's alpha coefficients along with intra-class coefficients (ICCs) were reported for each sub-dimension and the total scale within the context of reliability analysis. The split-half reliability method was used to assess the reliability of the Turkish version of the scale. The split-half reliability method was used to assess the reliability of the Turkish version of the scale. Questions were divided by half, as odd-numbered vs. even-numbered ones, and Guttman split-half coefficients were calculated to test the reliability. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed to identify the construct validity. Spearman correlation coefficients were recorded in assessing criterion validity. The sampling adequacy was determined using the Kaiser–Meyer Olkin (KMO) statistic, while the Bartlett Sphericity Test and determinant of the correlation matrix were used for evaluation of whether items in the dataset are correlated and the dataset is in factorial structure, respectively. CFA was applied to confirm the original structure of the scale to the dataset of interest, and several goodness-of-fit indices including Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residual (RMR), relative fit index (RFI), Comparative Fit Index (CFI), etc., were assessed for this aim. A path diagram was plotted to visualize the confirmation and factor loadings, error variances, and covariance between dimensions reported through this diagram. Statistical significance was determined using a two-sided $p<0.05$.

RESULTS

A total of 202 people were included in the study. Baseline characteristics of participants are summarized in Table 1.

Table 1. Baseline characteristics of participants

	Mean±SD
Age (years)	57.6±13.4
	n (%)
Gender	
Female	101 (50.0)
Male	101 (50.0)
Education level	
Primary	12 (5.9)
Secondary	38 (18.9)
High-School	60 (29.7)
University/College	92 (45.5)

SD: Standard deviation.

Table 2. Item analysis results of the questionnaire

Sub-dimension	Corrected item-total score correlation	Scale variance if item deleted	Cronbach's alpha if item deleted
Breathlessness	0.53	67.3	0.71
Cough/throat sensitivity/voice change	0.57	66.7	0.71
Fatigue	0.28	68.9	0.73
Smell/taste	0.42	68.6	0.72
Pain/discomfort	0.66	66.6	0.71
Cognition	0.55	68.1	0.71
Palpitations/dizziness	0.40	69.0	0.72
Post-exertional malaise (worsening of symptoms)	0.52	65.2	0.71
Anxiety/mood	0.66	66.2	0.71
Sleep	0.60	64.0	0.70
Communication	0.43	67.6	0.72
Walking or moving around	0.52	65.7	0.71
Social role	0.60	66.5	0.71
Personal care	0.52	70.1	0.72
Other activities of daily living	0.39	68.9	0.72
Additional symptoms	0.59	49.3	0.69
General Health	−0.25	78.9	0.87
**Cronbach's alpha for 17 items=0.74.*			
Breathlessness	0.52	71.8	0.86
Cough/throat sensitivity/voice change	0.56	71.3	0.86
Fatigue	0.44	70.96	0.86
Smell/taste	0.42	73.0	0.86
Pain/discomfort	0.66	71.0	0.86
Cognition	0.59	72.1	0.86
Palpitations/dizziness	0.49	72.4	0.86
Post-exertional malaise (worsening of symptoms)	0.58	68.7	0.86
Anxiety/mood	0.68	70.4	0.85
Sleep	0.66	67.4	0.85
Communication	0.42	72.3	0.86
Walking or moving around	0.59	69.1	0.86
Social role	0.58	71.0	0.86
Personal care	0.55	74.3	0.86
Other activities of daily living	0.50	72.0	0.86
Additional symptoms	0.63	52.0	0.88
**Cronbach's alpha for 17 items = 0.87.*			
Breathlessness	0.52	71.8	0.86
Cough/throat sensitivity/voice change	0.56	71.3	0.86
Fatigue	0.44	70.9	0.86
Smell/taste	0.42	73.0	0.86
Pain/discomfort	0.66	71.0	0.86
Cognition	0.59	72.2	0.86
Palpitations/dizziness	0.49	72.4	0.86
Post-exertional malaise (worsening of symptoms)	0.58	68.7	0.86
Anxiety/mood	0.68	70.4	0.85
Sleep	0.66	67.4	0.85
Communication	0.42	72.3	0.86
Walking or moving around	0.59	69.1	0.86
Social role	0.58	71.0	0.86
Personal care	0.55	74.3	0.86
Other activities of daily living	0.50	72.0	0.86
**Cronbach's alpha for 15 items = 0.88.*			

Item Analyzes

Based on the item analysis, it has been found that Cronbach's alpha value for the entire scale was 0.74. It was observed to increase to 0.87 (item-total correlation coefficient=−0.25 for the General Health subdimension) and 0.88 (item-total correlation coefficient=0.63 for the Additional Symptoms subdimension), respectively, after the General Health and Additional Symptoms subdimensions were removed. Therefore, these two dimensions were excluded from the Turkish adaptation as they produced inconsistent results with the full scale. Item analysis results of the questionnaire are summarized in Table 2.

Validity Analysis

The EFA results showed that the sample was adequate (KMO statistic of sampling adequacy=0.92, which is above the widely accepted threshold of 0.7), that the items of the scale were related with respect to Bartlett's test for sphericity (χ^2=1554.8, df=105; p<0.001) and that the dataset is compatible with factor analysis (determinant<0.00001).

The original scale structure was confirmed with the current data set, as suggested by the CFA. The model fit indices showed a reasonable level of agreement (maximum likelihood ratio χ^2=267.2 (p<0.001), NFI=0.88, GFI=0.85, RFI=0.80, IFI=0.88, CFI=0.88, RMSEA=0.10, RMR=0.04). The error variances could be considered tolerable, as they ranged from 0.19 to 1.45 for symptom severity, while they ranged from 0.19 to 0.36 for functional ability subdimensions. The path diagram for CFA is shown in Figure 2. The EFA and CFA results confirmed that construct validity was met for the Turkish adaptation.

Criterion Validity Assessment

Validated versions of the DASS-21 and SF36 scales were used to assess criterion validity. The coefficients ranged

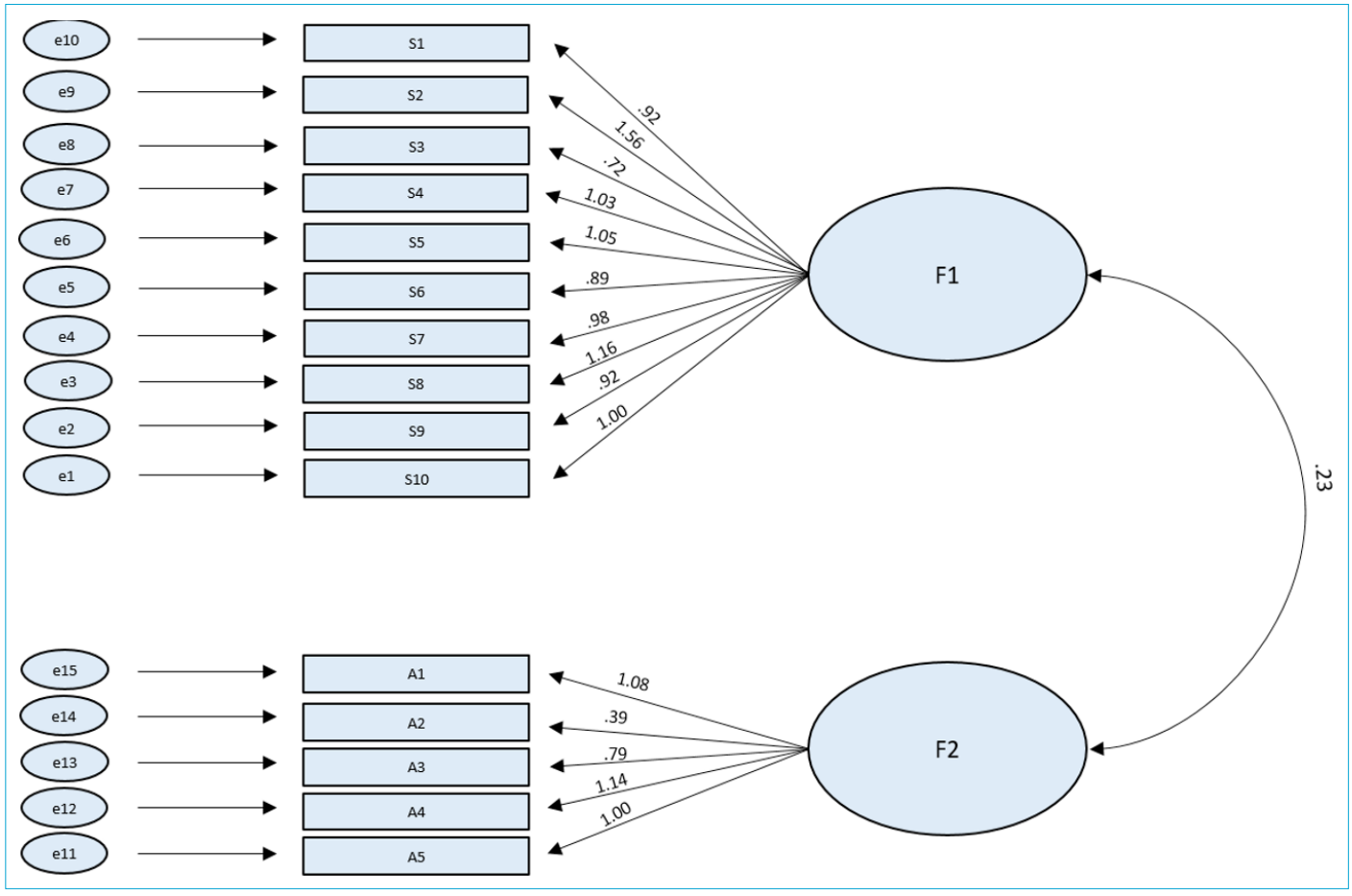

Figure 2. Path diagram for confirmatory factor analysis. A: Abilities (respectively)=Communication, walking or moving around, personal care, other daily activities, social role, e: Residual covariance matrix; F1: Symptom severity; F2: Functional ability; S: Symptoms (respectively)=Breathlessness, cough/throat sensitivity/voice change, smell/taste, pain/discomfort, cognition, palpitations/dizziness, post-exertional malaise (worsening of symptoms), fatigue (tiredness not improved by rest), anxiety/mood, sleep.

from −0.22 to 0.57, indicating moderate relationships among the subdimensions and demonstrating the criterion validity of the adaptation. Correlation coefficients for concurrent validity of the questionnaire are summarized in Table 3.

Reliability Analysis

The Guttman split-half coefficients obtained by the split-half method were 0.90, 0.83, and 0.88 for symptom severity, functional ability, and total scale, respectively. On the other hand, Cronbach's alpha and ICC coefficients of 0.89, 0.83, 0.92, 0.88, 0.81, and 0.90, respectively, were obtained for these subdimensions and the total scale. The high coefficients indicate that the responses are consistent (for ICC) and the adapted scale is reliable. The reliability analyses of the questionnaire are summarized in Table 4.

The dependent measure analysis revealed that participants scored significantly higher on all items, sub-dimensions, and total values compared to their pre-COVID status ($p<0.001$).

DISCUSSION

This study was conducted to determine the validity and reliability of C19-YRSm in Turkish. After assessing language adaptation and content validity, EFA and CFA were used to determine construct validity. Bartlett's test demonstrated the factorable structure of the data set.[20] In addition, the KMO statistic of 0.96 proved the adequacy of the sample size for factor analysis.[21] The EFA results that the total variance explained by the 2-factor solution is 56% supports the literature that states that the total variance accounted for by the model should be at least 50%.[22]

The model fit indices from the CFA results indicate acceptable model fit to the dataset, as they were found as <0.9; they are 0.88, 0.85, 0.803, 0.88, and 0.88 for NFI, GFI, RFI, IFI, and CFI respectively.[23-25] In addition, the RMSEA and RMR values were on the borderline of acceptable model fit. Overall, the model fit indices showed a good level of model fit for the dataset of interest. In addition, the psychometric analysis showed that the Turkish adaptation has a good to excellent level of reliability as the Cronbach alpha values ranged from 0.83 to 0.92.[26] and the ICC values ranged from 0.81 to 0.90.[27]

Table 3. Correlation coefficients for concurrent validity of the questionnaire

	Symptom severity	Functional ability	p
Physical functioning	−0.50	−0.36	<0.001
Role limitations due to physical problems	−0.36	−0.27	<0.001
Role limitations due to emotional problems	−0.31	−0.29	<0.001
Vitality	−0.33	−0.22	<0.001
Mental health	−0.27	−0.31	<0.001
Social functioning	−0.38	−0.26	<0.001
Bodily pain	−0.39	−0.27	<0.001
General health perceptions	−0.44	−0.43	<0.001
SF36 total score	−0.54	−0.43	<0.001
Depression	0.48	0.43	<0.001
Anxiety	0.52	0.49	<0.001
Stress	0.57	0.52	<0.001

SF-36: Short Form 36 Health Survey.

Table 4. The reliability analyses of the questionnaire

	Cronbach alpha	ICC	Guttman split-half coefficient*
Total scale	0.92	0.90	0.88
Symptom severity	0.89	0.88	0.90
Functional ability	0.83	0.81	0.83

ICC: Intraclass correlation coefficients. *Odds versus Even.

To the best of our knowledge, this is the first study to develop the validity and reliability of the Turkish version of the C19-YRSm. The psychometric properties of the original C19- YRS revealed high internal consistency (Cronbach's alpha=0.89) and acceptable levels of reliability (0.79 for symptom severity, 0.79 for functional disability, and 0.70 for additional symptoms).[10] In addition, the symptom severity and functional ability subscales of the C19-YRSm had good target accuracy and reliability.[11]

A limitation of this study is that we could not increase the sample size due to low patient admissions in the post-COVID outpatient clinic. Another limitation is that a valid Turkish scale for comparison with the C19-YRSm was not available. DASS 21 and SF-36 were used to assess criterion validity.

CONCLUSION

The current study shows that the Turkish version of the modified C19-YRSm has 2 subdimensions, symptom severity, and functional ability, and it can be used as a valid and reliable scale for the evaluation of patients with PCS in the Turks population. It is anticipated that the validity and reliability of the scale will be supported by future studies using this scale.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: Authors declared that no conflict of interest.

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Ethics Committee Approval: This study received approval from the Ethics Committee of Kırsehir Ahi Evran University for Non-interventional Research for Non-interventional Research (Approval date: November 11, 2022, Approval number: 2022-20/175). Permission was obtained from the Ministry of Health of the Republic of Turkey for the study (2022-03-21T16_06_08). Before beginning the study, the participants were properly informed and asked to provide written consent.

Authorship Contributions: Concept – N.Ç.; Design – M.D., N.Ç.; Supervision – M.D., N.M.K.; Materials – N.Ç.; Data collection and/or processing – M.D.; Analysis and/or interpretation – N.M.K.; Literature search – N.Ç.; Writing – M.D., N.Ç.; Critical review – M.D., N.Ç.

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