NCT
Neumología y Cirugía de Tórax

Check for updates

ORIGINAL ARTICLE

Design and validation of the Questionnaire for the Evaluation of Post-COVID-19 Respiratory Symptoms (CESRPC)

Diseño y validación del Cuestionario para Evaluación de Síntomas Respiratorios Post-COVID-19 (CESRPC)

*Ana K. Centeno-Cortez, Diego Yepez-Quiroz, and Reyna G. Martínez-Tapia**

Escuela Nacional de Estudios Superiores, Unidad León, Universidad Nacional Autónoma de México, León, Guanajuato, Mexico

Abstract

Introduction: *Currently, COVID-19 cases continue to emerge, so long COVID continues to pose a risk and challenge to the global public health system. Therefore, it is important to provide healthcare professionals with a valid and reliable tool to identify and assess respiratory sequelae of COVID-19.* **Objective:** *To design and determine the validity of a questionnaire for the assessment of persistent respiratory symptoms in patients with long COVID.* **Method:** *A validation study was conducted. A questionnaire was designed based on a literature search on persistent respiratory symptoms due to long COVID treatable with respiratory physiotherapy. The instrument was subjected to content validity testing using the modified Lawshe model. A pilot test was conducted with 65 participants. Data were analyzed using exploratory factor analysis. Convergent validity was determined, as well as reliability for each dimension and the entire instrument.* **Results:** *Content validity ratio greater than 0.58 for the 13 items, content validity index of 0.64. In the exploratory factor analysis, the 13 items were grouped into three dimensions. Dimension one (six items, $\alpha = 0.88$), two (three items, $\alpha = 0.62$), and three (four items, $\alpha = 0.79$); the entire instrument ($\alpha = 0.89$); (rs > 0.30) between all items, except between two items (correlation of rs = 0.17).* **Conclusions:** *The psychometric properties suggest that it is a valid and reliable questionnaire that is useful for identifying and assessing persistent respiratory symptoms and functional limitation in patients with LC.*

Keywords: *Long COVID. Respiratory physiotherapy. Questionnaire.*

Resumen

Introducción: *Actualmente los casos de COVID-19 continúan apareciendo, por lo que el COVID prolongado todavía representa un riesgo y un desafío para el sistema de salud pública mundial. En consecuencia, es importante brindar a los profesionales de la salud una herramienta válida y confiable para identificar y evaluar secuelas respiratorias por COVID-19.* **Objetivo:** *Diseñar y determinar la validez de un cuestionario para la evaluación de síntomas respiratorios persistentes en pacientes con COVID prolongado.* **Método:** *Se realizó un estudio de validación. El cuestionario se diseñó a partir de una búsqueda bibliográfica sobre síntomas respiratorios persistentes por COVID prolongado tratables en fisioterapia respiratoria. La validez de contenido se realizó mediante el modelo de Lawshe modificado. La prueba piloto se realizó con 65 participantes. Los datos se analizaron con un análisis factorial exploratorio. Se determinó la validez convergente y la confiabilidad para cada dimensión y todo el instrumento.* **Resultados:** *Razón de validez de contenido mayor que 0.58 para los 13 ítems, índice de validez de contenido de 0.64. En el análisis factorial exploratorio los 13 ítems se agruparon en tres dimensiones. Dimensión uno*

***Correspondence:**
Reyna G. Martínez-Tapia
E-mail: rg.martineztapia@gmail.com

Date of reception: 21-08-2025
Date of acceptance: 28-11-2025
DOI: 10.24875/NCTE.M25000038

Available online: 17-11-2026
Neumol Cir Torax (Eng). 2025;84(3):182-194
www.revistanct.org.mx

2594-1526 / © 2025 Sociedad Mexicana de Neumología y Cirugía de Tórax. Publicado por Permanyer. Este es un artículo open access bajo la licencia CC BY-NC-ND (http://creativecommons.org/licenses/by-nc-nd/4.0/).

(seis ítems, α = 0.88), dos (tres ítems, α = 0.62) y tres (cuatro ítems α = 0.79); todo el instrumento (α = 0.89); (rs > 0.30) entre todos los ítems, excepto entre dos ítems (correlación de rs = 0.17). **Conclusiones:** *Las propiedades psicométricas sugieren que es un cuestionario válido y confiable, que es de utilidad para identificar y evaluar síntomas respiratorios persistentes y la limitación funcional en pacientes con COVID prolongado.*

Palabras clave: *COVID prolongado. Fisioterapia respiratoria. Cuestionario.*

Introduction

Global estimates indicate that 6 of every 100 people who have had COVID-19 may develop post-COVID-19 condition.[1] According to the World Health Organization (WHO), although the likelihood of developing this condition was higher at the beginning of the pandemic, COVID-19 cases continue to occur; therefore, long COVID (LC) still represents a risk and a challenge for the global public health system.[2]

Patients who recover from acute COVID-19 may face a new condition known as LC or post-COVID-19 condition, which consists of symptoms persisting for more than 12 weeks after the onset of COVID-19.[3,4] These symptoms cannot be explained by an alternative diagnosis, are highly variable, may be continuously present or recur over time, and new symptoms may also develop, making this condition difficult to identify both for healthcare professionals and for affected individuals.[4,5] The most prevalent symptoms are fatigue, dyspnea, cough, chest tightness, postexertional malaise, and sleep disturbances.[6-8]

Respiratory physiotherapy has been recommended because evidence supports its benefits in patients with chronic respiratory diseases. Individualized treatment plans are aimed at reducing respiratory symptoms and improving exercise tolerance, functional capacity, and quality of life.[9]

Despite strong evidence supporting the benefits of respiratory physiotherapy, referral rates for rehabilitation remain low.[9] Factors preventing patients with LC from attending physiotherapy include limited awareness of its benefits and the absence of a formal diagnosis of LC.[9,10]

Several instruments have currently been developed, including the COVID-19 Yorkshire Rehabilitation Scale (C19-YRS), the LC Symptom Tool and Impact Tool (ST and IT), the Post-COVID-19 Functional Status Scale for adult COVID-19 survivors (Spanish version adapted for Chile by Lorca et al.), LONG COVID-CMAT, and LC-SSS. These instruments assess certain LC symptoms and/or their impact on patients' lives and have acceptable psychometric properties, establishing a precedent for the validity of this type of tool in assessing LC symptomatology. However, a tool specifically designed to assess persistent respiratory symptoms and their impact on patients' lives is needed because respiratory manifestations of LC are treatable with respiratory physiotherapy and are among the most prevalent symptoms in the LC population.

The purpose of this study was to design a questionnaire to assess persistent respiratory symptoms amenable to respiratory physiotherapy and functional limitations in individuals with LC. Validity was assessed through content validation by expert consensus using the modified Lawshe model, as well as convergent validity by establishing correlations using Spearman correlation coefficients (rs) in SPSS statistical software. Reliability was assessed by internal consistency.

The study aimed to develop a valid and reliable tool that is concise and clinically useful for healthcare professionals to identify symptoms, facilitate diagnosis, and guide respiratory physiotherapy treatment in individuals affected by LC.

Methods

We conducted a validation study. First, the questionnaire was designed based on a literature review. It was then validated through expert consensus for content validation, pilot testing, and convergent validation. Finally, reliability was assessed (Fig. 1).

To design the questionnaire, a literature review was conducted to identify persistent respiratory symptoms associated with LC that could be treated with respiratory physiotherapy. English- and Spanish-language articles published between January 2020 and November 2022 were searched in PubMed, Google Scholar, SciELO, and Elsevier using the following keywords in English and Spanish: "respiratory symptoms AND long COVID," "respiratory symptoms AND physiotherapy," "physiotherapy AND long COVID," "persistent symptoms AND COVID-19," "persistent COVID," "long COVID," and "post-COVID-19 symptoms." Based on the literature, the first version of the questionnaire was created with

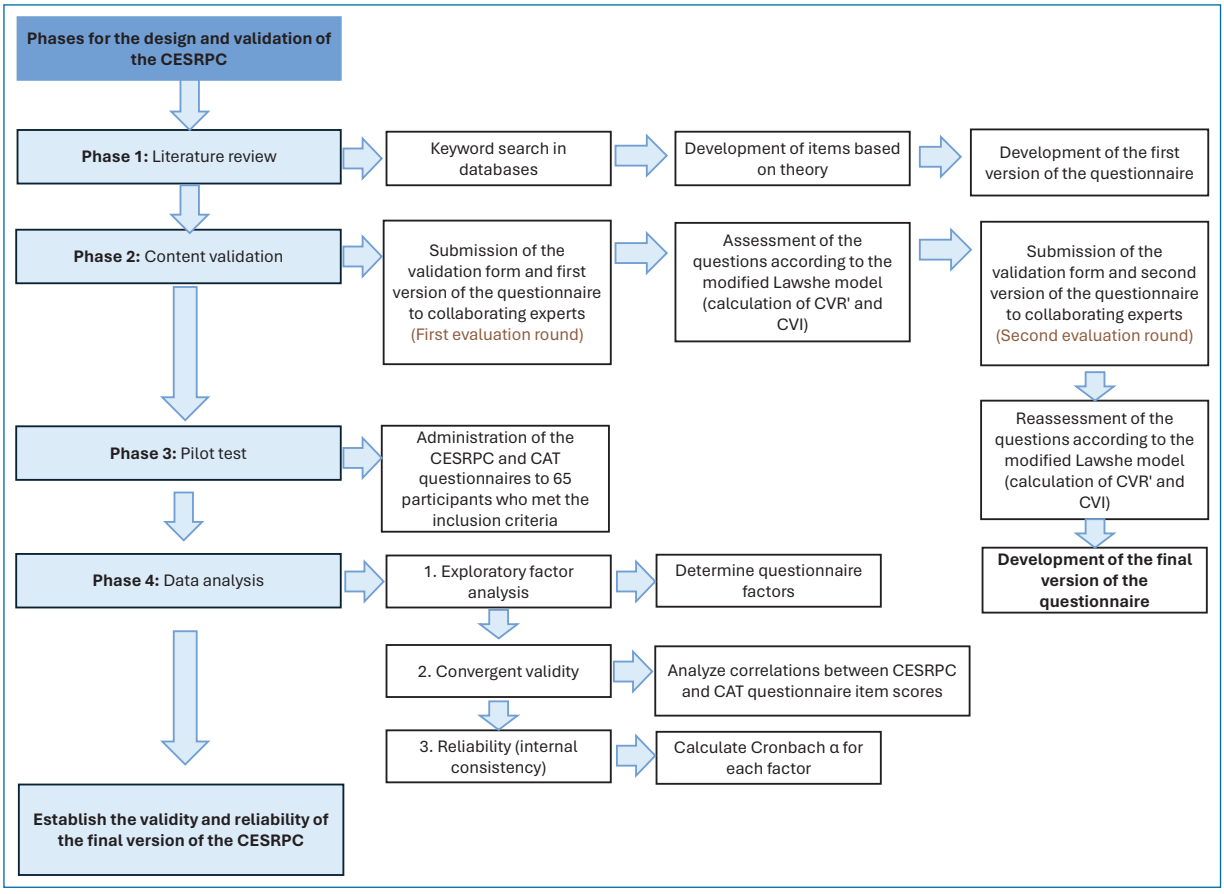

Figure 1. Flow diagram for the design and validation of the CESRPC questionnaire. CAT: COPD assessment test; CESRPC: Post-COVID-19 Respiratory Symptoms Assessment Questionnaire; CVI: content validity index; CVR: content validity ratio.

19 items designed to explore the presence of symptoms (dyspnea, dry cough, chest tightness, sputum production, fatigue, and headache) and the impact on quality of life, sleep quality, and exercise tolerance during activities of daily living. Four response options were provided on a frequency-based Likert scale for the periods before COVID-19 and after COVID-19 (previous 30 days) (Table 1).

The questionnaire validation process was subsequently initiated. First, content validity was assessed using the modified Lawshe model. For this purpose, 23 pulmonologists and internal medicine physicians were contacted by email with a letter requesting their participation. The response rate was 43% (8 pulmonologists, 1 internal medicine physician, and 1 physician specialized in both pulmonology and internal medicine). The participating experts were then sent the Post-COVID-19 Respiratory Symptoms Assessment Questionnaire (CESRPC) and the content validation form (Table 2). Once the experts had completed their evaluation of the items, the number of experts rating each question as "essential" was counted and the content validity ratio (CVR), defined by the expression shown in figure 2, was calculated. Questions with a CVR ≥ 0.58 were included in the questionnaire because 0.58 is the minimum CVR established by the modified Lawshe model for retaining an item.[11] Questions with a CVR < 0.58 were reviewed and either eliminated or modified according to expert comments. Furthermore, the content validity index (CVI) was determined by calculating the mean CVR of all items. The set of items was considered acceptable if the CVI was > 0.58.[11,12] The CVI of the acceptable items was also calculated as the mean CVR of items with a CVR ≥ 0.58 and was considered acceptable if it was > 0.58.[11,12] The content validation form and the revised questionnaire were then resent to the experts, and the same procedure was repeated to obtain the final version of the CESRPC (Table 3).

After completion of content validation, a pilot test was conducted over 3 weeks in April 2024. The CESRPC

Table 1. First version of the questionnaire

Instructions

– Identify how frequently the symptom occurred before you had COVID-19 and enter the corresponding number in the first column.
– Identify how frequently you experienced the symptom during the previous 30 days and enter the corresponding number in the second column.

Response scale:

NEVER (0 times/week)	ALMOST NEVER (once/week)	SOMETIMES (2-3 times/week)	ALMOST ALWAYS (4-5 times/week)	ALWAYS (6-7 times/week)
0	1	2	3	4
a) Dyspnea – Do you feel short of breath…?			Before COVID-19	During the previous 30 days (post-COVID-19)
1. When lying in bed				
2. When at rest				
3. When performing physical activity such as walking or running				
b) Fatigue			Before COVID-19	During the previous 30 days (post-COVID-19)
4. Do you feel tired while at rest?				
5. Do you feel unable to perform your usual daily activities even without having previously exerted yourself physically?				
6. Do you feel intense fatigue immediately after low-intensity physical exertion, such as walking 1 block?				
c) Cough			Before COVID-19	During the previous 30 days (post-COVID-19)
7. Do you have a persistent cough?				
d) Secretions			Before COVID-19	During the previous 30 days (post-COVID-19)
8. Do you expectorate secretions during the day?				
9. Do you experience nasal congestion?				
e) Chest tightness			Before COVID-19	During the previous 30 days (post-COVID-19)
10. Do you experience chest pain during physical exertion?				
11. Do you experience chest pain while at rest?				
12. Do you experience chest pain that worsens when breathing, coughing, or changing position?				
f) Headache			Before COVID-19	During the previous 30 days (post-COVID-19)
13. Do you have a headache upon waking?				
g) Exercise tolerance			Before COVID-19	During the previous 30 days (post-COVID-19)
14. During physical exertion, do you have to stop the activity because of fatigue and/or shortness of breath?				
h) Sleep quality				
15. Do you have difficulty falling asleep?				
16. Does your breathing stop abruptly and restart several times while you are asleep?				
17. Upon waking, do you feel tired even after sleeping through the night?				
i) Quality of life			Before COVID-19	During the previous 30 days (post-COVID-19)
18. Do you have difficulty performing activities of daily living?				
19. Do you need another person's help to perform activities of daily living?				

Table 2. Content validation form

Question number	Instructions: Based on your opinion, review each question in the attached questionnaire and indicate whether you consider the question essential (necessary), useful but not essential, or not essential (unnecessary) for identifying persistent respiratory symptoms due to long COVID. Select your chosen option by marking an "X" inside the corresponding parentheses.			Comments: Please indicate whether an item/question should be deleted or modified and explain the reason.
1.	a) Essential ( )	b) Useful but not essential ( )	c) Not essential ( )	

$$CVR' = \frac{ne}{N}$$

ne = number of panelists who agree on the "essential" category

N = total number of panelists

Figure 2. Expression for the content validity ratio (*adapted from Tristán-López*[11]).

and the COPD Assessment Test (CAT), required for the evaluation of convergent validity, were administered to 65 randomly selected individuals attending the *Escuela Nacional de Estudios Superiores, Unidad León, Universidad Nacional Autónoma de México (ENES León, UNAM)*. Participants were residents of León, Guanajuato, aged > 18 years, and verbally confirmed a history of COVID-19 diagnosed by testing or by a physician at least 3 months earlier. Participants with a past medical history of chronic respiratory disease or difficulty understanding and/or following instructions were excluded. The pilot test was conducted by the principal investigator and 3 social service students from the Physiotherapy Clinic of the *ENES León, UNAM*, who were trained to administer the questionnaires. Participants were asked to voluntarily sign an informed consent form, which included a section allowing them to withdraw participation if they chose to do so. They were informed that their data would be protected and used exclusively for research purposes. Instructions for completing the questionnaires and a form for collecting demographic data and information regarding their severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection were also provided. Each participant completed both questionnaires independently or, if preferred, the interviewer administered the questionnaire and assisted in recording the responses.

Sample size was determined according to recommendations in the literature, which suggest including between 5 and 10 participants per questionnaire item.[13] Therefore, 5 individuals were included for each item in the final version of the questionnaire (13 items), resulting in a sample size of 65 participants.

After completion of the pilot test, a Microsoft Excel database was created containing the responses of the 65 participants to each CESRPC item. An exploratory factor analysis (EFA) was performed to identify the factors (dimensions) into which the questionnaire items clustered. For the EFA, the response database was analyzed in SPSS statistical software using principal component analysis with Oblimin rotation.

Convergent validity of the CESRPC was subsequently assessed. The CAT was selected because it is a validated questionnaire that evaluates constructs shared with the CESRPC, that is, the questionnaires assess identical or similar symptoms and limitations in daily life. Data from the CESRPC and CAT pilot testing were analyzed using SPSS statistical software to establish correlations using the Spearman correlation coefficient, which is appropriate for analysis of correlations involving ordinal data, between each item grouped within the CESRPC dimensions and the 8 CAT items.

High positive correlations > 0.30 (rs > 0.30) between CESRPC items and CAT items assessing identical or

Table 3. Final version of the questionnaire

Respondent's name: Interviewer's name: Signature:				
Post-COVID-19 Respiratory Symptoms Assessment Questionnaire (CESRPC) Instructions: – Identify how frequently the symptom occurred before you had COVID-19 and enter the corresponding number in the first column. – Identify how frequently you experienced the symptom during the previous 30 days and enter the corresponding number in the second column.				
NEVER (0 times/week)	**ALMOST NEVER (once/week)**	**SOMETIMES (2-3 times/week)**	**ALMOST ALWAYS (4-5 times/week)**	**ALWAYS (6-7 times/week)**
0	1	2	3	4
EXAMPLE:				
			Before COVID-19	During the previous 30 days (post-COVID-19)
1. Do you feel tired while at rest?			2	4
			Before COVID-19	During the previous 30 days (post-COVID-19)
2. Do you feel short of breath while performing activities such as talking, eating, bathing, or dressing?				
3. Do you cough up phlegm during the day?				
4. Do you have a persistent cough?				
5. Do you feel short of breath while at rest (lying down or sitting)?				
6. Do you feel severe fatigue after low-intensity physical exertion, such as walking 1 block?				
7. Do you feel short of breath during physical exercise, for example, running?				
8. Are you dissatisfied with your ability to perform activities of daily living, such as cooking, cleaning, maintaining personal hygiene, shopping, working, exercising, or meeting friends?				
9. Do you experience chest tightness or chest pain that worsens with physical exertion?				
10. Do you feel that your physical health prevents you from carrying out your activities of daily living normally?				
11. Do you feel short of breath when walking?				
12. During physical exertion, do you have to stop the activity because of fatigue and/or shortness of breath?				
13. Do you have difficulty falling asleep?				

CESRPC: Post-COVID-19 Respiratory Symptoms Assessment Questionnaire.

similar constructs were considered evidence of convergent validity.

Moreover, reliability was assessed through internal consistency, calculated using Cronbach α. The CESRPC pilot-test response database was analyzed in SPSS, and Cronbach α was calculated for each factor identified in the EFA.

The minimum acceptable value for Cronbach α in this study was 0.70, following the interpretation proposed by Oviedo and Campo.[14] All data were analyzed using IBM SPSS Statistics version 29.0.2.0.

This study was evaluated and approved by the Research Ethics Commission and Research Committee of the *ENES León, UNAM*.

Table 4. Results of the first round of evaluation according to the modified Lawshe model. Total number of experts, n = 10

Category	No.	Item	Number of experts who selected the option:			CVR	Acceptable	CVI
			Essential	Useful but not essential	Not essential			
a) Dyspnoea	1	Do you feel short of breath when lying down in bed?	5	5	0	0.5		CVI of acceptable items: 0.79
	2	Do you feel short of breath while at rest?	8	2	0	0.8	X	
	3	Do you feel short of breath when performing physical activity such as walking or running?	10	0	0	1	X	
b) Fatigue	4	Do you feel tired while at rest?	8	2	0	0.8	X	
	5	Do you feel unable to perform your daily activities without having performed any prior physical exertion?	9	1	0	0.9	X	
	6	Do you feel intense fatigue immediately after performing low-intensity physical exertion (such as walking one block)?	9	1	0	0.9	X	
c) Cough	7	Do you have a persistent cough?	8	2	0	0.8	X	
d) Secretions	8	Do you expel secretions during the day?	5	4	1	0.5		
	9	Do you feel nasal congestion?	3	2	5	0.3		
e) Chest tightness	10	Do you feel chest pain when performing physical exertion?	6	4	0	0.6	X	
	11	Do you feel chest pain while at rest?	6	4	0	0.6	X	CVI of all items: 0.70
	12	Do you feel chest pain that worsens when breathing, coughing, or changing position?	5	5	0	0.5		
f) Headache	13	Do you have a headache upon waking?	6	2	2	0.6	X	
g) Exercise tolerance	14	When performing physical exertion, do you have to stop the activity due to fatigue and/or shortness of breath?	9	1	0	0.9	X	
h) Sleep quality	15	Do you have difficulty falling asleep?	8	2	0	0.8	X	
	16	Does your breathing abruptly stop and restart several times while you sleep?	5	4	1	0.5		
	17	Upon waking, do you feel tired even after sleeping through the night?	7	3	0	0.7	X	
i) Quality of life	18	Do you have difficulty performing your activities of daily living?	10	0	0	1	X	
	19	Do you need help from another person to perform your activities of daily living?	6	4	0	0.6	X	
			Total CVR of all items			13.3	Total = 14	
			Total CVR of acceptable items			11		

CVI: content validity index; CVR: content validity ratio.

Table 5. Results of the second round of evaluation according to the modified Lawshe model

Category	N.º	Item	Number of experts who selected the option			Content validity ratio (CVR)	Acceptable	CVI
			Essential	Useful but not essential	Not essential			
a) Dyspnoea	1	Do you feel short of breath while at rest (lying down or sitting)?	10	0	0	1	X	CVI of acceptable items = 0.75
	2	Do you feel short of breath when performing activities such as talking, eating, bathing, or dressing?	9	1	0	0.9	X	
	3	Do you feel short of breath when walking?	8	2	0	0.8	X	
	4	Do you feel short of breath when performing physical exercise (e.g., running)?	8	1	1	0.8	X	
b) Fatigue	5	Do you feel tired while at rest?	6	2	2	0.6	X	
	6	Do you feel unable to perform your daily activities without having performed any prior physical exertion?	5	5	0	0.5		
	7	Do you feel intense fatigue after performing low-intensity physical exertion (such as walking one block)?	8	2	0	0.8	X	
c) Cough	8	Do you have a persistent cough?	7	2	1	0.7	X	
d) Secretions	9	Do you expel phlegm when coughing during the day?	6	3	1	0.6	X	
e) Chest tightness	10	Do you feel chest tightness or pain that worsens during physical exertion?	7	1	2	0.7	X	
	11	Do you feel chest tightness or pain while at rest?	3	5	2	0.3		
	12	Do you feel chest tightness or pain that worsens when breathing, coughing, or changing position?	5	4	1	0.5		
f) Headache	13	Do you have a headache upon waking?	3	4	3	0.3	X	CVI of all items
g) Exercise tolerance	14	When performing physical exertion, do you have to stop the activity due to fatigue and/or shortness of breath?	8	2	0	0.8	X	
h) Sleep quality	15	Do you have difficulty falling asleep?	8	1	1	0.8	X	
	16	Has anyone noticed that you stop breathing while you sleep?	4	5	1	0.4		
	17	Upon waking, do you feel tired even after sleeping through the night?	4	5	1	0.4		
i) Quality of life	18	Do you consider that your physical health prevents you from carrying out your activities of daily living normally?	7	2	1	0.7	X	
	19	Are you dissatisfied with your ability to perform your activities of daily living (e.g., cooking, cleaning, attending to personal hygiene, shopping, working, exercising, or meeting with friends)?	6	3	1	0.6	X	
			Total CVR' of all items			12.2	Total = 13	
			Total CVR' of acceptable items			9.8		

CVI: content validity index; CVR: content validity ratio.

Table 6. Total variance explained

Component	Initial eigenvalues	% of variance	Cumulative %	Extraction sums of squared loadings	% of variance	Cumulative %	Rotation sums of squared loadings
	Total			Total			Total
1	5.984	46.032	46.032	5.984	46.032	46.032	5.313
2	1.329	10.221	56.252	1.329	10.221	56.252	2.319
3	1.231	9.470	65.723	1.231	9.470	65.723	3.667
4	0.839	6.453	72.175				
5	0.729	5.606	77.781				
6	0.674	5.187	82.968				
7	0.594	4.571	87.539				
8	0.426	3.274	90.814				
9	0.332	2.553	93.366				
10	0.299	2.303	95.669				
11	0.223	1.714	97.383				
12	0.191	1.469	98.852				
13	0.149	1.148	100.000				

Extraction method: principal component analysis.
When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Results

Content validity

The results of the first round of expert evaluation are shown in table 4.

Items 1, 8, 9, 12, and 16 obtained a CVR < 0.58 and were therefore modified or eliminated according to expert comments.

Items 2, 3, 4, 5, 6, 7, 10, 11, 13, 14, 15, 17, 18, and 19 had a CVR > 0.58 and therefore remained in the questionnaire according to the modified Lawshe model.

The CVI for all items was 0.70, and the CVI for acceptable items was 0.79 in the first evaluation round.

The results of the second round of expert evaluation are shown in table 5.

Items 6, 11, 12, 13, 16, and 17 obtained a CVR < 0.58 in the second evaluation round. The experts indicated that some of these items were unclear or suggested their removal. Given their low CVR values and expert comments, these items were eliminated.

Items 1, 2, 3, 4, 5, 7, 8, 9, 10, 14, 15, 18, and 19 obtained CVR values > 0.58 and therefore remained part of the questionnaire item bank.

The CVI for all items was 0.64, and the CVI for acceptable items was 0.75. Both CVI values were > 0.58; therefore, the set of questionnaire items was considered acceptable in the second evaluation round.

Exploratory factor analysis

The Kaiser-Meyer-Olkin measure was 0.84, and the results of Bartlett's test of sphericity (χ^2 = 432.309; p < 0,001) indicated that the data matrix was suitable for factor analysis.

Factors with eigenvalues > 1 were retained. The total variance explained table (Table 6) showed 3 latent factors with eigenvalues > 1. These 3 factors explained 65.72% of the common variance.

The variables were grouped into 3 dimensions (factors), all with factor loadings > 0.30 (Table 7).

The following dimensions were identified: dimension 1, symptoms related to physical activity; dimension 2, symptoms related to sleep quality; and dimension 3, symptoms related to quality of life (Table 8).

Table 9 illustrates the correlations among the factors (components) extracted in the principal component analysis.

Convergent validity

Correlations between items within the CESRPC dimensions and CAT items are shown in table 10.

Correlations > 0.30 (rs > 0.30) were found between all CESRPC items and CAT items assessing identical or similar constructs, except between CESRPC item 10 and CAT item 6, both of which assess quality of life, for which the correlation was rs = 0.17.

Table 7. Pattern matrix from principal component analysis and communalities

Items	Component or factor			Communality
	1	2	3	
1. Do you feel tired while at rest?			0.442	0.413
2. Do you feel short of breath while performing activities such as talking, eating, bathing, or dressing?	0.768			0.595
3. Do you cough up phlegm during the day?		0.898		0.742
4. Do you have a persistent cough?	0.504	0.569		0.675
5. Do you feel short of breath while at rest (lying down or sitting)?			0.699	0.705
6. Do you feel severe fatigue after low-intensity physical exertion, such as walking 1 block?	0.846			0.716
7. Do you feel short of breath during physical exercise, for example, running?	0.820			0.658
8. Are you dissatisfied with your ability to perform activities of daily living, such as cooking, cleaning, maintaining personal hygiene, shopping, working, exercising, or meeting friends?			0.950	0.774
9. Do you experience chest tightness or chest pain that worsens with physical exertion?	0.608			0.597
10. Do you feel that your physical health prevents you from carrying out your activities of daily living normally?	0.318		0.666	0.773
11. Do you feel short of breath when walking?	0.890			0.795
12. During physical exertion, do you have to stop the activity because of fatigue and/or shortness of breath?	0.578			0.573
13. Do you have difficulty falling asleep?		0.602		0.527

– The pattern matrix is shown with the number of factors extracted.
– Items are shown in rows with their corresponding factor loading for each factor.
– Communalities after extraction are shown in the last column.

Reliability (internal consistency)

Table 8 illustrates Cronbach α for each factor and for the overall instrument in this study population, as well as the degree of reliability according to the interpretation proposed by Oviedo and Campo.[14]

Discussion

The set of 13 items obtained a CVI of 0.64 in the second evaluation round and was reviewed and approved by most experts participating in the content validation process, providing evidence of content validity.

The dimensions identified in the EFA indicate that certain respiratory symptoms associated with LC are more closely related to impairment in exercise tolerance, sleep quality, or quality of life in this study population. If the questionnaire were administered to a larger population, the correlations obtained in the EFA might identify different questionnaire dimensions.

CESRPC item 10 showed a correlation of rs = 0.17 with CAT item 6. Because both items are intended to assess respondents' quality of life, a stronger correlation (rs > 0.30) was expected. The questionnaire was administered to students, workers, professors, patients attending dentistry, optometry, or physiotherapy clinics, and relatives of patients at a university. This may explain the low correlation because, for this specific population, feeling safe when leaving home may not be related to limitations in activities of daily living.

Significant correlations (rs > 0.30) between CESRPC and CAT variables assessing constructs identical or similar to dyspnea, fatigue, cough, secretions, chest tightness/pain, exercise tolerance, sleep quality, and quality of life were considered evidence of convergent validity.

Reliability of the first factor (α = 0.88) and third factor (α = 0.79) was acceptable, indicating very good intercorrelation among the items and homogeneity within both factors. However, reliability of the second factor (α = 0.62) was low. This may be attributable to the small number of items grouped within the factor or to the response pattern of the study population.

Regarding the sample, 58.46% (n = 38) were women and 41.53% (n = 27) were men. Because more than half of the sample was female, the symptoms reported may have been influenced by sex because female sex

Table 8. Reliability of each factor and the overall instrument

Dimension (factor)	CESRPC items	Cronbach α	Reliability
Dimension 1: Symptoms related to physical activity	2. Do you feel short of breath while performing activities such as talking, eating, bathing, or dressing? 6. Do you feel severe fatigue after low-intensity physical exertion, such as walking 1 block? 7. Do you feel short of breath during physical exercise, for example, running? 9. Do you experience chest tightness or chest pain that worsens with physical exertion? 11. Do you feel short of breath when walking? 12. During physical exertion, do you have to stop the activity because of fatigue and/or shortness of breath?	α = 0.88	Acceptable
Dimension 2: Symptoms related to sleep quality	3. Do you cough up phlegm during the day? 4. Do you have a persistent cough? 13. Do you have difficulty falling asleep?	α = 0.62	Low
Dimension 3: Symptoms related to quality of life	1. Do you feel tired while at rest? 5. Do you feel short of breath while at rest (lying down or sitting)? 8. Are you dissatisfied with your ability to perform activities of daily living, such as cooking, cleaning, maintaining personal hygiene, shopping, working, exercising, or meeting friends? 10. Do you feel that your physical health prevents you from carrying out your activities of daily living normally?	α = 0.79	Acceptable
Overall instrument	-	α = 0.89	Acceptable

– The dimensions and the items grouped within each dimension are shown.
– Cronbach α and the degree of reliability of each dimension and the overall instrument are shown.

CESRPC: Post-COVID-19 Respiratory Symptoms Assessment Questionnaire.

Table 9. Correlations between factors

Matrix of component correlations			
Component (factor)	**1**	**2**	**3**
1	1.000	-	-
2	0.295	1.000	-
3	0.449	0.200	1.000

Component correlation matrix.
Factors 1, 2, and 3 are correlated with one another, indicating that the rotation method used was appropriate.
Extraction method: principal component analysis.
Rotation method: Oblimin with Kaiser normalization.

is associated with a higher risk of developing LC.[15] A total of 87.69% (n = 57) reported the onset or worsening of symptoms after COVID-19, but only 3.07% (n = 2) reported hospitalization or a need for supplemental oxygen because of COVID-19. This confirms that individuals with mild COVID-19 infection may also develop LC.[15,16]

This study has several key limitations. The sample size was relatively small. It would therefore be relevant to administer the questionnaire to a larger sample, analyze the data, and determine whether the variables cluster within the same factors and whether reliability remains consistent. In addition, the sample excluded individuals with chronic respiratory diseases and those with difficulty understanding and/or following instructions; therefore, the questionnaire should also be evaluated in these populations. During pilot testing, the questionnaire was self-administered by participants, although in some cases it was interviewer-administered, with assistance provided to record responses. Therefore, the scores may be subject to bias, and responses may have been influenced by the use of 2 different methods of questionnaire administration.[17,18] This study required verbal confirmation of a history of diagnosed COVID-19 for participation in the pilot test. However, verbal confirmation is insufficient to verify previous SARS-CoV-2 infection, and this may have introduced response bias.

The CESRPC has not been designed to replace tests or scales specifically developed and validated for the assessment of fatigue, dyspnea, cough, pain, physical activity and exercise, sleep quality, or quality of life. It is designed to help individuals with LC understand their symptoms and to help healthcare professionals identify and assess persistent respiratory symptoms, facilitate the diagnosis of LC, and provide appropriate respiratory physiotherapy treatment.

Table 10. Correlations between CESRPC items and CAT items. Spearman rho

Correlation of dimension 1 with CAT							
	CAT	Item 2	Item 6	Item 7	Item 9	Item 11	Item 12
Spearman rho	CAT 1 (Cough)	0.153	0.258	0.082	0.099	0.112	0.271
	CAT 2 (Secretions)	–0.027	0.146	0.061	0.092	0.154	0.321
	CAT 3 (Chest tightness)	0.496	0.413	0.564	0.635	0.563	0.527
	CAT 4 (Dyspnea)	0.407	0.337	0.551	0.389	0.518	0.515
	CAT 5 (Limitation)	0.086	0.288	0.218	0.265	0.326	0.403
	CAT 6 (Confidence)	0.120	0.259	0.254	0.332	0.310	0.373
	CAT 7 (Sleep quality)	0.043	0.316	0.268	0.288	0.259	0.319
	CAT 8 (Energy)	0.080	0.320	0.411	0.210	0.298	0.320
Correlation between dimension 2 and CAT							
	CAT	Item 3	Item 4	Item 13			
Spearman rho	CAT 1 (Cough)	0.602	0.560	0.241			
	CAT 2 (Secretions)	0.575	0.255	0.228			
	CAT 3 (Chest tightness)	0.144	0.237	0.283			
	CAT 4 (Dyspnea)	0.128	0.147	0.263			
	CAT 5 (Limitation)	0.296	0.204	0.257			
	CAT 6 (Confidence)	0.140	0.194	0.100			
	CAT 7 (Sleep quality)	0.253	0.248	0.770			
	CAT 8 (Energy)	0.001	0.162	0.360			
Correlation between dimension 3 and CAT							
	CAT	Item 1	Item 5	Item 8	Item 10		
Spearman rho	CAT 1 (Cough)	0.203	0.139	0.063	0.070		
	CAT 2 (Secretions)	0.289	0.054	–0.008	0.179		
	CAT 3 (Chest tightness)	0.299	0.398	0.271	0.547		
	CAT 4 (Dyspnea)	0.173	0.395	0.421	0.531		
	CAT 5 (Limitation)	0.316	0.415	0.363	0.335		
	CAT 6 (Confidence)	0.146	0.341	0.338	0.175		
	CAT 7 (Sleep quality)	0.176	0.231	0.253	0.373		
	CAT 8 (Energy)	0.479	0.174	0.237	0.281		

Item 1: Do you feel tired while at rest?
Item 2: Do you feel short of breath while performing activities such as talking, eating, bathing, or dressing?
Item 3: Do you cough up phlegm during the day?
Item 4: Do you have a persistent cough?
Item 5: Do you feel short of breath while at rest (lying down or sitting)?
Item 6: Do you feel severe fatigue after low-intensity physical exertion, such as walking 1 block?
Item 7: Do you feel short of breath during physical exercise, for example, running?
Item 8: Are you dissatisfied with your ability to perform activities of daily living, such as cooking, cleaning, maintaining personal hygiene, shopping, working, exercising, or meeting friends?
Item 9: Do you experience chest tightness or chest pain that worsens with physical exertion?
Item 10: Do you feel that your physical health prevents you from carrying out your activities of daily living normally?
Item 11: Do you feel short of breath when walking?
Item 12: During physical exertion, do you have to stop the activity because of fatigue and/or shortness of breath?
Item 13: Do you have difficulty falling asleep?

CAT: COPD Assessment Test; CESRPC: Post-COVID-19 Respiratory Symptoms Assessment Questionnaire.

Conclusions

The CESRPC provides evidence of content validity and construct validity and showed acceptable reliability for 2 of the 3 dimensions.

The psychometric properties of the CESRPC suggest that it is a valid and reliable questionnaire that may be useful for identifying persistent respiratory symptoms amenable to respiratory physiotherapy and functional limitations in patients with LC.

Future research assessing the validity and reliability of the questionnaire in a larger sample and in populations with different characteristics would help accumulate further evidence to confirm its validity and improve the reliability of its dimensions.

Acknowledgments

The authors thank the *ENES León, UNAM* for allowing the pilot test to be conducted at its facilities. They also thank all healthcare professionals, professors, and students involved who provided support in carrying out this project.

Funding

No funding agency participated in the study design, data collection and analysis, conduct, or publication of this work.

Conflicts of interest

The authors declared no conflicts of interest whatsoever.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors followed the protocols of their healthcare center/institution for access to medical record data. Informed consent was obtained from the patients, and approval was obtained from the Ethics Committee. The recommendations of the SAGER guidelines were followed.

Declaration on the use of artificial intelligence. The authors declare that no type of generative artificial intelligence was used in the writing or creation of content for this manuscript.

References

1. Global Burden of Disease Long COVID Collaborators; Wulf Hanson S, Abbafati C, Aerts JG, Al-Aly Z, Ashbaugh C, Ballouz T, et al. Estimated global proportions of individuals with persistent fatigue, cognitive, and respiratory symptom clusters following symptomatic COVID-19 in 2020 and 2021. JAMA. 2022;328(16):1604-15. https://doi.org/10.1001/jama.2022.18931.
2. World Health Organization. Post-COVID-19 condition (long COVID) [Internet]. World Health Organization; 26 de febrero de 2025 [citado en agosto de 2025]. Available from: https://www.who.int/news-room/fact-sheets/detail/post-covid-19-condition-(long-covid).
3. Lewthwaite H, Byrne A, Brew B, Gibson PG. Treatable traits for long COVID. Respirology. 2023;28(11):1005-22. https://doi.org/10.1111/resp.14596.
4. Organización Panamericana de la Salud. Condición post-COVID-19 [Internet]. Washington, DC: Oficina regional para las Américas de la Organización Mundial de la Salud; 2022 [citado el 10 de agosto de 2023]. Available from: https://www.paho.org/es/temas/coronavirus/brote-enfermedad-por-coronavirus-covid-19/condicion-post-covid-19.
5. Srikanth S, Boulos JR, Dover T, Boccuto L, Dean D. Identification and diagnosis of long COVID-19: a scoping review. Prog Biophys Mol Biol. 2023;182:1-7. https://doi.org/10.1016/j.pbiomolbio.2023.04.008.
6. Krishna B, Wills M, Sithole N. Long COVID: what is known and what gaps need to be addressed. Br Med Bull. 2023;147(1):6-19. https://doi.org/https://doi.org/10.1093/bmb/ldad016.
7. Chuang HJ, Lin CW, Hsiao MY, Wang TG, Liang HW. Long COVID and rehabilitation. J Formos Med Assoc. 2024;123(Suppl 1): S61-S69. https://doi.org/10.1016/j.jfma.2023.03.022.
8. Huerne K, Filion KB, Grad R, Ernst P, Gershon AS, Eisenberg MJ. Epidemiological and clinical perspectives of long COVID syndrome. Am J Med Open. 2023;9:100033. https://doi.org/10.1016/j.ajmo.2023.100033.
9. Halabe Cherem J, Robledo Aburto Z, Fajardo Dolci G. Síndrome post-COVID-19. Certezas e interrogantes. México: Médica Panamericana; 2022.
10. National Institutes of Health. Symptoms of long COVID differ for people of different racial and ethnic groups [Internet]. Rockville Pike: National Institutes of Health; 2023 [citado en abril de 2023]. Available from: https://covid19.nih.gov/news-and-stories/symptoms-long-covid-differ-people-different-racial-and-ethnicgroups#:~:text=Compared%20with%20White%20adults%2C%20Black,like%20brain%20fog%2C%20or%20fatigue.
11. Tristán-López A. Modificación al modelo de Lawshe para el dictamen cuantitativo de la validez de contenido de un instrumento objetivo. Avances en Medición. 2008;6:37-48.
12. Puerta L, Marín ME. Análisis de validez de contenido de un instrumento de transferencia de tecnología universidad-industria de Baja California, México [Internet]. En: XX Congreso Internacional de Contaduría, Administración e Informática. Ciudad de México, México, 7-9 de octubre de 2015 [consultado en junio de 2023]. Available from: https://investigacion.fca.unam.mx/congreso_memoria_2015.php.
13. Roco-Videla Á, Hernández Orellana M, Silva González O. ¿Cuál es el tamaño muestral adecuado para validar un cuestionario? Nutr Hosp. 2021;38(4):877-8. https://doi.org/10.20960/nh.1851.
14. Celina Oviedo H, Campo-Arias A. Aproximación al uso del coeficiente alfa de Cronbach. Rev Colomb Psiquiatr. 2005;34(4):572-80.
15. Bai F, Tomasoni D, Falcinella C, Barbanotti D, Castoldi R, Mulè G, et al. Female gender is associated with long COVID syndrome: a prospective cohort study. Clin Microbiol Infect. 2022;28(4):611.e9-611.e16. https://doi.org/10.1016/j.cmi.2021.11.002.
16. Griffin DO. Postacute sequelae of COVID (PASC or long COVID): an evidenced-based approach. Open Forum Infect Dis. 2024;11(9):ofae462. https://doi.org/10.1093/ofid/ofae462.
17. Bowling A. Mode of questionnaire administration can have serious effects on data quality. J Public Health (Oxf). 2005;27(3):281-91. https://doi.org/10.1093/pubmed/fdi031.
18. Díaz de Rada V. Encuestas con encuestador y autoadministradas por internet. ¿Proporcionan resultados comparables? Rev Esp Invest Sociol. 2011;(136):49-90. https://doi.org/10.5477/cis/reis.136.49.