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PHAR-COV: Development and validation of a pandemic-specific pharmacist response scale

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ABSTRACT

The COVID-19 pandemic caused a major health crisis worldwide. The aim of this study is to develop and validate a valid and reliable PHAR-COV Scale that evaluates various parameters related to pharmacists providing critical services during the COVID-19 pandemic. 30 items were initially classified into three dimensions as knowledge, attitude, and behavior and evaluated for content validity index (CVI) by an expert. Online survey was administered to 156 pharmacists providing healthcare services in Türkiye for Exploratory Factor Analysis (EFA), and the sample size was increased to 300 for Confirmatory Factor Analysis (CFA). EFA, a three-factor structure emerged, and the scale's total Cronbach's alpha value was 0.909. CFA was performed, and the values were found to show acceptable fit (KMO=0.878; Bartlett's Test-Chi-Square=1547.562, $p<0.001$; X2/df=1.955; GFI=0.851; CFI=0.953; RMSEA=0.078). Following the confirmatory factor analysis, one item was removed, and the scale was finalized with 18 items across three dimensions (Knowledge, Attitude, and Behavior). The PHAR-COV scale demonstrates strong content validity and construct validity based on these results. The PHAR-

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COV Scale is recommended as a measurement tool that will provide positive contributions to educational institutions, health authorities, and policymakers in evaluating the roles of pharmacists in emergency public health situations and in developing preparedness strategies for potential future pandemics or disasters.

Keywords: COVID-19, PHAR-COV scale, pharmacists, professional role, psychometrics

INTRODUCTION

The COVID-19 (Coronavirus Disease 2019) pandemic has triggered a major global health crisis. This situation has led to paradigm shifts in perspectives on health, in the evaluation of national health policies, in the economy, and in individual behavior. First identified in December 2019, SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) has posed a significant challenge to public health and sparked widespread panic in many countries. Pharmacists are healthcare professionals who are always accessible to the public, and they play a key role in preventing the spread of infection by educating the public on the proper use of personal protective equipment and ensuring that medications are used correctly[1].

A study conducted in France found that pharmacists play an active role in screening and antigen testing for SARS-CoV-2, as well as in providing information about vaccines, administering them, and distributing them[2]. The role of neighborhood pharmacies in alleviating the panic and anxiety caused by the pandemic has highlighted their status as critical healthcare workers who provide the public with accurate information, are easily accessible, and play a key role in vaccination efforts[3,4].

A study conducted during the pandemic with participants from 25 different countries found that pharmacists play a significant role in alleviating patients' fears and anxieties and in providing information about vaccines and medications[5]. Pharmacists have continued to provide counseling services to people affected by the pandemic not only in person but also over the phone[6, 7]. It has been determined that, given that pharmacies pose a relatively lower risk of secondary infection compared to hospitals and are more easily accessible to individuals, their contribution to vaccination efforts is important[8,9]. Another study noted that pharmacists not only provided vaccination services during the pandemic but also distributed protective equipment, offering the public reliable and cost-effective services[10–12]. A survey of pharmacists revealed that they are experiencing high levels of anxiety due to facing a large-scale outbreak for the first time and are struggling to provide services[13].

The pandemic disrupted the global pharmaceutical supply chain, leading to fluctuations in drug prices and, consequently, disruptions in services at both hospital pharmacies and community pharmacies. This situation prompted the public to stockpile protective equipment such as medications and masks, increased instances of aggressive behavior among patients, and ultimately made it necessary to develop preparedness and preventive measures in this regard[14-17]. During the COVID-19 pandemic, surveys were conducted on the services provided by pharmacies and pharmacists, both regarding personal protective equipment such as medications and masks, and regarding patient awareness campaigns[6,13,14]. However, the use of scales with proven validity and reliability has remained limited.

While surveys such as INSPIRE, developed in Canada, provide valuable data revealing the importance of pharmacists working on the front lines in subsequent disasters and pandemics[18], the pharmacy system in Türkiye lacks the necessary infrastructure to assess the specific conditions encountered during a pandemic. Furthermore, the vast majority of surveys conducted fail to adequately reflect individual behavioral responses and coping strategies in the face of a crisis. This situation clearly highlights the need for a comprehensive and valid measurement tool that reflects the experiences of Turkish pharmacists during the pandemic.

The primary objective of this study is to develop a valid and reliable scale that comprehensively evaluates the counseling services provided by pharmacists during pandemic periods. This study presents the PHAR-COV Scale (Assessment of Pharmacists' Roles and Challenges in COVID-19). The scale aims to fill a significant gap in the literature by enabling a quantitative analysis of pharmacists' pandemic-related experiences across three theoretical dimensions. In this regard, the scale will contribute to the literature by providing data on pharmacists' knowledge, attitudes, and behaviors. Additionally, this scale can be used to establish a foundation for health policy design, professional education programs, and disaster-epidemic response frameworks in the field of pharmacy.

METHODOLOGY

Study design and setting

This research is a methodological study aimed at developing a scale to evaluate the professional experiences of pharmacists in Türkiye during the COVID-19 pandemic and conducting validity/reliability analyses. In the study, pharmacists who own independent pharmacies operating throughout Türkiye were reached via a survey created on Google Forms survey and asked to complete the survey. The workflow is presented schematically in Figure 1.

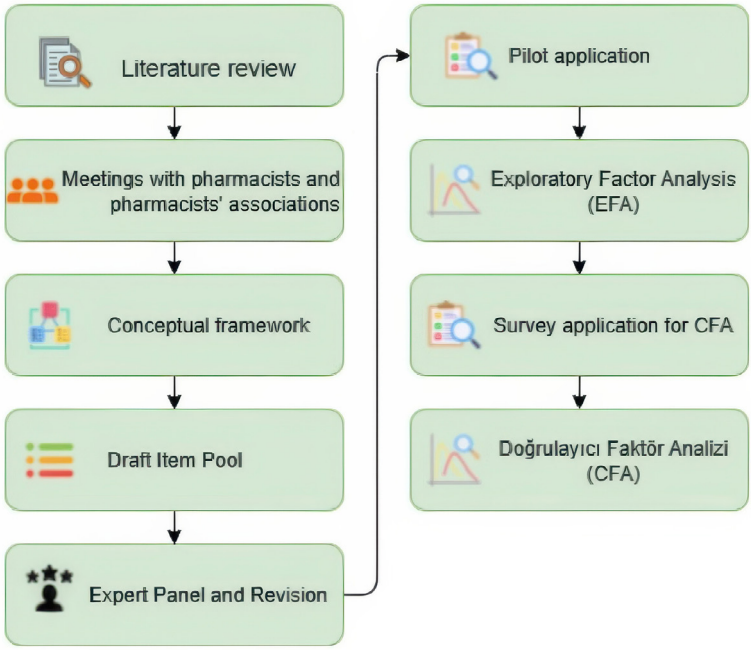

Figure 1. Research flow chart

Item generation and conceptual framework

During the scale development process, first, the literature was reviewed. Subsequently, a conceptual framework was established based on qualitative interviews conducted with the managers of pharmacists' associations and pharmacists in the field. During the pandemic, pharmacists' experiences were organized into four thematic categories (1) Professional Roles and Responsibilities, (2) Institutional Support and Infrastructure, (3) Psychological Burden and Burnout, and (4) Community Communication and Counseling—which were used solely as a content framework during the item development phase. These items were initially selected to ensure that the item pool comprehensively reflected pharmacists' pandemic experiences. However, the scale's measurement framework was defined from the outset as a three-dimensional Knowledge-Attitude-Behavior (KAB) structure, consistent with the KAB model widely adopted in health behavior research. Accordingly, the 30 draft items were classified into three functional measurement categories—Knowledge, Attitude, and Behavior—prior to expert review and factor analysis. The three-factor structure validated by the Exploratory Factor Analysis (EFA) constitutes an empirical validation of this predefined measurement model rather than a reduction from the conceptual framework. The mapping between

the four content dimensions and the three KAB measurement categories is defined as follows: Items derived from the "Community Communication and Counseling" dimension were primarily classified under the "Information" dimension, as they reflect the informative role pharmacists played in guiding patients and the public during the pandemic. Items belonging to the 'Professional Role and Responsibilities' dimension, on the other hand, were placed in the Behavior dimension because they encompass observable actions, such as mask distribution, guidance on over-the-counter medications, and physical safety measures. Items from the 'Institutional Support and Infrastructure' and 'Psychological Burden and Burnout' dimensions, on the other hand, were classified under the Attitude dimension because they reflect pharmacists' evaluative responses to systemic inadequacies and occupational stress. This conceptual mapping was determined prior to data collection and subsequently supported by the EFA factor analysis.

Content validity: expert review and content validity index

Although the literature generally recommends obtaining at least 5–10 expert opinions for calculating the Content Validity Index, a panel of 12 experts was formed in this study to ensure balanced representation across different fields of expertise and to enhance the reliability of the evaluations. I-CVI values calculated using 12 experts reduce the impact of individual judgment errors compared to smaller panels and provide more robust estimates. Twelve experts rated each item on a four-point scale: (1) Not appropriate, (2) Partially appropriate, (3) Quite appropriate, (4) Fully appropriate. Experts who assigned a score of 3 or 4 were coded as 'appropriate'; for each item, the Item-Level Content Validity Index [I-CVI=number of experts who found it appropriate / total number of experts] was calculated. Items with an I-CVI value of ≥0.78 were interpreted as 'excellent,' items with values between 0.56 and 0.77 as 'requiring review', and items with values <0.56 as 'to be removed from the scale[19]. The Scale-Level Content Validity Index (S-CVI/Avg.) was calculated by taking the average of all I-CVI values, resulting in an S-CVI/Avg. of 0.955[20].

Questionnaire structure

The final scale was prepared using a five-point Likert-type rating (1=Strongly Disagree, 5=Strongly Agree). Each item was associated with one of the three dimensions mentioned above. In addition, all items were also labeled according to the categories of knowledge, attitude, and behavior. The survey form also asked participants for demographic information such as age, gender, graduation year, and whether they had been contracted with COVID-19.

Pilot survey and participants

The pilot application of the scale was conducted online via Google Forms. The inclusion criteria for the study are as follows: (1) owning an independent pharmacy in Türkiye and being actively practicing, (2) having actually provided services during the COVID-19 pandemic. The exclusion criteria are as follows: (1) Being a hospital or public pharmacist (these pharmacists did not work at primary care service points in direct contact with the public during the pandemic), (2) Not having been actively working during the pandemic. The primary reason for prioritizing pharmacy owners is that this group represents pharmacists who were in the most direct contact with the public during the pandemic and provided critical services such as mask distribution, medication supply, and counseling firsthand. Additionally, the practical difficulties of reaching hospital pharmacists and systematically collecting data from this group were also taken into account. A minimum of 150 participants was targeted taking into account the rule of at least 5 participants/item for the pilot analysis. Participants were included in the study on a voluntary basis. A total of 156 pharmacists responded to the survey.

Data analysis

The collected data were analyzed using SPSS 22 and AMOS v22 software. The EFA was applied to test the construct validity of the scale. Prior to this analysis, the Kaiser-Meyer-Olkin (KMO) sample adequacy test and Bartlett's sphericity test were performed to test the suitability of the data set. Factor analysis was performed using the Principal Axis Factoring method, and Varimax rotation item-total correlations and corrected item correlations were also examined to increase the interpretability of the factor loadings.

Ethical considerations

The necessary ethical approval for this study was obtained from the Local Ethics Committee of Selcuk University (Decision No: 2025/35). Informed consent was obtained online from all participants, and data were collected anonymously. The research was conducted in accordance with the principles of the Helsinki Declaration.

Confirmatory factor analysis (CFA)

To validate the factor structure obtained with the Confirmatory Factor Analysis (CFA), CFA was applied in the second stage. A new sample of size n ≥300 was collected for this analysis. Confirmatory Factor Analysis (CFA) was performed using AMOS software. The following indices were used to assess model fit: Chi-square/df, CFI, and RMSEA. Acceptable limits were ≥0.90 for CFI and ≤0.08 for RMSEA[21].

Construct validity and criterion validity

Construct validity was assessed using both EFA and DFA findings. Correlations between subscales and cross-factor loadings were examined. Additionally, the relationships between subscale scores and demographic variables such as age, gender, and graduation year were analyzed. In terms of criterion validity, only construct validity was prioritized, as no other valid instrument measuring a similar theme was found.

RESULTS and DISCUSSION

Descriptive statistics

The demographic data from the surveys conducted as part of the scale study, along with the descriptive statistics for these data, are presented in Table 1 and Table 2.

Table 1. Demographic characteristics (age, gender, graduation year, pharmacy type [private/public], city, etc.)

	What Is Your Gender?					
	Female (n=167, 56%)			Male (n=133, 44%)		
	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count
How old are you?		41	11		44	10
How many years have you been a pharmacist?	0-5 years			23		19
	6-10 years			35		17
	11-15 years			23		12
	16-20 years			23		12
	21-25 years			17		19
	26-30 years			35		40
	31 years and over			12		13
Did you have a COVID infection during the pandemic?	Yes			102		73
	No			65		60

Table 2. Descriptive statistics for scale items: median, standard deviation, minimum, and maximum values (n=300)

	N Valid	Missing	Median	SD	Min.	Max.
Q1	300	0	5	0,694	2	5
Q2	300	0	5	0,973	1	5
Q3	300	0	5	0,724	1	5
Q4	300	0	5	0,751	1	5
Q5	300	0	4	0,948	1	5
Q6	300	0	5	0,762	1	5
Q7	300	0	5	0,684	1	5
Q8	300	0	5	0,712	1	5
Q9	300	0	5	0,764	1	5
Q10	300	0	5	0,732	1	5
Q11	300	0	5	0,739	1	5
Q12	300	0	5	0,852	1	5
Q13	300	0	5	0,815	1	5
Q14	300	0	5	0,874	1	5
Q15	300	0	5	0,732	1	5
Q16	300	0	5	0,842	1	5
Q17	300	0	4	0,940	1	5
Q18	300	0	4	1,021	1	5
Q19	300	0	4	0,949	1	5

Content validation index

As a result of the evaluations conducted by the expert panel established for Content Validation, the Item Content Validity Index (I-CVI) was calculated at the item level, and the Scale Content Validity Index (S-CVI/Ave) was calculated at the scale level for each item[19,20] (Table 3). Items with an I-CVI value of ≥0.78 were classified as having "excellent construct validity"; items with values between 0.56 and 0.77 were flagged for review, and items with values <0.56 were removed from the scale [19]. The scale-level content validity index (S-CVI/Mean) was found to be 0.955, which meets the criterion for excellent scale validity (≥0.90)[20].

In this regard, the content validity index (CVI) for seventeen items was calculated as 1.00, two items were calculated as ≥0.78, two items were determined to be between 0.56 and 0.77, and the CVI value for nine items was calculated to be less than 0.562. The average content validity index (S-CVI/Ave) is 0.955. Items

with values less than 0.77 were removed from the draft scale on the grounds that they needed revision, were repetitive, and created confusion. Thus, the scale was determined to consist of 19 items, and other analyses were carried out.

Table 3. Content Validity Index (CVI) results — Item-level (I-CVI)

	Number of Items Given I-CVI score			
	1.00	0.86	0.71	<0.56
Knowledge	7			
Behavior	6			
Attitude	4	2	2	9

I-CVI: Index CVI score.

Characteristics of participants

For Exploratory Factor Analysis (EFA), 156 participants responded to the scale items, and for Confirmatory Factor Analysis (CFA), 300 participants completed the survey. In total, 300 participants comprised of 56% women and 44% men.

Item-total correlation and reliability

Internal consistency analysis (Cronbach's Alpha)

Table 4. Percentage of variance explained and reliability results for the subscales

Scale	Sub-Dimension	Percentage of Variance Explained	Cronbach's Alpha Coefficient
PHAR-COV Scale	Attitude	40.579	0.903
	Behavior	13.839	0.830
	Knowledge	10.216	0.772
	Total	58.111	0.909

As presented in Table 4, 40.579% of the total variance explained is attributed to Attitude, 13.839% to Behavior, and 10.216% to Knowledge. The total variance explained of the scale is 58.111%. To prove the applicability of the scale, its internal consistency coefficient, i.e., Cronbach's Alpha value, was examined. The analysis revealed that the reliability coefficient for the entire scale was 0.909. We can say that the reliability of the measurement tool is high. As a result of all these analyses, the developed scale is seen to be three-dimensional, with high validity and reliability.

Exploratory factor analysis (EFA)

Factor analyses are crucial in conducting validity and reliability tests during scale development research[22]. In the study, an exploratory factor analysis (EFA) was conducted for the PHAR-COV Scale. Before proceeding with the factor analysis, the Kaiser-Meyer-Olkin (KMO) test, a test used to measure the suitability of the data collected for factor analysis, in other words, the adequacy of sampling, was calculated. Results between 0.5 and 1.0 were considered acceptable[23]. A value is lower than 0.7 indicates that the sample size is insufficient. The minimum KMO value is accepted as 0.7[24]. Bartlett test is used to test whether the correlation matrix is a unit matrix or not, in other words, whether the data are unrelated or related[25]. This test gives the "Chi square" value and the significance of this test result is when $p<0.05$[26]. If the significance value is lower than 0.05, the data are related and factor analysis is appropriate, so the analysis continues. If the significance value is greater than 0.05, factor analysis is not performed. The Kaiser-Meyer-Olkin (KMO) test results, which were used to test the adequacy of the sample size for factor analysis in our study, are presented in Table 5.

Table 5. Kaiser Meyer Olkin (KMO) values of the PHAR-COV scale

Scale	KMO	Bartlett Test-Chi-Square	p-value
PHAR-COV	0.878	1547.562	0.000

As seen in Table 5, the KMO coefficient for the scale was determined to be above 0.70, and the Bartlett test significance value was determined to be 0.000. The Bartlett test significance value (p) for the scales included in the survey form was less than 0.05. Therefore, the KMO and Bartlett test values calculated based on these results demonstrate the suitability of the variables for factor analysis. The results indicate that the data obtained from the participants are suitable for factor analysis and that meaningful groups can be formed.

The Kaiser criterion (eigenvalue>1) was used to determine the number of factors, and this finding was supported by a visual examination of the scree plot. The three-factor structure was found to be consistent both statistically and conceptually. Cross-loadings were examined; no cross-loadings exceeding the 0.30 threshold were observed, and it was confirmed that each item loaded significantly on only one factor. The factor loadings for all items were above the accepted threshold (0.50) and ranged from 0.574 to 0.826, as shown in Table 6.

For an item to be included in a factor, it must have sufficient factor loadings under that factor. It is recommended that items with factor loadings lower than the lower limit (0.50) determined for all factors in the measurement tool be removed from the measurement tool because they do not contribute sufficiently to the relevant factor structure in the measurement tool[27]. In our study, all the scale items valued were greater than 0.50. Therefore, as can be seen in Table 7, the PHAR-COV Scale was retained in 3-dimensional, 19-item form and submitted to confirmatory factor analysis. Following the CFA, one item (Attitude-3) was removed based on both statistical and theoretical grounds, and the scale took its final form with 18 items, as shown in Table 6 and Table 9.

Table 6. Factor loadings of the items in the scale

Scale	Sub-Dimension	Item Numbers	Item Contents	Factor Loadings
PHAR-COV	Attitude	Q2	Information and guidance from institutions were generally inadequate.	0.815
		Q1	The Ministry of Health's communication and organization on issues such as mask distribution were inadequate.	0.809
		Q3	During the pandemic, pharmacist interventions were often planned late and irregularly.	0.799
		Q5	In the first period of the pandemic, pharmacists were not given sufficient attention by the Ministry of Health.	0.733
		Q4	I was saddened by the fact that pharmacists were not sufficiently remembered in the Ministry of Health's statements.	0.729
		Q6	The tensions experienced in my pharmacy due to the supply of masks and medicines affected me.	0.715
		Q7	The increased patient pressure and uncertainty during the pandemic caused me to feel burnout at times.	0.646
		Q8	I am not sure if the pandemic experience will trigger better preparedness processes for pharmacists in the healthcare system.	0.643
		Q12	Working under constant public pressure during the pandemic period exhausted me psychologically.	0.624
		Q10	The fact that pharmacists were not included in the Scientific Committee established for pandemic management made me feel excluded.	0.602
		Q9	I believe that the experiences during the pandemic period have not been sufficiently reflected in permanent improvements at the system level.	0.602
		Q11	Throughout the pandemic, pharmacists were seen as logistics centers that only distributed products.	0.574
	Behavior	Q13	I provided service in accordance with the Ministry's system during the free mask distribution process in my pharmacy.	0.826

Table 6 (Continued). Factor loadings of the items in the scale

		Q14	In the first days of the pandemic, I tried to meet the public's needs for masks and disinfectants.	0,798
		Q15	I played an important role in guiding patients to obtain over the counter (OTC) medication.	0.678
		Q16	During the pandemic, I took physical security measures (plexiglass, disinfectant, social distance, etc.) in my pharmacy.	0.616
	Knowledge	Q17	During the pandemic, patients frequently turned to pharmacies to obtain medical information and guidance.	0.782
		Q18	Many patients who were unable to reach their family physicians and other healthcare units during the pandemic were directed directly to pharmacies to solve their health-related problems.	0.728
		Q19	I have received an intense public request for information about COVID-19.	0.682
KMO=0.878, Bartlett Test-Chi-Square: 1547.562, df:130, Sig:0.000, Cronbach's Alpha:0.909				

Table 7. Summary information about the dataset

Scale Sub-Dimension	Number of Items	Scale Types	Scale Range
Knowledge	3	Likert	1-5
Behavior	4	Likert	1-5
Attitude	12	Likert	1-5

The finalized scale for confirmatory factor analysis (CFA) was administered to 300 participants, and CFA was performed on the obtained data. Confirmatory factor analysis was conducted using the SPSS AMOS 22 program. The measurement model created to test the validity of the scales is given below.

Confirmatory factor analysis (CFA)

It was observed that the fit indices obtained initially in the CFA process fell below acceptable limits. Upon examining the modification indices, it was determined that the 'Attitude-3' item exhibited high error covariance and had relatively weak conceptual overlap with the other items in the Attitude dimension. This item was removed from the scale based on both statistical and theoretical grounds; upon rerunning the model, the fit indices reached acceptable limits ($X^2/df=1.955$; CFI=0.953; RMSEA=0.078) (Table 8) (Figure 2).

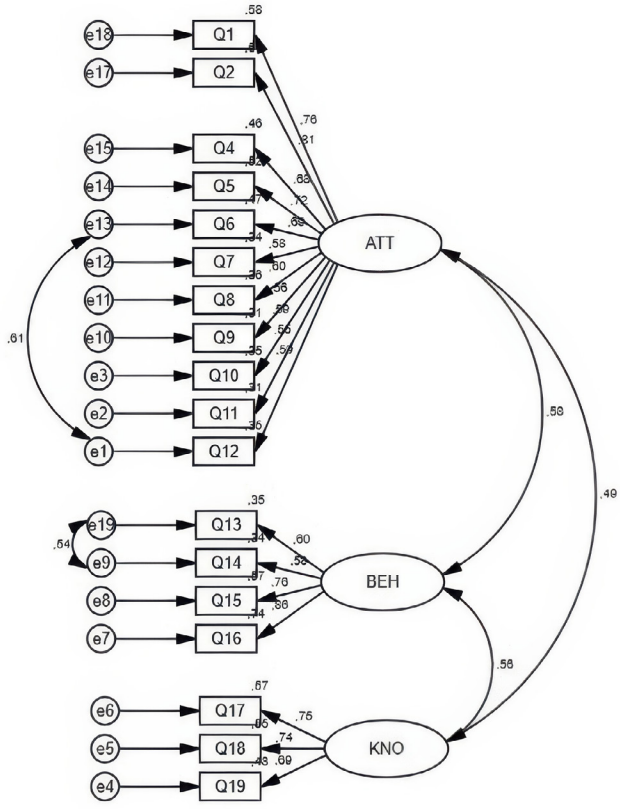

Figure 2. PHAR-COV Scale measurement model (ATT: Attitude, BEH: Behavior, KNO: Knowledge)

Table 8. Adaptation values of scales

	X^2	df	X^2/df	GFI	CFI	RMSEA
PHAR-COV	**254.104**	**130**	**1.955**	**0.851**	**0.953**	**0.078**
Good adaptation values			≤3	≥0.90	≥0.97	≤0.05
Acceptable compliance values			≤4-5	0.85-0.89	≥0.95	0.06-0.08

Although the GFI value (0.851) falls slightly below the threshold for good fit (≥0.90), it remains within the acceptable fit range (0.85–0.89), and all remaining indices (CFI=0.953; RMSEA=0.078) meet good fit criteria. Overall, the model demonstrates acceptable construct validity, and the scale was confirmed for inclusion in the study.

Table 9. Changes made to the scale

	Sub-Dimension	Number of Items	Number of Items Removed	Type of Confirmatory Factor Analysis Conducted
PHAR-COV	Attitude	12	1	Multifactor Confirmatory Factor Analysis
	Behavior	4	-	
	Knowledge	3	-	

This study was conducted to develop a valid and reliable measurement tool for assessing the situations encountered by independent pharmacists providing services to the public during the COVID-19 pandemic. Especially during the early stages of the pandemic, the lack of an approved antiviral treatment specific to COVID-19 led to primary care services taking on critical importance, a situation that naturally heightened fear within the community. In such an environment, pharmacists took the lead in providing counseling services despite the risk of infection. In the subsequent period, with the approval of various antiviral and supportive treatments, the guiding role of pharmacists in ensuring access to medications and providing medication information became even more pronounced.

Subsequently, these items were reviewed by experts, revised based on their feedback, and subjected to the exploratory factor analysis and confirmatory factor analysis.

The PHAR-COV scale developed in this study is presented as one of the valid and reliable scales that can be measured within a three-dimensional structure consisting of pharmacists' knowledge, attitudes, and behaviors during the COVID-19 pandemic.

According to the factor structure findings, the behavior factor regarding 'Professional Roles and Responsibilities' measures pharmacists' efforts in providing counseling and meeting the needs of the public from their pharmacies during the pandemic. This structure is parallel to the survey study conducted in Taiwan[10].

The aim is to measure how situations arising from the Ministry of Health's communication and organization will affect pharmacists' service delivery, through scale items that include pharmacists' attitudes toward psychological burden and burnout, supported by institutional support and infrastructure. These items are separated as a distinct factor because they address cases such as the difficulties pharmacists encountered while serving the public during the pandemic and whether pharmacists experienced burnout in response to client demands. This structure parallels the "systemic support" dimension in the INSPIRE study[18].

Items aimed at evaluating data obtained from pandemic experiences have been included in the information dimension of the scale to measure pharmacists' communication with the community and their counseling services, with the goal of developing their ability to cope with crises during a pandemic. These items are similar to the survey questions in the study conducted by Yang and Son[28].

The study conducted by Watson et al. using the INSPIRE survey aimed to identify the communication strategies and challenges faced by pharmacists actively providing services during the pandemic in patient care, thereby making their roles more visible[5]. The INSPIRE survey, developed by Lee et al., was designed to determine the effects of the pandemic on pharmacists operating in Canada, and it was noted that the full extent of the challenges was not entirely clear[18].

A significant portion of the scales developed in the current literature have generally focused on measuring pharmacists' knowledge, attitudes, or specific service roles during the COVID-19 process; the behavioral dimension has mostly been addressed in a limited manner. For example, while the INSPIRE scale examines pharmacists' roles, communication strategies, challenges encountered in practice, demographic information, and the psychological burden on pharmacists, the behavioral dimension has not been measured in terms of work and procedures performed in the local context and preparation for the future[5]. Elbeddini and colleagues' study addressed professional roles, public health practices, and pharmacists' communication with the public and educational activities, but did not address pharmacists' behavior, psychological burden, services provided in the local context, and preparation for the future[29]. Another study attempted to identify the professional challenges and learning needs faced by pharmacists during the pandemic but did not address behavioral aspects or future preparedness[13]. Duran et al. measured pharmacists' contributions and perceived difficulties regarding counseling, screening, testing, isolation, and vaccination services during the COVID-19 pandemic. While the behavioral dimension was partially addressed, no mention was made of pharmacists' views on psychological burden and future preparedness[2].

Our study aims to fill a gap in the literature regarding pharmacists providing frontline healthcare services during the COVID-19 pandemic, incorporating not only the attitude dimension but also behavioral indicators into the scale. The items of the PHAR-COV Scale reflect the unique conditions of Türkiye during the COVID-19 pandemic and cover practices such as the mask distribution process, prescription drug supply, local supply chain problems, and physical protection measures within pharmacies. Additionally, areas that have been limited in international scales, such as psychological burden and burnout

due to increased patient pressure and uncertainty, professional resilience, perceived organizational support, and preparedness for future pandemics, have also been included.

This multidimensional approach both expands the theoretical scope of the PHAR-COV scale and enhances its alignment with local realities. Consequently, our current study presents a unique measurement tool that is both internationally comparable and reflects the specific public health and pharmacy practice realities of Türkiye.

Furthermore, the fact that the items evaluated by expert opinion in terms of content validity during the scale development process achieved high validity values such as I-CVI≥0.56, and S-CVI/Ave=0.955 demonstrates that the scale contains items consistent with its theoretical structure.

Since no other instrument with a similar focus and previously established validity could be identified, external criterion validity could not be assessed. To further strengthen the validity framework of the scale, convergent validity could be examined in future studies through correlations with established instruments such as occupational burnout scales or pandemic-related anxiety scales. Additionally, known group comparisons among pharmacists with different levels of professional experience (e.g., 0–5 years vs. 10+ years) will provide further evidence regarding the scale's discriminant validity.

The Exploratory Factor Analysis (EFA) results of the scale indicate that its three-factor structure has high internal consistency. Cronbach's Alpha values for the Knowledge (0.772), Attitude (0.903), and Behavior (0.830) dimensions are above acceptable levels in terms of reliability. The total internal reliability of the scale was found to be 0.909. The KMO value, which measures the suitability and adequacy of the data for factor analysis, was 0.878, indicating that the data set is highly suitable for factor analysis. Furthermore, the confirmatory factor analysis (CFA) results (GFI=0.851, CFI=0.953, RMSEA=0.078) demonstrated acceptable model fit, supporting the construct validity of the scale. Although the GFI value (0.851) falls slightly below the threshold for good fit (≥0.90), it remains within the acceptable fit range (0.85–0.89). This does not compromise the scale's construct validity; however, it may be beneficial to test the model with larger sample sizes in future studies. Thus, the scale was finalized with 18 items.

The limitations of the scale, including the absence of criterion validity assessment, are discussed in the limitations section. When examining the sub-dimensions of the PHAR-COV Scale: The information dimension reflects pharmacists' requests for information regarding the course of the disease during

the COVID-19 pandemic, necessary information to prevent transmission, and managing people's panic. The Attitude dimension reflects issues related to pharmacists' role in mask distribution during the pandemic, the ministry's lack of necessary support, and their working conditions under psychological pressure. The Behavior dimension focuses on the infection prevention measures taken by pharmacists during the pandemic, their role in mask distribution, and the services they provided to individuals with chronic illnesses.

The PHAR-COV Scale provides data on the roles that researchers and health authorities managing the pandemic will assume in future pandemic situations, such as supplying medication and providing advisory services to patients on the front lines and ensuring that pharmacists are easily accessible to the public in residential areas. It also provides an opportunity to identify areas for improvement in pharmacy education in relation to the challenges encountered.

Furthermore, during post-pandemic health planning, various announcements and educational activities can be planned to enable the public to obtain information from pharmacies. This can also be evaluated in terms of diversifying and expanding the services provided by pharmacists, not only during pandemics but also during periods such as disasters and earthquakes that affect the public.

This study has some limitations. Data for the PHAR-COV Scale was collected online using Google forms. Criterion validity could not be compared due to the lack of similar examples in the literature for this scale; In future studies, it is recommended that the convergent validity of the PHAR-COV scale be examined through correlations with established instruments, such as burnout inventories or pandemic-related anxiety scales, and that known group comparisons be conducted among pharmacists with different levels of professional experience to provide additional evidence of validity. Additionally, increasing the number of participants in the scale would have been beneficial. Respondents to the scale were generally self-employed pharmacists who owned pharmacies. If hospital pharmacists had been included, data on services provided by public hospitals could also have been obtained. In future studies, longitudinal studies evaluating the test-retest reliability of this scale would further strengthen the scientific contribution of the PHAR-COV Scale.

The originality of this scale lies in its multidimensional approach, which assesses pharmacists' experiences during the COVID-19 pandemic not only in terms of attitude dimensions but also in terms of behavioral parameters, country-specific procedures, pharmacists' psychological burden and burnout, and future preparedness dimensions. The inclusion of unique processes not

found in the literature, such as mask distribution, prescription drug supply, and pharmacy logistics in Türkiye, enhances the scale's contextual validity. For health authorities, local administrators, and researchers, the PHAR-COV scale can be used as a practical tool both to analyze awareness of pharmacists' roles in the recent pandemic and to develop preparedness strategies for the support pharmacists can provide in future potential public health and general disaster situations.

STATEMENT OF ETHICS

Ethical approval was obtained from the Local Ethics Committee of Selcuk University (2025/35).

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

HK: Supervision, project administration, methodology, conceptualization; CC: Writing–review-editing, methodology, formal analysis, data curation; STR: Data collection, writing–review-editing; CK: Editing, methodology, software, validation formal analysis; YA: Editing, methodology, software, validation formal analysis; CG: Data collection, editing; YO: Data collection.

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