



# Development and Psychometric Assessment of a Scale for Measuring Knowledge, Attitude, and Practice About COVID-19

Samaneh Torkian<sup>1\*</sup>, Ali Ahmadi<sup>2</sup>, Vahid Khosravi<sup>3</sup>, Narges Khanjani<sup>4</sup>, Zahra Jaafari<sup>5</sup>, Mohammad Ali Morowatisharifabad<sup>6</sup>, Neda Malek Mohammadi<sup>5</sup>

<sup>1</sup>Department of Epidemiology, School of Public Health, Iran University of Medical Sciences, Tehran, Iran

<sup>2</sup>Department of Epidemiology and Biostatistics, School of Health and Modeling in Health Research Center, Shahrekord University of Medical Sciences, Shahrekord, Iran

<sup>3</sup>Department of Health Education and Promotion, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>4</sup>Neurology Research Center, Kerman University of Medical Sciences, Kerman, Iran

<sup>5</sup>Department of Biostatistics and Epidemiology, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran

<sup>6</sup>Aging Health Department, School of Public Health, Yazd Shahid Sadoughi University of Medical Sciences, Yazd, Iran

## Abstract

**Background and aims:** Knowledge, attitude, and practice (KAP) toward coronavirus disease 2019 (COVID-19) are important factors for adherence to protection strategies. The aim of this study was to construct and validate a questionnaire about the KAP of Iranians regarding COVID-19.

**Methods:** Initially, a questionnaire about the KAP with regard to COVID-19 was constructed in this cross-sectional study. The initial questionnaire was prepared based on a review of the extensive research literature and global and national guidelines. This researcher-made questionnaire was developed using the COVID-19-KAP questionnaire, which was originally used in China in 2020, and the influenza epidemic KAP Questionnaire (2015), the MERS KAP Questionnaire (2015), the H1N1 flu KAP questionnaire (2017), and the WHO KAP questionnaire about COVID-19. The applied questionnaire consists of three parts including knowledge- (n=26), attitude- (n=8), and practice-related (n=11) questions, respectively. Then, the face, content, and construct validity and the reliability of the questionnaire was determined, and analyzes were performed using SPSS v. 26 and AMOS v. 24 software.

**Results:** In the face validity stage, 2 questions with an impact score of less than 1.5 were excluded from the questionnaire. In the content validity check, all questions had a content validity index (I-CVI) of more than 0.7. However, the content validity ratio (CVR) for 6 questions was less than 0.51, and these questions were removed accordingly. The compliance of the CVI with the chance agreement was close to one for all questions, indicating the lack of a chance agreement. In the exploratory factor analysis stage, the Kaiser-Meyer-Olkin (KMO) value of 0.90 was obtained, implying the adequacy of the sample size for factor analysis. The significance of the Bartlett test (chi-square: 5820.06, df: 630,  $P < 0.001$ ) indicated a strong correlation between the questions and the appropriateness of factor analysis. Finally, 34 items in 4 domains remained in the questionnaire.

**Conclusion:** The validity and reliability of this questionnaire were confirmed based on the findings. This Farsi KAP questionnaire can be used to assess the level of knowledge, attitude, and practice of people about COVID-19.

**Keywords:** Development, Psychometric, Knowledge, Attitude, Practice, COVID-19

## \*Corresponding Author:

Samaneh Torkian,  
Ph.D. Student, Department of  
Epidemiology, School of Public  
Health, Iran University of  
Medical Sciences, Tehran, Iran.  
Tel: +98-9014211075,  
Email: Torkiansamane72@  
gmail.com

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## Introduction

Coronavirus disease 2019 (COVID-19) is an emerging respiratory illness caused by a new coronavirus. The disease was first diagnosed on December 31, 2019, in Wuhan, China.<sup>1</sup> Due to the rapid spread and serious conditions of the disease in the world, the World Health Organization (WHO) declared the disease as a public health emergency on January 30, 2020, and called on all countries to attempt to prevent the rapid spread of the virus.<sup>2</sup> On December 1, 2020, the WHO reported the

disease as a pandemic,<sup>3</sup> which has affected all countries of the world.<sup>4</sup> According to the last report of the WHO (19-25 July 2021), the cumulative number of globally reported cases and deaths is almost 194 million and over 4 million, respectively. It was further mentioned that if these trends continue, the cumulative number of reported cases reported could exceed 200 million in the next two weeks.<sup>5</sup> Iran is also one of the countries that reported two cases of the virus in Qom province on February 19, 2020. Then, it spread to the neighboring provinces of Qom

such as Tehran, Isfahan, Markazi, Semnan and the whole country after a short period.<sup>6</sup> Base on the WHO data, the cumulative total number of cases and deaths per 100 000 population was 4432.81 and 106.11 until July 27th, 2021 in Iran, respectively. These values are about twice the global average (2496.722 and 106.11 per 100 000 people).<sup>7</sup>

Due to the lack of effective treatment, the main way to slow the spread of COVID-19 is to prevent the transmission of the virus among individuals through vaccination, awareness, and appropriate preventive measures.<sup>8</sup> The WHO emphasized that though vaccines alone cannot end the pandemic, they can be an extremely important additional tool for strengthening our response to COVID-19 when used in combination with other useful measures. It should be noted that maintaining physical distance, observing hand hygiene, staying home when being sick, and avoiding crowded spaces, which are all behaviors that have been promoting for the last year, must be continued in countries with outbreaks and ongoing community transmission.<sup>9</sup> In Iran, measures and protection policies at the national level (e.g., closing schools and universities, using masks in public places, and encouraging people to adhere to hygiene principles) were advertised through national media.<sup>10,11</sup>

Following health protocols is still one of the important recommendations for controlling the pandemic that is affected by the KAP of people toward this disease.<sup>12,13</sup> In addition, monitoring the awareness, attitude, and practice of the community during a pandemic is highly important and is considered one of the important pillars of pandemic control.<sup>9</sup> Thus, a valid questionnaire is needed for this purpose. Due to the lack of a single and valid questionnaire in Iran, the aim of this study was to develop and assess the psychometric properties of a questionnaire about knowledge, attitude, and practice (KAP) of Iranians toward COVID-19.

## Materials and Methods

The initial questionnaire was prepared based on a review of the extensive research literature and global and national guidelines. It is noteworthy that this questionnaire was developed using the COVID-19-KAP questionnaire originally used in China in 2020, as well as the influenza epidemic KAP Questionnaire (2015),<sup>14</sup> the MERS KAP Questionnaire used in (2015),<sup>15</sup> the H1N1 flu KAP questionnaire (2017),<sup>16</sup> and the WHO KAP questionnaire about COVID-19.<sup>17</sup> The proposed questionnaire has three parts related to knowledge (n = 26) on a dichotomous scale (true = 1 and false/I do not know = 0), attitude (n = 8) on a 7-point Likert-type scale (from strongly disagree = 1 to strongly agree = 7), and practice (n = 11) on a five-point Likert-type scale (never = 1, rarely = 2, sometimes = 3, most of the time = 4, and always = 5).

## Face Validity

To evaluate face validity, the questionnaire was given to 14 experts including epidemiologists, anatomists, physicians,

virologists, and health educators. The panel checked the level of difficulty, appropriateness, and ambiguity of each question and scored each question as quite important (= 5), somewhat important (= 4), moderately important (= 3), slightly important (= 2), and not important (= 1). Then, the percentage of experts, who selected items 5 and 4 (frequency %), and the average importance score were calculated, and then the impact score (IS = frequency \* Importance) of each question was computed using the mentioned parameters. If the IS of the question was equal to 1.5 or greater, it remained in the questionnaire, otherwise, it was excluded from it.<sup>18</sup>

## Content Validity

Both qualitative and quantitative approaches were used to assess content validity. First, the questionnaire was reviewed by 14 experts in terms of the appropriate use of words and appropriate scoring. Then, content validity was measured with a quantitative approach using Content validity ratio (CVR), content validity index (CVI), and the modified kappa statistic (K\*). The CVR and CVI evaluate the necessity of the questions and their relevance, respectively.<sup>19</sup>

In this approach, the panel commented if the question was essential, useful, not essential, or not necessary. Then, the CVR for each question was calculated based on the following formula:

$$CVR = (N_e - N / 2) / (N / 2).$$

“N<sub>e</sub>” is the number of the panel of experts selecting the essential option and “N” is the total number of the panel of experts (N = 14). Based on the Lawshe table and considering the number of experts, the minimum acceptable CVR for each question was considered 0.51.

The relevance scale was applied to measure the CVI. The experts had to select one option among several options (irrelevant = 1, item needs revision = 2, relevant but needs a little revision = 3, and fully relevant = 4) for each question. To calculate this index for each question, the number of panels selecting items with a value of 3 and 4 were divided into the total number of experts. Questions with values above 0.70 remained in the questionnaire while items with less values less than that were removed from the questionnaire. The content validity of the whole instrument (S-CVI) was computed by averaging the I-CVI of individual questions. The minimum acceptable value for S-CVI was 0.80.<sup>19</sup>

## CVI Compliance With Chance Agreement

The CVI does not take into account the chance agreement. Therefore, a modified kappa statistic (K\*), which is a combination of kappa and CVI, was employed to correct this index.

$$K^* = (I - CVI - PC) / (1 - PC).$$

where PC represents the chance agreement that is expressed by the following formula:

$$PC = [N! / A! (N - A)!] \times 0.5 \times N$$

“N” is the number of experts and A denotes the number of experts who approved the relevance of the question. For Kappa interpretation, values greater than 0.75, 0.6-.74, and 0.4-.59 were excellent, good, and fair, respectively.<sup>20</sup>

### Construct Validity

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to extract hidden factors. Kaiser-Meyer-Olkin (KMO) and Bartlett tests were performed to determine sampling adequacy. The minimum acceptable value for KMO was 0.7. Scree plot, eigenvalue, and factor rotation were applied for extracting factors. Moreover, the CV value was employed to confirm a question related to a factor. CV is the minimum value for a question to remain in a factor and is expressed by the following formula:

$$CV = 5.152 \div \sqrt{(n-2)}$$

“n” is the sample size of the study. In this study, CV was approximately 0.3. Finally, the parsimonious comparative fit index (PCFI, acceptable range >0.5), chi-square *P* value (in AMOS, the chi-square value is called CMIN), acceptable range >0.05), the root means square error of approximation (RMSEA, acceptable ranges <0.08, 0.08-0.1, and >0.1 represent good, moderate, and week levels, respectively), adjusted goodness of fit index (acceptable range > 0.8), and chi-square/freedom ratio (CMIN/DF, acceptable ranges <3 and <5 are good and acceptable, respectively), were examined to evaluate the final model for its factor structures.

### Reliability

Overall, 360 people were selected for checking the reliability. To confirm the reliability of the questionnaire, the split-half coefficient and Spearman-Brown coefficient (with equality of variance between the two halves of the questions) were calculated for the knowledge domain. The Cronbach’s alpha coefficient was computed for the attitude and practice domain. The minimum acceptable coefficient for Cronbach’s alpha was considered to be 0.70. Further, the McDonald Omega coefficient was estimated for correcting Cronbach’s alpha, which is affected by the number of questions and inverse scores. Item-total statistics including scale mean and variance were reported in case of item deletion and corrected item-total correlation. SPSS 26 and AMOS v. 24 were used to analyze the data.

## Results

### Face Validity

In the qualitative phase, the wording and importance of each question was evaluated and some changes were made accordingly. Two questions with an IS of less than 1.5 were

excluded from the questionnaire (Table 1).

### Content Validity

Amendments were made to the questionnaire according to the experts’ opinions. Six questions were removed after calculating the CVI, CVR, and  $K^*$  for each question (Table 2). The S-CVI for the remaining questionnaire was 0.82, which is acceptable.

### Construct Validity

EFA and CFA were performed to evaluate the construct validity of the scale. In total, 360 individuals were included in the study.

Table 2 presents the demographic characteristics of the participants. The KMO value was 0.90, indicating the adequacy of the sample size for factor analysis. The significance of the Bartlett test (chi-square: 5820.06, *df*: 630,  $P < 0.001$ ) represents a strong correlation between the questions and the appropriateness of factor analysis.

The number of factors was determined through a Scree plot, eigenvalue, and factor rotation. According to Scree plot evaluations, 4 factors were appropriate (Figure 1). Based on the eigenvalue, 10 factors with eigenvalues greater than 1 were identified, describing 63.20% of the total variance. Finally, based on the Scree plot, the characteristics of the items, and factor rotation, 4 factors, which accounted for 43.55% of the total variance of the questionnaire, were considered as structural factors. The presence of an item in a factor was based on the CV value (approximately 0.3). At this stage, one question was removed from the study structure (Table 1). The chi-square test of CFA was used to confirm the final model [34 questions and 4 factors,  $\chi^2$  (492,  $N = 360$ ) = 597.655,  $P < 0.001$ ]. The intended indices (PCFI: 0.83, CMIN/DF: 1.21, RMSEA: 0.055, and PNFI: 0.0827) confirmed the final model fit.

Eventually, 34 questions remained in the questionnaire in 4 areas. Two domains were related to knowledge and included information about the virus and ways of prevention. The third and fourth domains belonged to attitude and practice, respectively.

### Reliability

The split-half coefficient and Spearman-Brown coefficient were 0.54 and 0.70 for the knowledge part, respectively.

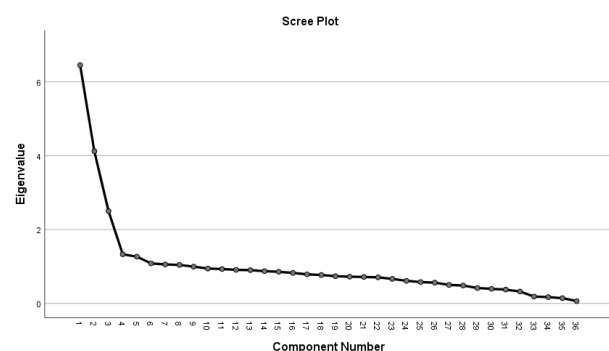


Figure 1. The Number of Factors Through the Scree Plot.

**Table 1.** IS, CVI, CVR, and Adjusted Kappa in Evaluating the Face, Content, and Construct Validity of the COVID-19-KAP Scale

Row	Items	Content Validity				Face Validity	CV-Value	Interpretation Items
		I-CVI	CVR	K*	Interpretation K*	IS		
<b>Knowledge Questions</b>								
1	What is the cause of COVID-19 disease?	1	0.66	1	Excellent	2.80	0.57	Remained
2	What does the isolation period of people with COVID-19 disease?	1	0.83	1	Excellent	3	0.36	Remained
3	Which organ is most affected by the COVID-19?	1	0.83	1	Excellent	3	0.32	Remained
4	The main clinical symptoms of COVID-19 are fever, fatigue, and dry cough.	1	0.83	1	Excellent	3	0.35	Remained
5	Unlike colds, purulent noses, runny noses, and sneezing are less common in people infected with the coronavirus.	0.91	0.83	0.90	Excellent	3	0.54	Remained
6	There is currently no effective treatment for the COVID-19, but early symptomatic and supportive treatment can help most patients recover from this disease.	1	0.83	1	Excellent	3	0.50	Remained
7	Not everyone with the COVID-19 will experience a severe condition. The elderly having chronic pre-existing conditions and smokers are more likely to get severe forms.	0.91	0.83	0.90	Excellent	3	0.41	Remained
8	Eating or having contact with wild animals can lead to the COVID-19.	0.83	0.50	-	-	2.80	-	Eliminated
9	People with the COVID-19 cannot infect other individuals if they do not have a fever.	1	0.83	1	Excellent	2.80	0.06	Eliminated
10	The COVID-19 can be spread through the respiratory droplets of infected people.	1	1	1	Excellent	3	0.31	Remained
11	People can use masks to prevent the COVID-19 infection.	1	0.66	1	Excellent	3	0.34	Remained
12	Children and adults, due to their high immunity, do not need to adherence the hygiene protocol.	-	-	-	-	1.08	-	Eliminated
13	To prevent getting the COVID-19, people should avoid going to crowded places such as train stations and public transportation.	0.91	0.83	0.90	Excellent	3	0.65	Remained
14	Isolation and treatment of people infected with the COVID-19 are effective ways to reduce the prevalence of the COVID-19.	0.91	1	0.90	Excellent	3	0.43	Remained
15	Washing hands with soap and water and using a mask can help prevent the transmission of the COVID-19.	0.91	1	0.90	Excellent	3	0.66	Remained
16	The COVID-19-vaccine is available in the market.	0.83	0.33	-	-	2.58	-	Eliminated
17	Someone who gets the COVID-19 becomes invulnerable.	0.91	0.33	-	-	2.80	-	Eliminated
18	A person infected with the COVID-19 does not necessarily become immune.	0.91	.42	-	-	2.58	-	Eliminated
19	The COVID-19 is transmissible.	0.91	0.33	-	-	2.80	-	Eliminated
20	The COVID-19 has been transmitted from animals to humans.	0.91	0.83	0.90	Excellent	3	0.31	Remained
21	The COVID-19 is not transmissible.	-	-	-	-	1.28	-	Eliminated
22	The COVID-19 is transmitted to humans through sneezing.	1	0.83	1	Excellent	3	0.36	Remained
23	The COVID-19 is transmitted to humans through the touch of the mouth and nose by an infected hand.	1	1	1	Excellent	3	0.57	Remained
24	The COVID-19 is transmitted to humans after close contact with an infected patient.	1	1	1	Excellent	3	0.72	Remained
25	The COVID-19 is transmitted to humans through touching infected surfaces.	1	1	1	Excellent	3	0.56	Remained
<b>Attitude Questions</b>								
1	Using a standard mask protects me from the COVID-19.	0.91	1	0.90	Excellent	3	0.52	Remained
2	Washing my hands regularly with soap and water can protect me from the COVID-19.	1	1	1	Excellent	3	0.81	Remained
3	Not going to crowded places will protect me from the COVID-19.	1	1	1	Excellent	3	0.90	Remained
4	Cooking food can thoroughly protect me against the COVID-19.	0.91	0.66	0.90	Excellent	2.80	0.81	Remained
5	Washing fruits and vegetables can protect me against the COVID-19.	1	0.83	1	Excellent	3	0.91	Remained

Table 1. Continued

Attitude Questions								
6	The COVID-19 will be controlled by following health guidelines.	0.91	0.66	0.90	Excellent	3	0.91	Remained
7	Avoiding unnecessary travel can protect me against the COVID-19.	0.91	1	0.90	Excellent	3	0.93	Remained
8	Staying home during the COVID-19 pandemic can protect me against it.	1	1	1	Excellent	3	0.91	Remained
Practice Questions								
1	Have you been in crowded places since the COVID-19 epidemic in Iran?	1	1	1	Excellent	3	0.41	Remained
2	Have you used protective equipment (e.g., gloves, masks, and disinfectant gels) since the COVID-19 epidemic in Iran?	1	1	1	Excellent	3	0.71	Remained
3	Have you used disinfectants for your hands in the absence of soap and water since the COVID-19 epidemic in Iran?	1	0.83	1	Excellent	3	0.59	Remained
4	Have you eaten foods that are healthy and boost your immune system since the COVID-19 epidemic in Iran?	1	.33	-	-	-	-	Eliminated
5	Have you avoided touching your eyes, nose, or mouth (when you are unsure of the cleanliness of your hands) since the COVID-19 epidemic in Iran?	1	1	1	Excellent	3	0.56	Remained
6	Have you blocked your nose and mouth when you cough or sneeze since the COVID-19 epidemic in Iran?	1	1	1	Excellent	3	0.59	Remained
7	Have you kept your distance (at least one and a half meters) from others since the COVID-19 epidemic in Iran?	1	0.83	1	Excellent	3	0.70	Remained
8	Have you been washing your hands frequently with soap and water since the COVID-19 epidemic in Iran?	1	1	1	Excellent	3	0.68	Remained
9	Have you used a mask when leaving the house since the COVID-19 epidemic in Iran?	1	1	1	Excellent	3	0.71	Remained
10	Have you refrained from close contact since the COVID-19 epidemic in Iran?	1	1	1	Excellent	3	0.52	Remained
11	Have you adhered to health protocols since the COVID-19 epidemic in Iran?	1	0.66	1	Excellent	3	0.76	Remained

Note. IS: Impact score; COVID: Coronavirus disease; KAP: Knowledge, attitude, and practice; CVR: Content validity ratio; CVI: Content validity index.

Table 2. Demographic Characteristics of Participants in the Study for Evaluating Construct Validity and Cronbach's Alpha Coefficient

Variables	No. (%)
Gender	Male 134 (37.2)
	Female 226 (62.8)
Education	High school diploma or less 125 (34.7)
	Graduate diploma 47 (13.1)
	Bachelor 125 (34.7)
	Masters/doctorate 63 (17.5)
Marital status	Married 273 (75.8)
	Single 79 (21.9)
	Divorced/widow 8 (2.3)
Job	Unemployed 18 (5.0)
	Manual worker 15 (4.2)
	Student 48 (13.3)
	Freelance 39 (10.8)
	Employee 123 (34.2)
	Housewife 117 (32.5)
Financial situation	Good 50 (13.9)
	Moderate 238 (66.1)
	Poor 72 (20.0)

In addition, Cronbach's alpha coefficient for attitude and practice was 0.93 and 0.82, respectively, confirming the

high internal consistency of the questionnaire. McDonald Omega coefficient for the attitude and practice sections was 0.93 and 0.82, respectively. These values were the same as Cronbach's alpha coefficients. Item-total statistics are provided in Table 3.

## Discussion

The psychometric properties of the KAP questionnaire about COVID-19 were approved with 34 questions and four structural factors. The psychometric assessment provided strong evidence for the validity and reliability of this questionnaire. Some studies reported that the level of knowledge, attitude, and practice of individuals is associated with the control and prevention of diseases.<sup>21-23</sup> The low level of knowledge, attitude, and practice has been one of the most important risk factors for poor health, non-compliance with healthcare measures, and reduction of preventive behaviors.<sup>24,25</sup> The lack of a definitive treatment for COVID-19 has made prevention strategies the only way to deal with this disease and has increased the importance of training in this regard.<sup>26</sup> The success or failure of these strategies and the consequent control of the disease largely depend on the practice of the community.<sup>27</sup> According to evidence, knowledge about COVID-19 can also affect attitudes and practice toward this disease.<sup>28</sup> KAP toward COVID-19 disease play a key role in determining

**Table 3.** Item-total Statistics (Mean, Variance, and Correlation) for Attitude and Practice Section (N = 360)

Items	Skewness	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation
A1	-0.914	43.53	116.20	0.508
A2	-1.818	42.93	106.82	0.837
A3	-2.312	42.69	106.57	0.879
A4	-1.927	42.94	108.4	0.759
A5	-2.269	42.72	108.50	0.894
A6	-2.410	42.70	108.03	0.846
A7	-2.673	42.62	107.23	0.913
A8	-2.710	42.61	106.81	0.917
P1	-1.219	39.19	26.07	0.395
P2	-1.334	39.29	23.62	0.602
P3	-1.460	39.17	25.08	0.448
P4	-1.474	39.29	24.04	0.467
P5	-2.576	38.83	26.02	0.521
P6	-1.048	39.40	24.40	0.581
P7	-2.110	38.89	25.43	0.601
P8	-1.035	39.52	22.52	0.597
P9	-3.130	38.83	25.65	0.452
P10	-1.774	38.93	25.76	0.641

Note. A: Attitude; P: Practice.

the community's readiness to accept behavior changes and follow the existing strategies in these critical situations.<sup>29</sup> Improper attitudes and practices directly increase the risk of infection.<sup>30</sup> Therefore, determining the knowledge, attitude, and practice of the community and its subgroups during the COVID-19 pandemic is extremely important for planning prevention strategies and increasing adjustment.<sup>27</sup> This study focused on constructing a questionnaire of KAP-COVID-19.

Our study examined the validity of the questionnaire in terms of face validity, content, and structure. At each stage, appropriate indicators were used to examine the questions.<sup>31-33</sup> Both quantitative and qualitative examinations of the face and content validity were considered so that to put more precision on the agenda.<sup>34</sup> Furthermore, a suitable sample size was considered for construct validity, which was confirmed by KMO.<sup>35</sup> Similarly, RMSEA, PCFI, CMIN/DF, and PNFI were applied to fit the model. Another study considered these indicators to be sufficient.<sup>36</sup> Our findings showed the appropriateness of the questionnaire, and all fit indices were in acceptable values, thus supporting the validity of the structure.<sup>37</sup> Some questionnaires do not have accurate psychometric measurements.<sup>38-40</sup> Some studies used questionnaires without psychometrics or questionnaires that have not been cultured for their target population.<sup>41</sup> The developed questionnaires in Iran only examine knowledge and attitude<sup>42</sup> or lack proper trans-cultural dimensions.<sup>43</sup>

This is the first study to accurately develop and investigate the psychometric properties of the KAP-

COVID-19 instrument in Iran. Several points should be considered when applying this questionnaire. Its application in other countries should be cultured, and the reliability of this questionnaire should be reported again in each population.

### Conclusion

The validity and reliability of the Farsi KAP-COVID-19 questionnaire were confirmed with 34 questions and 4 factors. The questionnaire is a reliable tool for measuring the KAP of COVID-19 in the Iranian community and can be used in different populations.

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### Authors' Contribution

ST, MM, ZJ, VK, AA, and NK wrote the first draft, and the statistical analysis was conducted by NM and ST. All authors contributed to collecting data, interpreting the results, and commenting on the initial manuscripts.

### Conflict of Interest Disclosures

The authors declare that there is no conflict of interests.

### Ethical Approval

The ethics approval was obtained from Shahrekord University of Medical Sciences (with the ethical code IR.SKUMS.REC.1399.026).

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