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# Challenges in the clinical education environment during the outbreak of COVID-19: Development and psychometric testing

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## Abstract:

**BACKGROUND:** COVID-19 pandemic poses unique physical and emotional challenges in providing clinical education. Failure to identify the challenges and problems that students face in the clinical learning environment hinders their effective learning and growth. Consequently, the progress of their skills is affected. The aim of this study was to develop a challenge in the clinical education environment of medical students during the outbreak of COVID-19 questionnaire and to test its psychometric properties.

**MATERIALS AND METHODS:** This study is part of a larger study that was conducted using a combined consecutive method in Qazvin. In the first stage, a phenomenological study was performed with van Manen's method by interviewing 12 students at Qazvin University. To extract the items of the tool in the second stage, the concept was defined. Ultimately, the psychometric properties of the questionnaire were evaluated with face validity, content validity (quantitative and qualitative), construct validity (exploratory factor analysis), internal consistency (Cronbach's alpha), and test-retest reliability (intraclass correlation coefficient).

**RESULTS:** The initial tool had 70 questions. After validation, 53 items remained in the final questionnaire. Four extracted dimensions were as follows: "Inadequate professional competency," "Inefficient clinical planning" and "outcomes of learning-teaching activities," and "the challenges related to the stigma of medical staff." Cronbach's alpha for the whole questionnaire was 0.98 (range: 0.87–0.98). The test-retest (intraclass correlation coefficient) reliability was 0.98 ( $P < 0.001$ ).

**CONCLUSIONS:** According to the obtained results, if the items of "Inadequate professional competency," "Inefficient clinical planning" and "outcomes of learning-teaching activities," and "the challenges related to the stigma of medical staff," the challenges of students' clinical education can be reduced during the COVID-19 outbreak.

## Keywords:

COVID-19, education, psychometrics, surveys and questionnaires

## Introduction

Covid-19 pandemic poses unique physical and emotional challenges in providing clinical education.<sup>[1,2]</sup> It has severely disrupted the clinical education process and health-care systems around

the world.<sup>[3]</sup> The pandemic poses major challenges to clinical education, which, due to its focus on Covid-19 patients, limits the care of other patients, thus limiting the opportunity for medical students to experience a variety of clinical training.<sup>[4,5]</sup>

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So far, no study has been found on the tools for measuring the challenges of the clinical environment during the outbreak of COVID-19, but qualitative studies have examined the challenges of clinical education of students, including the study of Abbaszadeh *et al.* believed that for effective clinical training, in the first stage, flexible planning should be done based on educational needs and the way of providing theoretical and practical courses should be coordinated with each other as much as possible; in addition, the profession job dissatisfaction and unsafe care environment were mentioned as future professional challenges.<sup>[6]</sup> Aboshaiqah *et al.*, which addressed the experiences of Saudi student nurses using Competences for Educational Testing (CCET) that their clinical learning challenges included ambiguous evaluation, unsupported learning environment, and inappropriate outcomes of clinical learning. The ambiguous evaluation was the most common component of clinical challenges. Afterward, the “unsupported learning environment” followed by “inefficient competency” was gained including “excessive need,” “exams unrelated to clinical concepts,” and “lack of reliable methods for evaluation,” when “theoretical knowledge is not applied in the clinical setting,” “insufficient opportunity to perform procedures,” “inadequate preparation for clinical exposure,” and “inappropriate patient care planning” were the most common components of clinical challenges.<sup>[7]</sup> Failure to identify the challenges and problems that students face in the clinical learning environment hinders their effective learning and growth. Consequently, the progress of their skills is affected.<sup>[8]</sup>

Students are the best and most reliable resources for examining clinical training problems because they are directly present in this process and have direct interaction with it. As instructors’ service recipients, they are the best source for identifying their teachers’ clinical training behaviors.<sup>[9]</sup>

Given the importance of the issue and that we should be aware of the various dimensions of the challenges and concerns of COVID-19, all efforts should be made to explore students’ experiences in this regard. Since so far, limited studies have been conducted to examine the tools in the field of challenges in the clinical education environment of medical students in relation to COVID-19 in the country, so the research team decided to conduct a study aimed at psychometrical analysis, a suitable tool for assessing the challenges in the clinical education environment of medical students during the outbreak of COVID-19.

## Materials and Methods

### Study design and setting

Developing the questionnaire and assessing its

psychometric properties were performed through a cross-sectional study. The setting was Qazvin University of Medical Sciences, Qazvin, Iran. In this study, the tool to investigate the challenges in the clinical education environment of students in the epidemic of COVID-19 was designed and psychometrically analyzed in three stages and in the following order.

### Study participants and sampling

Medical students participated in this study. Sampling was done using the census method in the research environment. First, a list of students of Qazvin University of Medical Sciences in all academic levels and from all fields was prepared, and then students were entered into the study by random classification. After obtaining informed written and oral consent, the tool designed in the present study was completed by 200 students. In the present study, 12 participants of both genders (6 females and 6 males) with undergraduate education level (2 students), medical and intern students (3 students), and residents from different faculties (7 people) of Qazvin University of Medical Sciences were interviewed (in-depth and semi-structured).

Inclusion criteria for participants were to study in one of the fields of medical sciences and the ability of hearing and speech, and exclusion criteria were incompletely answering to interview questions and lack of consent to participate in the study. Sampling continued until data saturation was reached. Sampling continued until data saturation was reached.

### Data collection tool and technique

In the qualitative part of the research, the researcher explained the purpose of the study to the participants and showed them the permission obtained. After obtaining the informed and written consent of the participants, the interview and recording was done with their permission. In all interviews, participants’ names were removed and code letters were used instead, and their values and decisions were respected. Participants’ confidentiality and freedom to participate in or leave the study were also considered, and they had the right to leave the research at any stage. In addition, individuals’ private information was kept confidential, and participants in the study were thanked at the end of each interview.

In the coding process, each interview initially was read several times and this question was asked: “which statements are necessary to a deep understanding of the experiences of the students regarding the challenges of the clinical education environment.” Then, the statements were identified and underlined and their meanings and interpretations were written down. Finally, the thematic sentences were merged and categorized so that the major themes and minor

categories were obtained. After initial coding, 130 codes were extracted. The similar items were omitted and the codes were reduced to 113; as a result, 15 categories and 5 themes were discovered. The accuracy of the qualitative findings was confirmed by assessing their validity, verifiability, reliability, and transferability.<sup>[10]</sup>

To design and determine the phrases of the aforesaid tools, students' experiences of the challenges in the clinical education environment in the COVID-19 pandemic were obtained and recorded using a study of hermeneutic phenomenology based on the van Manen's method.<sup>[11]</sup> Data collection began as a purpose-based process using semi-structured interviews, observation, and note taking and then continued by theoretical sampling method until data saturation.

At this stage, to design a "tool to assess the challenges in the clinical education environment," first, the phrases from the text of interviews and notes were extracted, then by literature review, the comprehensiveness and completeness of the phrases were ensured. Finally, the phrases of the tool were designed. The exact definitions of theoretical and practical words in designing tools in this stage were done. Challenges in the clinical education environment of medical students included four dimensions: "Inadequate professional competency," "Inefficient clinical planning" "outcomes of learning-teaching activities," and "the challenges related to the stigma of medical staff," which in the compiling of initial phrases were used.

Psychometrical analysis of the tools as face validity; content validity (quantitatively and qualitatively); structural validity (exploratory factor analysis); internal consistency (Cronbach's alpha); and stability (retest reliability) was evaluated. In the present study, two qualitative and quantitative methods were used to determine the face validity of the "assessment tool of the challenges in the clinical education environment." In determining the qualitative face validity of cases, the level of difficulty in understanding the phrases, the degree of inconsistency, and ambiguity, i.e., the possibility of misinterpretations of the phrases, were examined.<sup>[11]</sup>

The research tool was evaluated in terms of writing, sentence structure, and logical appearance, as well as based on the opinion of experts in the tool judgment stage. After correcting the mentioned items, in the next step to reduce and eliminate inappropriate phrases and determine the importance of each phrase, the quantitative method of the phrase effect was used.<sup>[12]</sup>

The content validity was assessed using the Waltz–Basel content validity index (CVI) by 20 university faculty

members and other experts in this field. In the Waltz and Basel CVI, first, the "relevance" of each phrase in the tool was evaluated based on a three-part index with four scores (ranged from 1 to 4). If the score of "relevance" of a phrase in the questionnaire was more than or equal to 0.79, the phrase was retained in the tool and if this score was between 0.70 and 0.79, the phrase was corrected and revised and if it was <0.70, the phrase was deleted.<sup>[13]</sup> Similarly, based on this index, the "clarity" and "simplicity" of the phrases were assessed.

To measure the content validity, the content validity ratio (CVR) was used according to the Lawshe's table. In other words, 20 faculty members and experts in this field were asked to determine the necessity of each phrase in a 3-point Likert scale (necessary [3], useful but not necessary [2], and not necessary [1]). Then, the content validity of the questionnaire phrases was calculated.<sup>[14]</sup> According to Lawshe's table, the minimum acceptable value was calculated to be 0.42; therefore, phrases with a value higher than 0.42 were retained and phrases with a lower value were deleted.<sup>[14]</sup>

It should be noted that the score obtained from determining the CVR was compared with the criteria in Lawshe's table. If the score obtained was higher than the number in the table, it indicated that the presence of that phrase with an acceptable level of statistical significance ( $P < 0.05$ ) in the tool was necessary and important.<sup>[14]</sup>

To determine the validity of the construct (factor analysis) and the reliability of the research tool, first, to determine the suitability and adequacy of the samples for factor analysis, the KaiserMeyerOlson sampling adequacy index test was used, and then factor analysis was conducted. In the next step, to determine the number of constructive factors of the research tool and extract them, the methods of Pebble diagram and eigenvalue diagram were used and varimax rotation to discover the class of variables having the most relationship with each other.

To determine the number of phrases related to each factor, the factor load of each phrase was used. The correlation of each variable with each factor is called factor load and the value varies between  $-1$  and  $+1$ .<sup>[15]</sup> The cutoff point for the factor load to extract factors has been considered differently in different studies.<sup>[16]</sup> In the present study, the cutoff point was considered to be 0.3.

To measure the reliability of the present tool, in terms of internal consistency, the Cronbach's alpha method and test–retest were used. To determine the correlation of the scores obtained from the test–retest,

the intraclass correlation coefficient was used for each factor and the whole tool. The final tool was set with four dimensions.

In the phenomenological analysis, based on the description of the participants' experiences, the themes of assessing the challenges in the clinical education environment of medical students during the outbreak of COVID-19 were identified and the dimensions were determined according to the phenomenological study. The exact definitions of theoretical and practical words in designing tools in this stage were done. Challenges in the clinical education environment of medical students included four dimensions: "Inadequate professional competency," "Inefficient clinical planning" "outcomes of learning-teaching activities," and "the challenges related to the stigma of medical staff," which in the compiling of initial phrases were used. At the end of this stage, an initial questionnaire with 70 questions was prepared. It should be mentioned that in this stage, the literature review was used to complete the dimensions and phrases, but nothing was added to these phrases.

In the next stage, during two sessions, it was reviewed by experts (research team) to ensure the accuracy of the phrases and to find overlapping and repetitive cases and final confirmation was done. Some of the phrases that were somehow repeated were removed, the phrases that could be merged were integrated, and some of the phrases were changed so that eventually it was reduced to 64 phrases. By performing qualitative and quantitative face validity, incomprehensible and extra phrases with an impact coefficient of <1.5 were removed and too after examining by experts and summarizing the research team, 11 phrases were removed and the tool phrases were reduced from 64 items to 53 items.

To determine the CVR, 20 experts were asked to choose one of the options for each of the 75 phrases (necessary, useful but not necessary, and not necessary) and to calculate the CVR, the percentage of those who had chosen option 1 (necessary) was calculated.

Considering the number of 20 experts, according to Lawshe's Table 2012,<sup>[14]</sup> the phrases with a score below 0.42 should be removed, which was done according to the opinion of the experts.

To determine the CVI of the tool, the percentage of those who gave a score of 3 or 4 for each of the options of "relevance," "clarity," and "simplicity" was calculated.<sup>[8]</sup> They were asked to comment on deleting, modifying, or adding some phrases to the tool based on the Waltz-Basel (2005) CVI. Afterward, the modified tool was given to a number of students and they were asked to express their views on the

comprehensiveness of the content, the clarity, and simplicity of its phrases. To determine the construct validity (exploratory factor analysis) of the research tool, 200 students were selected by the stratified random method.

### Ethical consideration

In this study, all ethics were observed so that, after receiving a written letter of introduction from the Vice Chancellor for Research of Qazvin University of Medical Sciences, sampling began (code ethical: IR. QUMS. REC.1399.269).

After determining the tool's phrases and performing factor analysis on them, Cronbach's alpha coefficient for each dimension and the whole tool was calculated to determine the internal consistency of the tool. The Cronbach's alpha of the whole tool was 0.98 and Cronbach's alpha of the dimensions was in the range of 0.87–0.98, indicating the existence of an appropriate internal correlation in each of the dimensions and the whole tool. The stability of the tool was assessed using the reliability of the test-retest method. After reviewing the construct validity and a period of 2 weeks' interval, 20 students were asked to complete the questionnaire again. The intraclass correlation coefficient was calculated using SPSS software version 20 [Table 1].

The matrix rotation was performed to maximize the relationship between variables and some factors. The factor load of each phrase should be at least 0.3 and preferably higher so that each dimension has at least three questions [Table 2].

In scoring the phrases in the tool, using the Likert scale, each item included "never" (score 0), "rarely" (score 1), "occasionally" (score 2), "often" (score 3), and "always" (score 4). Due to the existence of 53 phrases, the minimum and maximum tool scores were calculated between 0 and 212, and obtaining a higher score indicated the existence of many challenges in the students' clinical environment.

The Pebble diagram showed that four factors explained the factor construct of the tool. The horizontal axis represents the number of factors and the vertical axis represents the eigenvalue [Figure 1].

To determine the correlation between the variables, the rotated component matrix was used. The minimum factor load was considered to be 0.3. All phrases had a factor load above 0.3, but two phrases were omitted at this stage, according to the research team's idea.

Prior to exploratory factor analysis, the Kaiser Meyer Olson sampling adequacy index test was performed with the Kaiser-Meyer-Olkin (KMO) test of 0.94.



**Table 1: Cronbach's alpha for the tool and test-retest correlation coefficients**

Dimension	Cronbach's alpha (n=200)	Intra-class coefficients	F-test with true value 0	
			Single measures	Average measures
Inadequate professional competency	0.90	0.9	10.722	10.722
Inefficient clinical planning	0.96	0.96	29.848	29.848
Outcomes of learning-teaching activities	0.94	0.94	19.221	19.221
The challenges related to the stigma of medical staff	0.87	0.87	8.059	8.059
Total inventory	0.98	0.98	49.655	49.655
P			0<0.0001	

**Table 2: Exploratory factor analysis (rotated component matrix)**

Items (item number)	Component								
	Insufficient professional competency	Inefficient clinical planning	Outcomes of learning-teaching activities	Challenges related to medical staff stigma	Items (item number)	Insufficient professional competency	Inefficient clinical planning	Outcomes of learning-teaching activities	Challenges related to medical staff stigma
1	-	0.476	-	-	28	0.665	-	-	-
2	-	0.419	-	-	29	0.652	-	-	-
3	-	0.555	-	-	30	0.668	-	-	-
4	-	0.540	-	-	31	0.701	-	-	-
5	-	-	0.510	-	32	0.744	-	-	-
6	-	-	0.714	-	33	0.687	-	-	-
7	-	-	0.615	-	34	-	0.767	-	-
8	-	-	0.607	-	35	-	0.529	-	-
9	-	-	0.567	-	36	-	0.593	-	-
10	-	-	0.534	-	37	-	0.727	-	-
11	0.482	-	-	-	38	-	0.566	-	-
12	0.556	-	-	-	39	-	0.581	-	-
13	0.537	-	-	-	40	-	0.521	-	-
14	0.153	-	-	-	41	-	0.694	-	-
15	0.587	-	-	-	42	-	0.739	-	-
16	0.656	-	-	-	43	-	0.602	-	-
17	0.329	-	-	-	44	-	0.318	-	-
18	0.334	-	-	-	45	-	0.651	-	-
19	0.460	-	-	-	46	-	0.593	-	-
20	0.430	-	-	-	47	-	0.481	-	-
21	0.613	-	-	-	48	-	0.662	-	-
22	0.574	-	-	-	49	-	0.489	-	-
23	0.298	-	-	-	50	-	-	-	0.615
24	0.636	-	-	-	51	-	-	-	0.569
25	0.702	-	-	-	52	-	-	-	0.690
26	0.720	-	-	-	53	-	-	-	0.742
27	0.735	-	-	-	-	-	-	-	-

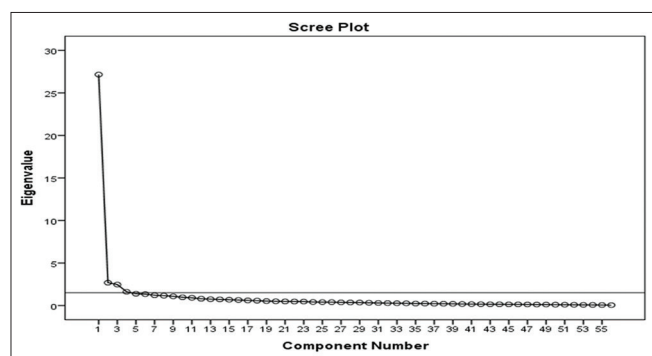


Figure 1: Scree Plot of explanatory factors

By evaluating the table of variances, about 60.57% of cumulative variance was predicted by the initial four factors with an eigenvalue >1 [Figure 1]. The first factor explained 27.15% of the variance followed by 2.68%, 2.46%, and 1.61% by the second to fourth factors. In this study, a factor load of at least 0.3 was considered to preserve the phrases. These dimensions were named as follows: “insufficient professional competency” (10 phrases), “inefficient clinical planning” (24 phrases), “outcomes of learning-teaching activities” (12 phrases), and “challenges related to medical staff stigma” (7 phrases). In total, the number of phrases reached was 53 [Table 3].

Table 4 shows that according to the Pearson correlation test, there was a significant relationship between insufficient professional competency dimension with inefficient clinical planning dimension ( $P < 0.001$ ) and outcomes of learning-teaching activities dimension with inefficient clinical planning dimension ( $P < 0.001$ ) and challenges related to medical staff stigma dimension with inefficient clinical planning dimension ( $P < 0.001$ ) [Table 4].

### Discussion

The tool was designed to assess the challenges in the clinical education environment of medical students during the outbreak of COVID-19, with 53 phrases in 4 dimensions with optimal validity and reliability. To design this tool, a deductive-inductive approach was used in such a way that after extracting the themes from the interviews conducted with the phenomenological approach, a literature review was used to increase the dimensions and phrases. However, no new phrase was found by literature review. The number of phrases in the dimensions is as follows: “insufficient professional competency” (10 phrases), “inefficient clinical planning” (24 phrases), “outcomes of learning-teaching activities” (12 phrases), and “challenges related to medical staff stigma” (7 phrases).

The Cronbach’s alpha of the whole tool was 0.98 and Cronbach’s alpha of the dimensions was in the range of 0.94-0.84, indicating the existence of an appropriate internal correlation in each of the dimensions and the whole tool. Besides, the results of test-retest with a correlation coefficient of 0.98 and  $P < 0.0001$  showed that the tool “assessing the challenges in the clinical education environment of medical students during the outbreak of COVID-19” had proper reliability.

This pandemic poses major challenges to clinical education that can lead to limit caring of a patient due to the focus of the health care on COVID-19 patients and limit access to clinical education opportunities for medical students. Therefore, informing the university officials, especially the faculty officials and the heads of the departments about the challenges in the clinical education environment of medical students during the outbreak of COVID-19, using this tool can be useful in developing educational and clinical programs for medical students.

In searches conducted by researchers, no study was found examining the tool of the challenges in the clinical education environment of medical students during the outbreak of COVID-19. One of the studies examining the challenges in the clinical environment was Aboshaiqah

**Table 3: Total variance explained by the first fourth principal components**

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	Percentage of variance	Cumulative (%)	Total	Percentage of variance	Cumulative (%)	Total	Percentage of variance	Cumulative (%)
Insufficient professional competency	27.156	48.493	48.493	27.156	48.493	48.493	11.273	20.131	20.131
Inefficient clinical planning	2.684	4.793	53.286	2.684	4.793	53.286	9.885	17.652	37.782
Outcomes of learning-teaching activities	2.465	4.402	57.688	2.465	4.402	57.688	8.150	14.554	52.337
Challenges related to medical staff stigma	1.614	2.882	60.570	1.614	2.882	60.570	4.611	8.233	60.570

**Table 4: Correlations component challenges in the clinical education environment of medical students during the outbreak of Covid-19**

Component	Insufficient professional competency	Inefficient clinical planning	Outcomes of learning-teaching activities	Challenges related to medical staff stigma
Insufficient professional competency				
Pearson correlation	1			
P				
Inefficient clinical planning				
Pearson correlation	0.834	1		
P	0<0.001			
Outcomes of learning-teaching activities				
Pearson correlation	0.744	0.824	1	
P	0<0.001	0<0.001		
Challenges related to medical staff stigma				
Pearson correlation	0.572	0.650	0.663	1
P	0<0.001	0<0.001	0<0.001	

and colleageous. They addressed the experiences of Saudi student nurses using Competences for Educational Testing (CCET) that their clinical learning challenges included ambiguous evaluation, unsupported learning environment, and inappropriate outcomes of clinical learning. The ambiguous evaluation was the most common component of clinical challenges. Afterward, the “unsupported learning environment” followed by “inefficient competency” was gained including “excessive need,” “exams unrelated to clinical concepts,” and “lack of reliable methods for evaluation,” when “theoretical knowledge is not applied in the clinical setting,” “insufficient opportunity to perform procedures,” “inadequate preparation for clinical exposure,” and “inappropriate patient care planning” were the most common components of clinical challenges.<sup>[17]</sup>

Jamshidi and *et al.* stated that the challenges of nursing students in dealing with the clinical learning environment, three main themes emerged: ineffective communication, inadequate readiness, and emotional reactions.<sup>[8]</sup>

Heidari and Norouzadeh showed that the tasks and objectives in planning patient care received low ratings at the beginning made the student nurses’ learning more challenging. Furthermore, bringing together the context of theory in lectures and manuals in clinical areas is a recommended strategy in resolving the theory–practice gap.<sup>[17]</sup> Mabuda *et al.* stated a clinical setting that is rich in learning experiences, but lacking a supportive environment, discourages learners from seeking experience.<sup>[18]</sup>

In their study, Fathi *et al.* examined the challenges of health-care practitioners during the outbreak of Covid-19 in Qom. Interviews with health-care practitioners reveal that one of the most important challenges was to reduce interpersonal relationships and coronavirus stigma (distance from others due to fear of transmission of virus and loneliness and avoiding others from medical staff because of fear of infection were the experiences of the medical staff that caused social stigma.<sup>[19]</sup>

Duy *et al.* used Berger’s HIV Stigma Scale to measure experienced stigma and its association with mental health problems among health-care workers in Vietnam, with higher scores, indicated higher levels of stigma. Three dimensions were obtained from factor analysis, including “negative self-image”, “concerns about revelation and personal stigma”, and “concerns about society’s attitudes”. The Cronbach’s alpha was proper in all factors, ranging from 0.75 to 0.86.<sup>[20]</sup>

Since generalization in qualitative research is limited, we cannot generalize the results to the whole country

because the interviews were conducted only with students of Qazvin University of Medical Sciences.

### Limitations

The generalization of the results of this study is limited because the participants belonged to only one province. However, since in this province, the students of different fields of medical sciences live in Qazvin and surrounding cities, the researcher controlled this limitation by the variety in choosing participants. Other limitations that can be mentioned are the low sample size and the use of a small and limited number of students in some fields of medical sciences. The nature of the self-report cannot exclude the possibility that respondents provided responses affected by challenge clinical factors.

### Conclusions

Using the tool assessed in this research, university and faculty officials can identify the challenges in the clinical education environment during the outbreak of COVID-19, and by modifying them, the quality of theoretical and clinical education of students in providing patient care during the outbreak of COVID-19 can be promoted. This pandemic poses major challenges to clinical education that can lead to limit caring of a patient due to the focus of the health care on COVID-19 patients and limit access to clinical education opportunities for medical students. Therefore, using this tool can be useful to informing the university officials, especially the faculty officials and the heads of the departments about the challenges in the clinical education environment, to develop educational and clinical programs for medical students. Moreover, policymakers of the Ministry of Health care programs can use this tool to extract the challenges in the clinical education environment during the outbreak of COVID-19.

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### Conflicts of interest

There are no conflicts of interest.

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