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Development and validation of a questionnaire for professionalism in cyber users in medical sciences in Iran

Leili Mosalanejad, Saeed Abdollahifard¹

Abstract:

BACKGROUND: Considering the importance of virtual professionalism and professional ethics in medical sciences, and the necessity to pay attention to this issue and its impact on medical professionalism, this study aimed to build a professional culture questionnaire in a virtual environment for students of medical sciences in Iran.

MATERIALS AND METHODS: This is an exploratory, sequential, mixed-methods research which was conducted in three sections. In the first section, the concept of e-professionalism in medical sciences was analyzed using the hybrid concept analysis in the theoretical work, field work, and final analysis stages in order to extract information related to the concept. In the second section, an item of the questionnaire was designed based on the concept, reviewed texts, and related questionnaires, in the third section, psychometric properties of a questionnaires were evaluated.

RESULTS: Totally, 39 items were included in the initial pool, which reduced to 33 items in the final questionnaire after reviewing the psychometric properties. Factor analyses led to extraction of five factors including appraisal of e-professionalism compliance with the laws and regulations governing cyberspace, individual professionalism, knowledge management, respect for professionalism in interpersonal and group rules, and complying with ethics in the use of cyberspace. The internal consistency of questionnaire was also confirmed by Cronbach's alpha coefficient of 0.78, also all factor correlations absed stability were significant ($P < 0.05$).

CONCLUSION: An exploratory sequential study in this study led to the extraction of five factors and development of a 33-item questionnaire in e-professionalism. As results and analysis of the psychometric properties and validation of each item, this questionnaire is valid and reliable for the assessment of levels of e-professionalism in medical sciences in Iran.

Keywords:

Cyber ethic, e-learning, Internet, medical ethic, medical sciences, netiquette, professionalism, social media, virtual learning

Department of Medical
Education, Jahrom
University of Medical
Sciences, Jahrom,

¹Department of Medical,
Student Research
Committed, Shiraz
University of Medical
Sciences, Shiraz, Iran

Address for correspondence:

Dr. Leili Mosalanejad,
Department of Medical
Education, Jahrom
University of Medical
Sciences, Jahrom, Iran.
E-mail: mosalanejad @
jums.ac.ir,

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Introduction

In recent years, with development of technology related to information and communication technology (ICT), the impact of technology on human thinking has also grown dramatically. Despit the ease of communication, using the technologymay be led to the transformation of identities and loss of human being in the virtual space.^[1]

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Like earlier digital instruments, mobile phones pave the way for new types of communication and interaction, which can also specify new paths to teaching.^[1,2] In addition, generally speaking, participants have a positive view point concerning technology and investments in technology by universities and their workplace, despite the fact that their attitudes on applying such technologies for educational purposes remain obsolete. The majority of them determined laptop as the most effective

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ICT for education and learning, followed by learning management systems and smartphones.^[3]

In some studies, it has been reported that mobile phones are used for educational purposes in clinical environments to access learning materials.^[4,5] In addition, e-learning could effectively enhance learners' knowledge and performance compared to traditional learning and improved students' clinical performance.^[6-10]

Internet-assisted mobile phones have growingly led users to access social networking sites. In fact, statistics make it possible for smartphone users to spend significantly more time on social media and social networking sites than personal computer users. Again, medical and health research has concentrated on the use of social media in high-income countries.

Such technologies enable educational participation of users outside local communities.^[11] Other research has

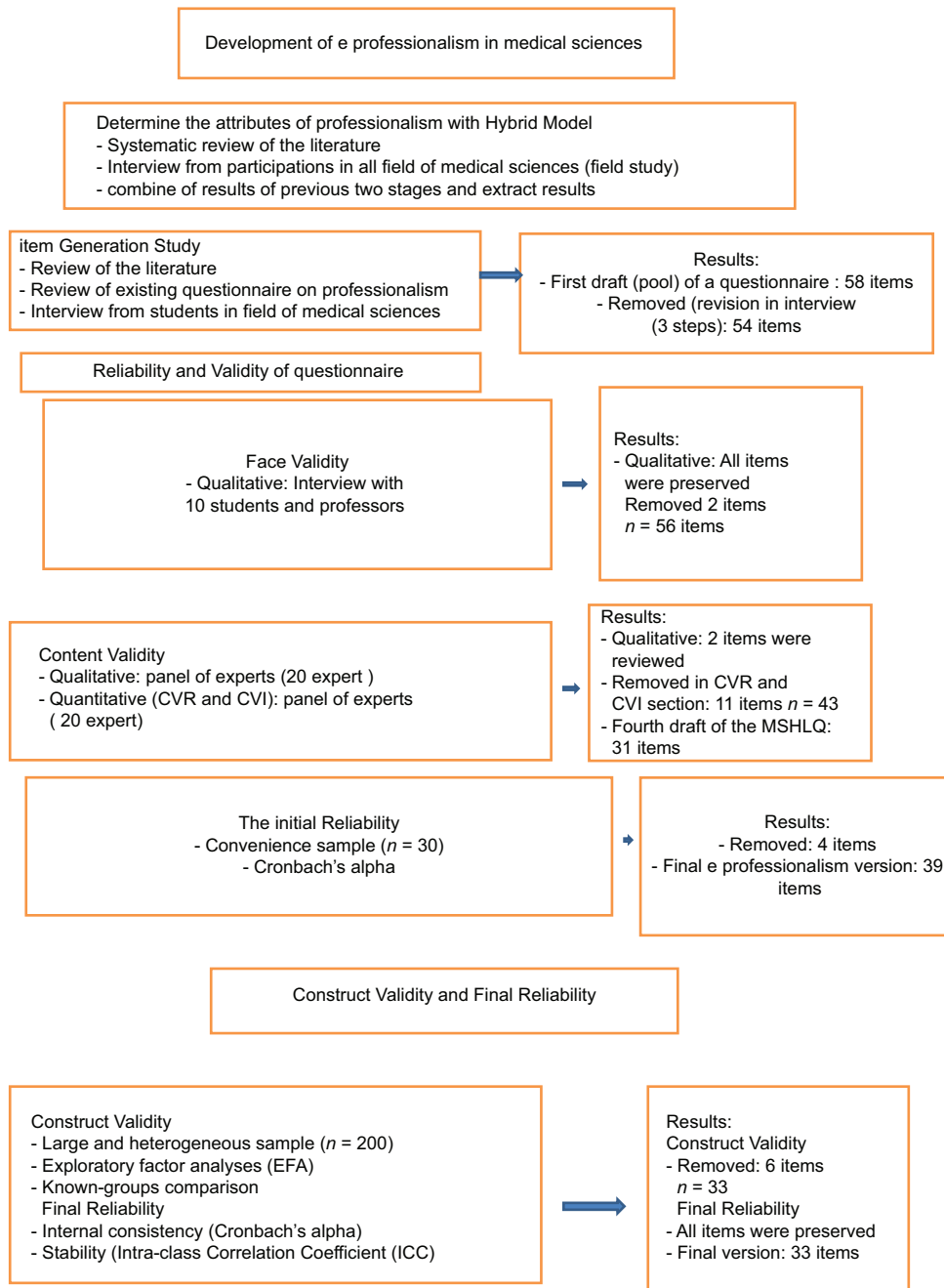


Figure 1: Flow diagram of the development and psychometric properties of e-professionalism in medical sciences in Iran. EFA = Exploratory factor analysis, ICC = Intraclass coefficient, CVR = Content validity ratio, CVI = Content validity index

shown that technology has educational merits in addition to perils associated with ethical issues and privacy.^[12]

Earlier studies propose that using smartphones in medical centers would not only improve clinical practice but also increase patient care quality and effectiveness, even in developing countries.

Some organized reviews demonstrate that handheld computers provide health-care professionals with easy and opportune access to information, decision-oriented evidence support, and patient management systems, which leading to improved clinical decision-making.^[13]

Furthermore, there is technology-based education specifically designed for health-care professionals such as guidelines, e-book, medical calculators, medical guidelines such as drug guidelines, as well as applications that permit health-care professionals to perform numerous tasks at point of care. This also helps from social signs and concerns health team to communicate with colleagues effectively.^[6,8,12,14-16]

Even though the principles and obligations for medical professionalism already exist, we believe that various doctors may have difficulty in using these principals to their online practices at least due to the following three reasons. First, some of the online contents in both medical literature and mass media might not clearly violate the principles of medical professionalism. The second is that many people experience a lower level of embarrassment in their online practices. Social media in particular can create the anonymity and detachment from social sign and consequences of on line action. The potential of f such carelessness is much greater than the usual face-to-face interactions due to wide range of media.^[17,18]

The Internet has made capability for medical students and doctors to interact, share information rapidly, and reach to million of people easlily. Taking part in social networking and other parallel occasions can support doctors' personal expression, enable them to have a professional presence online, nurture collaboration and friendship among them, and offer chances for extensively spreading public health messages and other health communications. Studies are now demonstrating how social media can improve medical practice and online presence.^[15,19,20]

Conventionally, professionalism has been characterized as a traditional value system, accompanied by faith, specialized knowledge, and decision required to cope with risk in public service. However, critics claim that professionalism is not a way of exist; instead, it is an conceptual discourse used to promise job-related inhibition and control.^[21]

We are required to nurture new understandings of how Internet and social media influences professional margin issues, online identities, relations with patients and other sponsors, and professional learning. While studying these issues, we are possible to observe both new guiding principle for professionalism and cultivate new notions of professionalism.^[22]

Considering the importance of virtual professionalism and professional ethics in medical sciences, and the necessity to pay attention to this issue and its impact on medical professionalism, this study aimed to build a professional culture questionnaire in a virtual environment for students of medical sciences.

Materials and Methods

Aim

This study aimed to build a professional culture questionnaire in a virtual environment for students of medical sciences.

Design and setting

In this study, which was carried out in three stages, a hybrid study was used at the first stage.

This study is a qualitative study with a hybrid approach that consists of the following three stages: theoretical stage, field research, and analysis. The hybrid model is one of the methods of conceptualization, evolution of concept, and the development of theory, and this method is used to eliminate abstractness and ambiguity of concepts, which will be explained in sequence. This model is applicable in practical and clinical sciences and in explaining important phenomena.

The three stages of theoretical phase, the stage of work in the context, and the final analysis, form different stages of the model.^[23,24]

In the first phase, a systematic review was carried out using the Cochrane Community Search Strategy. The databases were searched including PubMed, ProQuest, Scopus™, Web of Science®, Science Direct, Google Scholar without time limit until the end of 2018.^[25]

In the next study with purpose of developing virtual professional codes to examine the indices and themes identified in the previous study, adaptive code and code list were extracted.

In the second stage of the research, expert opinions were collected on the initial draft of the codes so that the meetings of the centralized expert group with the presence of five experts were convened. All of these experts^[26] have interdisciplinary experiences or education

in three areas of ethics, education, and medicine, including two faculty members of the university, with education and experience in the field of medical education, two with medical education and experience, and a faculty member nurse with extensive research in the field of virtual vocational codes. In these meetings, among the reached collections, the participants chose professionalism-specialized codes in the virtual environment, with emphasis on medical education.

In the third stage, the set of obtained codes was validated and finalized. Then, the validation criteria including content validity and then structural validity and reliability were considered [Figure 1].

In the process of designing a questionnaire, the following steps were taken into consideration:

To prove validity of the research tools, there are several ways that include content validity, formal validity, criterion validity (prerequisite and concurrent), construct validity (convergent, divergent, and internal consistency and factor validity), age differentiation, evolutionary change, and group differences. In this study, content and formal and exploratory convergent content were used.

Hence, the research samples at this stage comprised national-level experts, twenty faculty members in the field of virtual science, and professors participating in the Ethics Workshop at the virtual campus of the National Congress of Medical Education (2018). To this end, relevant topic-related scholars were asked to express their views on the product of the second stage, in terms of the clarity of the contents of each code and the ability to perform, or, if necessary, more codes in this field with an emphasis on the professionalism in the field of virtual education. The next step was to check the code changes by the executives on the basis of the agreement. During a meeting, codes were reviewed in each area, and final changes were made to change, add, or remove them. Finally, the codes for professionalism in virtual education in the field of science were developed in a group of researchers based on agreement.

In the study of content validity indicators, two indicators were used: (a) Content Validity Ratio (CVR): This indicator was designed by Lavashe.^[26]

This index is based on the views of experts specializing in the content of a test so that each of the questions is based on a 3-point Likert scale, which is categorized as "the item is necessary," "the item is useful but not necessary," and "the item is not necessary."

(b) Content Validity Index (CVI): In order to examine the CVI, experts determined the relevance extent of

each item in the following order, from their own point of view: 1 "is not relevant," 2 "is relatively related," 3 "is relevant," and 4 "is completely relevant."^[26-28] In this study, the coefficients of calculation are as follows: the CVR and CVI indicators were examined in this part. The amounts of CVR and the CVI were obtained as 0.60 and >0.79, respectively.^[29,30]

Initial implementation of test

In this stage of the construction of a test, a designed questionnaire, whose formal and content validity have been reviewed, was initially carried out on a limited number of target group, and re-evaluation was used to calculate the reliability coefficient.

The next step is to run the questionnaire on the target group.

At this stage of a test, the designed test on the target group was fully implemented to examine other types of validity and reliability of the test.

Analysis of questions by factor analysis method: Factor analysis is a combination of a number of statistical techniques and aims at simplifying complex data sets. The main objective of factor analysis is to simplify the description of data by reducing the number of variables or dimensions studied.

Therefore, exploratory analysis is considered more as a method of theoretical formulation, rather than a theoretical test method. In confirmatory factor analysis, the goal of the researcher is to confirm a particular factor structure. It is expressly hypothesized about the number of factors, and the fit of the desired factor structure in the hypothesis is tested with the covariance structure of the measured variables.^[26]

(c) Initial reliability: In this part, correlation coefficient between items and the whole questionnaire were determined using Cronbach's alpha coefficient. Moreover, inter-item correlation coefficient was performed by thirty students.

(d) Construct validity: Exploratory factor analysis (EFA) was applied to determine the construct validity of e-professionalism in medical students. EFA has been used to determine the relationship between items and summarize related items in a class.^[30]

Bartlett's Test was used to evaluate the correlation between the items of a questionnaire in order to integrate them and the Varimax rotation was used to interpret the factor structure by taking eigenvalues >1.^[31]

Final reliability

Reliability of the e-professionalism questionnaire

in medical sciences was investigated using internal consistency and stability. In order to evaluate the internal consistency, a questionnaire was completed by thirty students in different fields and then Cronbach's alpha coefficient was calculated. Alpha coefficient above 0.7 was considered adequate for the reliability.^[32]

Table 1: KMO and Bartlett's tests in the questionnaire

KMO and Bartlett's Test	Statistical value
KMO measure of sampling adequacy	0.619
Bartlett's Test of Sphericity	
Approximate Chi-Square	4431.751
df	741
Significant	0.000

KMO=Kaiser–Meyer–Olkin

To test the stability of the questionnaire, a test–retest method was used. The questionnaires were completed by twenty students on 2-week intervals. Afterward, the correlation of scores between the two tests was calculated with intra-class correlation coefficient (ICC). ICC above 0.8 reflects the acceptable stability of the questionnaire.

Results

In the analysis of a questionnaire, EFA method was used. The method used in the factor analysis is the main component method with a Varimax rotation. The Kaiser–Meyer–Olkin (KMO) index and the Bartlett's test are as follows: According to Table 1, the KMO index is calculated to be 0.619, which

Table 2: Shared Value of each questions

Question	Shares
The ability to find up-to-date resources on Internet sites	0.745
The ability to distinguish valid sources from non-valid	0.798
Ability to manage resources and mass data to achieve specialized findings	0.740
Understanding the most up-to-date and functional software tailored to the needs	0.725
Applying up-to-date software and applications at work	0.562
The art of analyzing content in cyberspace and identifying its validity	0.773
Familiarity with a variety of file formats and ways to convert and modify them	0.826
Familiarity with specialized sites	0.714
Managing the use of Internet resources in search and use	0.709
Using virtual storage spaces to store information	0.816
Complying with the media regime in the use of cyberspace	0.664
Respecting the privacy of individuals in entering cyberspace	0.755
Attention to the values and intellectual and cultural interests of the group in the publication of virtual content	0.745
Assessing the value of content in target groups before sending it	0.713
Not going too far in sending bulk contents in interest groups	0.606
Possessing appropriate literature for the publication of virtual works and content	0.722
Commitment to the goals and rules of grouping on the use of social networks	0.857
Non-publishing of immaterial content in cyberspace	0.787
Having the art of discussion and dialogue in collaborative environments	0.725
Enjoying the art of criticism and critique in a virtual group environment	0.854
Considering the privacy of individuals in using resources and information	0.799
Understanding the rules and regulations for the use of virtual spaces	0.674
Respecting intellectual property rights (copyright) in accordance with the rules for the use of virtual content	0.817
Getting permission from the authors of resources and then using them	0.772
Professional commitment to business in cyberspace	0.743
Using the names of the content authors in the referrals	0.660
Not logging into resources through blockers and locksmiths if their use is restricted	0.799
Recognizing customers and their Needs	0.747
Using the right technology in advertising and business	0.779
Commitment to customers and their needs in advertising and business	0.682
Respecting all guidelines and regulations regarding the supply of goods and services in the electronic environment	0.772
Not creating pseudo-worthless sites in cyberspace	0.730
Not transmitting non-valid news and rumours on channels, groups and virtual spaces	0.777
Logical use of time spent on the web	0.755
Not manipulating information in virtual spaces	0.759
Honesty in declaring personal identity in virtual spaces	0.751
Non-publication of images and immoral content inappropriate to the culture and norms of society	0.791
Introducing one's role in cyberspace	0.783
Non-publication of unsafe content anonymously in cyberspace	0.674

is fairly reasonable and acceptable. In addition, the *P* value of Bartlett's sprite test is <0.001, which indicates that correlation coefficients between questions are appropriate for performing factor analysis.

The shared value of each question is given in Table 2. According to this table, it is seen that the shared values

Table 3: Principal components analysis of e professionalism in medical sciences (n=250)

Question	Factor				
	1	2	3	4	5
q22	0.808				
q21	0.781				
q18	0.714				
q17	0.688				
q25	0.640				
q26	0.618				
q24	0.602				
q23	0.590				
q14	0.551				
q11		0.767			
q30		0.697			
q15		0.626			
q35		0.613			
q39		0.584			
q3		0.555			
q4		0.522			
q6		0.398			
q31		0.396			
q13			0.726		
q10			0.687		
q9			0.589		
q20			-0.562		
q7			0.461		
q19			0.397		
q36				0.758	
q38				0.716	
q37				0.584	
q1				0.499	
q8				0.495	0.409
q12					0.686
q5					0.567
q2					0.551
q32					0.430
q27					0.428
Eigenvalue	4.739	4.211	3.338	2.582	2.493
% of variance	13.937	12.384	9.818	7.594	7.333
% of cumulative variance	13.937	26.321	36.139	43.733	51.066

of questions are high (most often above 0.7) and therefore no questions can be deleted.

Initially, all the 39 questions for performing EFA were taken into consideration.

For the extraction of factors, the main components and Varimax rotation method were used. The minimum acceptable value for special values was equal to 2, which resulted in the extraction of five factors that accounted for 51.06% of the total variance, which is an acceptable value [Table 3].

According to Table 4, five factors were extracted, and related questions for each factor were determined as follows:

Reliability using Cronbach's alpha (for internal consistency assessment)

With regard to the extraction factors and related questions, reliability was determined using Cronbach's alpha method as follows:

It seen that except the third factor, the alpha value for other extractives was at an acceptable level. By reviewing the third factor, it was found that if the question 20 was deleted, the alpha value would be increased to 0.581. Therefore, at this stage, question 20 was removed from the questionnaire set. Finally, the alpha value was calculated as follows [Table 5]:

- Investigating the relationship between each item and entire questionnaire:
The correlation coefficient of each question with the total score of a questionnaire is presented in Table 6
- Investigating the relationship between each factor and total questionnaire:
- The correlation coefficient of each extraction factor with the total score of a questionnaire is given in Table 7

Reliability was tested by test–retest method. The test was repeated on twenty people. The test–retest was 0.812, which is a good value.

Correlation coefficient was also investigated with professional attitude questionnaire in social networks.^[33] This questionnaire has ten questions and five areas in the field of professionalism toward virtual networks

Table 4: Factors and questions extracted from questionnaire

Factor	Related Questions
1. Compliance with the laws and regulations governing cyberspace	21-22-23-28-24-26-23-25-29
2. Individual professionalism in using cyberspace	11-30-15-35-3-39-4-2-6
3. Knowledge management and information literacy	1-10-9-20-7-8
4. Respect for professionalism in interpersonal and group rules	12-27-19-13-32
5. Complying with ethics in the use of cyberspace	36-38-8-31-37

Table 5: Reliability by internal consistency

Factor	Related Questions	Cronbach's alpha
1	21-22-23-28-24-26-23-25-29	0.861
2	11-30-15-35-3-39-4-2-6	0.746
3	1-10-9-8-7	0.581
4	12-27-19-13-32	0.550
5	36-38-8-31-37	0.694
The whole questionnaire with 33 questions		0.781

Table 6: Correlation coefficient of each question with the total score

Question	Correlation coefficient	P
q1	0.278**	0.000
q2	0.231**	0.001
q3	0.305**	0.000
q4	0.385**	0.000
q5	0.238**	0.001
q6	0.211**	0.003
q7	0.217**	0.002
q8	0.184*	0.045
q9	0.194*	0.040
q10	0.287**	0.000
q11	0.309**	0.000
q12	0.161*	0.022
q13	0.342**	0.000
q14	0.459**	0.000
q15	0.491**	0.000
q16	0.657**	0.000
q17	0.176*	0.012
q18	0.670**	0.000
q19	0.550**	0.000
q20	0.426**	0.000
q21	0.591**	0.000
q22	0.475**	0.000
q23	0.660**	0.000
q24	0.379**	0.000
q25	0.416**	0.000
q26	0.519**	0.000
q27	0.305**	0.000
q28	0.315**	0.000
q29	0.380**	0.000
q30	0.23 *	0.022
q31	0.325**	0.000
q32	0.365**	0.000
q33	0.234*	0.034

*P<0.05, **P<0.001

Table 7: The correlation of factors with the total score of the questionnaire

Factor	Correlation coefficient	P
F1	0.783*	0.000
F2	0.617*	0.000
F3	0.236*	0.001
F4	0.346*	0.000
F5	0.548*	0.000

*p<0.05

including accountability, hiring decisions, profile edits, professionalism, and privacy settings. The results showed that internal consistency of questionnaire was confirmed. ($r = 0.69$, $P = 0.004$).

Discussion

The results of this study indicate that professionalism questionnaire of cyberspace users in medical sciences has a good validity and reliability. The results of the EFA showed that there are five distinct dimensions. Dimensions are as follows: compliance with the rules and regulations governing cyberspace with nine items, individual professionalism in use of cyberspace with nine items, knowledge management and information literacy with five items, professionalism in interpersonal and group rules with five items, and ethics of the use of cyberspace with five items. All of them were the most effective factors in each dimension. These 33 items predict 51.06 of the total variance, which is a good percentage for a questionnaire. In addition, the Cronbach's alpha was 0.781 and factors were 0.861, 0.746, 0.581, 0.550, and 0.694, which indicates the acceptable internal consistency of a questionnaire and that of its subscales. In explaining results obtained from the factor analysis, one can refer to a research that addresses the emergence of new e-professionalism and social networks, which, after explaining the subject and reviewing previous research and evidences, has proposed the following recommendations: The exploratory factors of the present study are consistent with the following:

Awareness and updating of information on rules and regulations of regulatory agencies; Internet privacy policies and their compliance; appropriate media literacy; honesty in the introduction of virtual identity; continuous monitoring of online activity; respect for intellectual property rights and e-commerce; respecting privacy of official, personal, and friendly relations; and avoiding the publication of nonspecialized content.^[34]

Of course, it should be noted that these five items and factors do not mean that the professional boundaries are ignored in accordance with the general guidelines of professional ethics. However, any virtual activity in medical sciences, in addition to general practice of professionalism in the field of medical sciences, including compliance with patients' privacy rights and competencies of the doctor's professional relationship with patients, peers, and colleagues, also requires compliance with specific issues of cyberspace use.

Conclusion

Considering the lack of a similar and indigenous standard questionnaire for measuring the professionalism of

cyberspace in medical sciences, it seems that a prepared questionnaire can address this need. However, the spread of the use of the Internet in various areas of health care and medical education, especially the advent of doctors in new areas such as telemedicine and e-health, e-consulting, and e-learning, also emphasizes the impact of online medical professionals on real life.^[35]

It is important to pay attention to the professionalism of the use of cyberspace in order to maintain the confidence of the physician and the patient and maintain the health service credit.

The developed 33-item-questionnaire is valid and reliable for the assessment of levels of e-professionalism in medical sciences in Iran.

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Ethics approval and consent to participate

First, the approval for the study was obtained from the Ethics Committee affiliated to Jahrom University of Medical Sciences COD of IR. JUMS. REC.1398.039.

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Conflicts of interest

There are no conflicts of interest.

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