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Development and psychometric evaluation of a questionnaire for measuring distraction due to mobile phone use in operating rooms

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Development and psychometric evaluation of a questionnaire for measuring distraction due to mobile phone use in operating rooms

Abstract

Aim: Use of mobile phones in health care centres can distract care providers and consequently disrupt the care procedure and risk patient safety. This study aims to develop and evaluate the psychometric properties of a questionnaire for measuring distraction caused by mobile phone use in operating rooms.

Sample and setting: 208 operating room nurses and doctors from five hospitals affiliated to Shiraz University of Medical Sciences participated in the study.

Method: This methodological study was conducted in two stages. In stage one, through a review of relevant texts, articles and books, the different dimensions of distraction as caused by mobile phone use were determined, and the items of the questionnaire were developed after several meetings with experts. In stage two the researchers used the two tests of content and face validity to determine the validity and internal consistency (Cronbach's alpha) and stability (test-retest) to evaluate the reliability. Also, the construct validity of the instrument was determined using exploratory factor analysis.

Results: In the first stage of the study, distraction due to mobile phone use was defined and 29 items on a five-point Likert scale were developed. In the second stage, after face and content validity assessments, 17 items remained. Evaluations of the reliability of the questionnaire using internal consistency and test-retest reliability yielded a Cronbach's alpha of 0.743. The Spearman–Brown correlation coefficient of the instrument was found to be 0.994. The construct validity of the instrument was examined through factor analysis.

Conclusion: The findings show that the developed instrument has enough validity and reliability to measure distraction due to mobile phone use in operating rooms.

Keywords: distraction, mobile phone, operating room, psychometric evaluation

Introduction

Recent studies show that distractions in the operating room contribute to 50 per cent of medical errors. Distractions may happen as often as once every three minutes and, on average, 13.5 times per case.[1] Distraction and attending to several tasks simultaneously result in work overload, adverse effects on perception and an increase in the incidence of errors.[2] Minimising the possibility of distraction in such environments as clinics and hospitals, where there is a constant need for communication and coordination between the personnel, is essential.[3] Computers are used widely in health care centres and there has been a rapid increase in the use of mobile phones in hospitals recently. Mobile phones are becoming

increasingly indispensable to everyday activities, for example using the internet, accessing bank services and entertainment.[2] Use of computers and other personal electronic devices in clinical environments is quickly growing.[3] This fact is especially alarming in operating rooms where distraction on the part of care providers can disrupt the therapeutic procedure and risk patients' safety.[4]

In 2013, distraction due to mobile phone use was ranked ninth on the list of the ten technologies threatening health care systems.[5] The seriousness of distraction can vary according to many factors, including the features of the tasks one should perform (main job), the source of distraction and the environment.[3] A major source of distraction at work, mobile phone use can increase one's reaction time and adversely affect concentration and performance.[6] Distraction in medical environments is defined as inconsistency or interruption in the performance of one's main medical tasks.[7,8] The members of a surgical team can be the source or recipient of distraction due to use of communication devices. Distraction can even be caused by loud music or conversations which are not related to the condition of the patient.[8] In an operating room, distraction can be due to internal sources (e.g. alarms of surgical equipment, conversations related to the surgery) and external sources (e.g. ringing phones, phone calls, contacting personnel from other wards).[4] Known as major sources of distraction, communication devices can reduce concentration and increase the possibility of clinical mistakes.[3] Distraction can affect all the members of a surgical team, including anaesthetists, nurses, surgeons and surgical technicians, thereby reducing the effectiveness of teamwork, increasing surgeon stress and leading to extra workload.[3,8]

As distraction can influence one's clinical performance,[7] it must be controlled in order for care providers to concentrate on patients and their work.[9] Development of policies to reduce or eliminate sources of distraction can prove very effective.[1] The Association of periOperative Registered Nurses (AORN) in the United State of America (USA) believes that a team-based interdisciplinary approach is needed to reduce distraction and noise levels to create a safer environment for patients and surgical teams. It is vital that during the critical stages of surgery, surgical teams work in an environment where unnecessary conversations and activities are forbidden.[9]

A review of the articles available in the databases of Medline, CINAHL, PubMed, Scopus and Elsevier showed that a valid and reliable tool exclusively designed to measure distraction caused by mobile phone use of operating room doctors and nurses has never been developed. In view of the seriousness of distraction in operating rooms and the urgency of studying distraction due to mobile phone use in the operating room, a valid instrument to measure distraction in the operating room is required.

The validity of the instrument/s used in a study is an indication of the significance of the subject under study. Therefore, development of a questionnaire should be followed by a psychometric evaluation.[10] Researchers who are involved in the development of research instruments should design and develop instruments with satisfactory validity and reliability. Accordingly, in view of the lack of a measurement tool, the present study aimed to develop and subsequently evaluate the psychometric properties of a questionnaire for measuring distraction caused by mobile phone use in operating room doctors and nurses.

Method

The present study is a methodological work undertaken to develop and determine the psychometric properties of an instrument for measuring distraction caused by mobile phone use in operating rooms. The current study was designed based on the STROBE guidelines for observational studies. The study was conducted in two stages. In stage one, the various dimensions of distraction due to mobile phone use in operating rooms were identified, based on a review of the relevant literature, and the researchers developed the items of the questionnaire, based on the definition of the concept and the objectives of the study. The questionnaire items were evaluated by experts (a surgeon, an epidemiologist and an operating room nurse) at several meetings. In stage two, the questionnaire was validated. There are various views about the numbers and types of validity and reliability of questionnaires. Norbeck, for example, believes that in the development of a research instrument, at least the following must be validated: content or face validity, predictive validity, construct validity, test-retest and internal consistency.[11] The researchers used the two methods of content and face validity to determine the validity of the instrument, and internal consistency (Cronbach's alpha) and constancy (test-retest) to evaluate the reliability. Also, exploratory factor analysis was used to determine the construct validity of the instrument. The questionnaire included questions about distraction, the patterns of mobile phone use, respondents' personal views and attitudes, respondents' knowledge

and awareness, respondents' activities, use of mobile phones, the advantages and disadvantages of mobile phone use, policies on mobile phone use at work, and use of social networks during clinical work.

The inclusion criteria for participants were being an operating room nurse or surgeon, owning at least one smartphone or tablet, and willingness to participate in the study.

Exclusion criteria included being unwilling to participate in this study, not returning the questionnaire, returning an incomplete questionnaire and lack of fluency in Persian language.

To evaluate the validity of the questionnaire, the researchers provided three professors, four faculty members of the university and three operating rooms nurses with copies of the questionnaire. Based on the factors which the questionnaire was intended to measure and the feedback of the consulted professors, faculty members and nurses, some items were eliminated or revised and some new items were added. The two indexes of face validity and content validity were used to assess the validity of the questionnaire. Face validity was assessed first, as a change in the statements and items of a questionnaire can lead to a change in its total validity.[12]

To determine the face validity of the instrument, the researchers used both qualitative and quantitative approaches. For qualitative evaluation of face validity, five operating room nurses and five surgeons were interviewed separately, face-to-face and the levels of difficulty, relevance and ambiguity of items were discussed. That is, how difficult the statements and words were to understand, how relevant the items were to the dimensions of the questionnaire, and how ambiguous words were as well as the possibility of items being misunderstood. After the unsatisfactory items had been revised, the quantitative method of item impact testing was used to determine the significance of each item so that the irrelevant items could be identified and eliminated. In item impact testing, those items whose impact score is 1.5 or more are considered as valuable and kept for later analysis.[13,14] Statistical analysis software SPSS version 22 was used, together with descriptive and analytical statistics, for analysing the collected data.

Both quantitative and qualitative approaches were used to determine the content validity of the instrument. The evaluation of the content validity of the questionnaire was based on the judgment of experts in the fields of instrument development, medicine, epidemiology and nursing who were consulted. For the qualitative evaluation of content validity, 15 experts (five surgeons, six faculty members of the university and four operating room nurses) were asked to read the items and give feedback about the grammatical structure of the statements, the appropriateness of the words, and the arrangement of the items. For the quantitative evaluation of content validity, the two measures of content validity ration (CVR) and content validity index (CVI) were used. First, for determination of CVR, ten experts (three surgeons, four faculty members of the university and three operating room nurses) were asked to rate each item on a three-point scale: 'necessary', 'helpful but not necessary' and 'unnecessary'. According to Lawshe's table, to determine the minimum value of CVR, the items whose CVR score (based on the evaluation of the ten experts) was over 0.62 were regarded as significant (P-value<0.05) and kept in the questionnaire.[15] Subsequently, CVI was assessed according to Waltz and Bausell's content validity index.[14] The 15 experts were asked to score each item in the questionnaire in terms of its relevance, clarity, simplicity and specificity; thus, the four indexes were scored individually on a four-point Likert scale. In the present study, the CVI score of each item was calculated by dividing the number of experts who had scored the item 3 or 4 by the total number of experts.[16] Hyrkas et al. recommend a score of 0.79 or above for accepting items according to their CVI scores.[17]

To determine the construct validity of the instrument, the researchers used factor analysis, which addresses the relationships between items, to identify and categorise the items which had the closest inter-relation. Construct validity can be evaluated in a variety of ways, including convergent validity, divergent validity, discriminant analysis and factor analysis. Factor analysis is regarded as a major step in the development of new instruments.[18] In the present study, the researchers executed exploratory factor analysis using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy, Bartlett's test of sphericity, a scree plot, principal component analysis and varimax rotation. In the present study, factor loading of 0.5 was considered as the lowest factor loading required for an item to remain in the factors obtained from factor analysis. After the items in each factor had been established, the relevance of the factors to the concept and main dimensions of distraction due to mobile phone use in operating rooms was examined. Researcher opinion about the minimum number of samples required for factor analysis to evaluate construct validity ranged from five to ten samples per item.[19] In the present study, the sample of operating room nurses and surgeons selected was more than ten times the number of items in the questionnaire.

In the final stage of the study, the two methods of internal consistency analysis and stability analysis (test-retest) were used to determine the reliability of the questionnaire. Internal consistency was measured using Cronbach's alpha. A Cronbach's alpha of between 0.7 and 0.8 indicates a satisfactory level of internal consistency.[20] The stability of the instrument was evaluated using the test-retest method. An important factor in this method is the length of the interval between the two tests: according to Fox, the interval should be long enough for the respondents to forget the items of the instruments, but not so long enough for the phenomenon under study to change.[19] Grove et al. suggest two weeks to one month as an appropriate interval.[21] In the present study, the retest was carried out two weeks after the initial test. Subsequently, the correlation between the scores obtained from the two tests was examined using Spearman–Brown's test. For evaluation of construct validity and reliability, the operating room nurses and surgeons in the five large hospitals affiliated to Shiraz University of Medical Sciences in Shiraz, the largest city in the south of Iran, were sampled based on the random sampling method. The participants selected according to stratified sampling consisted of experts, operating room nurse, and anaesthetists assistants who met the inclusion criteria of the study.

Statistical analysis

SPSS software version 22 was used for data analysis. In all analyses, the significance level was considered as $p<0.05$. the researchers executed exploratory factor analysis using the KMO measure of sampling adequacy, Bartlett's test of sphericity, a scree plot, principal component analysis and varimax rotation. In the factor

Table 1: Demographic characteristics of the participants

Variable		Absolute frequency	Relative frequency (%)
Age (years)	under 25	34	16.3
	26–30	68	32.7
	31–35	46	22.1
	36–40	52	25
	over 40	8	3.8
Gender	male	102	49
	female	106	51
Marital status	married	109	52.4
	single	96	46.2
	divorced	3	1.4
Professional experience (years)	under 5	131	63
	6–10	42	20.2
	over 11	35	16.8
Organisational position	operating room nurse	95	45.7
	anaesthetist assistant	47	22.6
	surgeon	66	31.7
Type of employment	permanent	34	16.3
	contractual	27	13
	temporary (extendable)	30	14.4
	trainee	47	22.6
	student	70	33.7
Education	associate degree in operating room nursing	18	8.7
	bachelor degree in operating room nursing	70	33.7
	bachelor degree in nursing	5	2.4
	associate's degree in anaesthetics	2	1
	bachelor degree in anaesthetics	44	21.2
	masters degree in nursing	4	1.9
	resident	57	27.4
	specialist	6	2.9
	super specialist	1	0.5
	fellowship	1	0.5

Table 2: The results of the evaluations of the items of the questionnaire in terms of content validity

No.	Item	Relevance (CVI)	Clarity (CVI)	Simplicity (CVI)	Specificity (CVI)	Necessity (CVR)
1	In the operating room, I use my mobile phone only for urgent calls.	0.93	0.93	1	0.87	0.8
2	During clinical work, if my mobile phone rings, I will answer it.	0.87	1	1	0.87	0.8
3	I always turn off my mobile phone before I begin my shift.	0.87	1	1	0.87	0.8
4	I always set my mobile phone to silent mode before I begin my shift.	0.87	1	1	0.87	0.6
5	Using my mobile phone in the operating room reduces my awareness of my surroundings.	1	0.93	0.93	1	1
6	The ringing sound of my mobile phones disturbs my concentration on my clinical duties in the operating room.	1	1	1	1	1
7	The ringing sound of the doctors' and my co-workers' mobile phones has a disruptive effect on my work.	0.93	0.87	0.93	0.93	0.8
8	The ringing sound of my co-workers' mobile phones distresses me.	0.93	1	1	1	0.8
9	Use of mobile phones (by myself or my co-workers) has made me forget matters about patients which needed to be attended to.	1	0.81	0.93	1	0.8
10	During clinical work, I use my mobile phone for professional purposes or to improve treatment of patients.	0.75	0.87	0.93	0.81	0.8
11	My using my mobile phone during work in the operating room has caused problems at the cost of patients (waking up patients during surgery, failure to check supplies of gauze or other essentials, administration of the wrong drug, failure to monitor patient's conditions etc.).	1	0.93	0.87	1	0.8
12	During clinical work, I listen to music or take calls by headset.	0.87	0.93	1	0.87	0.8
13	Do you use the internet on your phone in the operating room?	0.81	0.93	1	0.81	0.8
14	During clinical work, I surf social networks (WhatsApp, Telegram, Instagram etc.) on my mobile phone.	0.87	1	1	0.87	0.8
15	When I am on my shift, I check my mobile phone regularly for new messages.	0.81	1	1	0.87	0.8
16	In the operating room, I download and install new apps and games.	0.81	1	1	0.87	0.4
17	In the operating room, I use my mobile phone to entertain myself.	0.87	1	1	0.87	0.8
18	In the operating room, I use my mobile phone to read and send personal emails.	0.75	1	0.93	0.87	0.6
19	I support a ban on the use of mobile phones in operating rooms.	0.81	1	1	0.81	0.8

analysis, items with the loading factor of 0.5, Eigen values of greater than 1 and variance of 60.886 determined the dimensions of the questionnaire. In the last stage of the study, the reliability of the instrument was measured using the two tests of internal consistency (Cronbach's alpha coefficient) and constancy (test-retest).

Ethical considerations

The present study was approved by the ethics committee of Shiraz University of Medical Sciences (Ethical code: IR.SUMS.REC. 1395. S1221) before it was conducted. All the participants were informed about the objectives of the study and participants' names were replaced with codes to ensure confidentiality. Moreover, all the participants signed an informed consent form.

Results

In the present study, 208 operating room nurses and surgeons with the average age of 31.8±6.5 and average experience of 6.2±5.7 years participated in the study. Table 1 shows the distribution of the participants according to age, gender, marital status, education, professional experience, type of employment and organisational rank.

At the beginning of the study, the definition of distraction was established based on a review of literature: distraction due to mobile phone use means dividing one's attention between one's tasks and a mobile phone during clinical work. In the first stage of the study, 29 items were developed based on a review of related literature. After separate, face-to-face interviews with ten operating room nurses and surgeons, the questionnaire was revised several times and the number of items was reduced to 19 (see Table 2). Based on the results of the content validity

Table 3: The factor loading of the items of the questionnaire about distraction due to mobile phone use in operating rooms based on rotation matrix

	Factor				
	1	2	3	4	5
Q1 before			0.715		
Q2 before		0.644			
Q3 before			0.562		
Q5 before					
Q6 before	0.642				
Q7 before	0.798				
Q8 before	0.802				
Q9 before	0.821				
Q10 before					0.892
Q11 before	0.668				
Q12 before				0.811	
Q14 before		0.598			
Q15 before		0.749			
Q17 before				0.756	
Q20 before		0.672			
Q21 before			0.639		

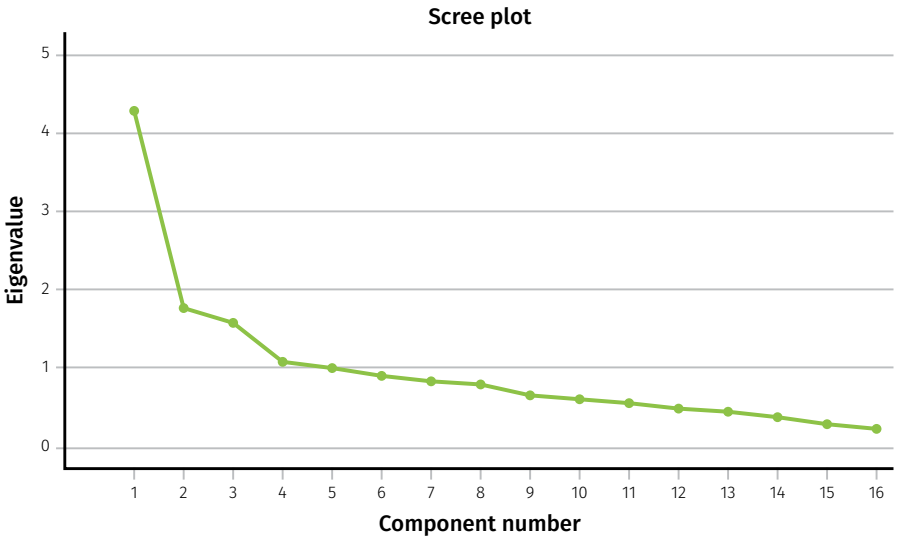

Figure 1: The factor analysis scree plot

evaluation and several meetings of the research team, items 9, 10, 11 and 15 were revised and corrected.

Furthermore, items 4, 16 and 18 were eliminated due to their CVR values of under 0.62 and two new items were added (see items 20 and 21 in Table 4) bringing the number of questionnaire items to 18. Of the 18 items, 16 items had five-point Likert scales and two items had two possible answers – 'I agree' and 'I disagree'. Since factor analysis can only be used for items which are answered on a Likert scale, items 13 and 19 which had only two possible answers, were not analysed in exploratory factor analysis with the principal items approach; exploratory factor analysis was performed for 16 items.

After performing exploratory factor analysis on 16 items, item 5 was deleted due to insufficient exploratory factor load. The final questionnaire had 15 items that were designed to be scored on a five-point Likert scale and two items (13 and 19)

Table 4: The items of the questionnaire grouped into the three categories as obtained from the factor analysis test

Categories	Items	Factor loadings
Category 1: Lack of concentration	6. The ringing sound of my mobile phone disturbs my concentration on my clinical duties in the operating room.	0.64
	7. The ringing sound of the doctors' and my co-workers' mobile phones has a disruptive effect on my work	0.79
	8. The ringing sound of my co-workers' mobile phones distresses me.	0.82
	9. Use of mobile phones (by myself or my co-workers) has made me forget matters about patients which needed to be attended to.	0.80
	11. My using my mobile phone during work in the operating room has caused problems at the cost of patients (waking up patients during surgery, failure to check supplies of gauze or other essentials, administration of the wrong drug, failure to monitor patient's conditions etc.).	0.66
Category 2: Patterns of mobile phone use	12. During clinical work, I listen to music or take calls by headset.	0.81
	2. During clinical work, if my mobile phone rings, I will answer it.	0.64
	14. During clinical work, I surf social networks (WhatsApp, Telegram, Instagram etc.) on my mobile phone.	0.59
	15. When I am on my shift, I check my mobile phone regularly for new messages.	0.74
	17. In the operating room, I use my mobile phone to entertain myself.	0.75
	20. In the operating room, I put my mobile phone where I can easily notice when I have a new message.	0.63
Category 3: Responsible use of mobile phones	1. In the operating room, I use my mobile phone only for urgent calls.	0.71
	3. I always turn off my mobile phone before I begin my shift.	0.56
	10. During clinical work, I use my mobile phone for professional purposes or to improve treatment of patients.	0.79
	21. I am aware of the consequences of professional mistakes that mobile phone use during work can cause.	0.67
Questions with two possible answers	19. Do you support a ban on the use of mobile phones in operating rooms?	–
	13. Do you use the internet on your phone in the operating room?	–

with only the two possible answers of 'I agree' and 'I disagree'. The final total number of questionnaire items was 17 (see Table 4).

The factor analysis results showed the KMO measure of sampling adequacy to be 0.754. Moreover, Bartlett's test of sphericity yielded the value of 987.234 which was significant at 0.001 (see Table 3). The factor analysis scree plot showed that by considering the special values of greater than 1 and the slope of the scree plot, three factors with the predictive power of 60.886 per cent determined the dimensions of the questionnaire (see Figure 1).

Kaiser–Meyer–Olkin measure of sampling adequacy = 0.754; Bartlett's test of sphericity = 987.234, P<0.0001; test–retest correlation coefficient = 0.994; Cronbach's alpha = 0.734.

The factor analysis yielded five factors which were grouped into three categories (see Table 4):

- Factor 1 consisted of five items (6, 7, 8, 9 and 11) and accounted for 20.046 per cent of the total variance. As these items dealt with such concepts as disruption or lack of concentration during clinical work and forgetting to attend to patients' needs, the category was labelled 'Lack of concentration'.
- Factor 2 consisted of four items (2, 14, 15 and 20) and accounted for 14.162 per cent of the total variance. These items addressed how mobile phones were used during clinical work; therefore, the category was labelled 'Patterns of mobile phone use'.
- Factor 3 consisted of three items (1, 3, 21) and accounted for 10.372 per cent of the total variance. These items addressed such issues as not using mobile phones during clinical work and being aware of the hazards of using mobile phones during clinical work; therefore, the category was labelled 'Responsible use of mobile phones'.
- Factor 4 consisted of two items (12 and 17). The researchers agreed to transfer these items, which were related to patterns of mobile phone use, to category two.
- Factor 5 consisted of one item (item 10). Due to its conceptual similarities to the items which addressed responsible use of mobile phones, item 10 was transferred to category three.

One item of the questionnaire (item 5) was eliminated due to not having sufficient loading factor.

To determine internal consistency, after factor analysis, the researchers used a sample consisting of 208 surgeons and nurses and found the Cronbach's alpha coefficient of the whole questionnaire to be 0.743. Evaluation of the stability of the questionnaire was conducted through the test-retest approach with a two-week interval. Spearman's correlation coefficient of the results was found to be 0.994 for the whole instrument, which was an indication of the high stability of the questionnaire.

Initially, 29 items were developed for the questionnaire but, after several revisions by a team of experts and researchers and evaluation of the validity of the instrument, the questionnaire was reduced to 17 items. With regard to the scoring of the instrument, 15 items were designed to be scored on a five-point Likert scale – 'never', 'rarely', 'sometimes', 'often' and 'always', scored from 0 to 5 with 'never' and 'always' being assigned 0 and 5 points respectively – and two items had only two possible answers – 'I agree' and 'I disagree' that would be given a score of 0 or 1.

Discussion

The present instrument was developed to measure distraction caused by mobile phone use by operating room nurses and surgeons and addresses a variety of factors, including perception, awareness, performance and patterns of mobile phone use. The definition of distraction due to mobile phone use in operating rooms as provided in the present study is based on a literature review; however, the development and psychometric evaluation of the instrument is an innovation in Iran and the world. In the present study, the face and content validity (qualitative and quantitative), construct validity (factor analysis), internal consistency (Cronbach's alpha coefficient), and stability (test-retest) of the instrument were verified.

The initial version of the questionnaire consisted of 29 items that were developed based on a review of related literature and views of experts. To evaluate the face validity of the instrument, in addition to a qualitative evaluation which resulted in the merger of some items, the researchers used the quantitative approach of item impact. As the impact score of the entire items was over 1.5, none of the items was eliminated.

The content validity of the instrument was evaluated using the CVR and CVI, one of the strengths of the study, which resulted in the elimination of four items and revision of another four. The construct validity of the instrument was examined through factor analysis. The results of the KMO measure and Bartlett's test,

0.754 and P<0.001 respectively, showed the factor analysis model to be valid and satisfactory. The results also showed the instrument to be multifactorial in the domains of lack of concentration, patterns of mobile phone use and responsible use of mobile phones during clinical work. The results proved that the factors derived from the factor analysis were consistent with the definition of distraction, thus confirming the construct validity of the instrument.

The Cronbach's alpha coefficient of the instrument was found to be greater than the acceptable minimum of 0.7, which points to the high internal consistency of the items.[16] Likewise, the results of the test-retest with a two-week interval showed the stability of the instrument to be high.

The score range of the instrument is between 15 and 77, with higher scores indicating a greater degree of distraction due to mobile phone use in operating rooms. Fifteen of the items on the questionnaire are scored on a five-point Likert scale. For 13 of these items 'never' = 1, 'rarely' = 2, 'sometimes' = 3, 'often' = 4, 'always' = 5; the other two items (3 and 21) are scored reversely, i.e. 'never' is scored as 5 and 'always' is scored as 1. Two items (13 and 19) are scored as 1 or 0 as they have two possible answers: 'I agree' and 'I disagree'. For item 13, 'I agree' = 1 and 'I disagree' = 0 points, for item 19 it is vice versa.

There are not many instruments that measure distraction due to mobile phone use in Iran or elsewhere in the world. One example is the checklist developed and used by Sevdalis et al. to study the effects of distraction during surgery on patient safety. There are two possible answers to the items on the checklist, 'done' and 'not done', which are checked by the researcher as they observe surgery. The factors addressed in the checklist include electronic communication, telephones, pagers, equipment, regulations and the environment.[22] The items are derived from the study of Wu et al. which addresses the safety and effectiveness of task performance in operating rooms.[23] Sevdalis's instrument has only been subjected to content validity and its CVI has been calculated; its CVR, however, is unknown.[22]

In the existing instruments, the Likert scale used is for agreement, ranging from 'I completely agree' to 'I completely disagree'; therefore, it is possible that a respondent agrees with an item but does not actually practice it. In the present questionnaire, however, the Likert scale, ranging from 'always' to 'never', reflects what respondents actually do.

McBride et al. have designed a questionnaire to measure nurses' non-work-related use of mobile phones in hospitals. Consisting of 30 items, the questionnaire has been subjected to face and content validity analyses – Cronbach's alpha and test-retest with a one-week interval have been used to determine its reliability – however, its construct validity has not been examined. Moreover, this instrument addresses only non-work-related use of mobile phones during clinical practice, which includes reading the news, playing games, surfing social networks, online shopping and reading and sending emails and text messages.[24] The present questionnaire, on the other hand, covers all the factors that can contribute to distraction, among them internet-related mobile phone use, making phone calls, individuals' awareness, regulations and work-related as well as non-work-related use of mobile phones.

To study the rate, patterns and potential of distraction due to mobile phone use during clinical rounds, Katz-Sidlow et al. used a self-made questionnaire, observation and interview with the participants. Their questionnaire consisted of 12 items which have only been subjected to face validity evaluation; the content validity, construct validity and reliability of the instrument have not been tested. The strength of the study is its use of several methods to measure distraction.[4]

Cho et al. have developed an instrument to measure distraction caused by mobile phones during clinical practice and the policies that limit use of mobile phones by nursing students. Consisting of 13 items, the instrument addresses distraction in nursing students and nurses, policies that restrict use of mobile phones, the amount of time mobile phones are used during clinical work and the main reasons for using mobile phones. The researchers use exploratory factor analysis to assess the construct validity of this questionnaire, but there is no mention of its face validity, content validity, or reliability. Cho's questionnaire measures distraction in clinical areas, while the present instrument has been developed exclusively for evaluating distraction in operating rooms.[5]

The questionnaire developed by Smith et al. has assessed the views and concerns of perfusionists about mobile phone use during clinical practice. The questionnaire consists of 19 items and addresses the three dimensions of communication devices, patterns of mobile phone use during work with the cardiopulmonary machine, and views about mobile phone use and safety of patients. Some of the items in the questionnaire are scored on a Likert scale and the others are open-ended questions. The reliability and validity of the instrument are not reported.[25].

Avidan et al. conducted a study on distraction caused by mobile phone

calls of operating room nurses during elective surgery. To collect data, the researchers used direct observations which focused on the length and topic (patient-related, work-related or personal) of calls. Lengths of distraction were also recorded through observation. This study evaluated the extent of distraction caused by mobile phone calls, while the present study addresses all aspects of mobile phone use, including visiting social networks, receiving and sending text messages as well as making and receiving phone calls.[26]

In a review study, Dala-Ali et al. examined doctors' responsible use of iPhones.[27] Wu et al. conducted a study to determine how mobile phones are used to make clinical communication in general wards and how they can affect the effectiveness of teamwork and communication — their study is a mixed methods work where data has been collected based on the frequency of calls and emails on smart phones, interviews with doctors, and observation of clinical interactions.[23] Another example is the review study by Ruskin et al.[28] Most of the above-mentioned studies focus on the benefits of mobile phones and how they can improve care providers' efficiency; the present study, however, addresses not only the benefits of mobile phone use, but also the aspects of distraction and patterns of mobile phone use.

The instrument developed in the present study was subjected to validity and reliability tests. Also, it addresses most aspects of mobile phone use including patterns of use, performance, awareness, knowledge, attitude and distraction. One of the advantages of the instrument is that it can be easily used: operating room nurses and surgeons can complete it in approximately ten minutes.

Furthermore, the majority of the above-mentioned instruments are intended for collection of general data and do not examine the causes of distraction. Also, most of the instruments in this field lack satisfactory validity and reliability and are not fit for use in operating rooms.

Limitations of the study

Because the views of culture of Iranian society have been used in the process of developing the present instrument, it is possible that the results may not be applicable to all societies. However, since the initial content of the questionnaire was derived from an extensive review of international literature, it seems likely that the present instrument can be applied to operating room personnel in other countries.

Conclusion

Based on the results of the study, the present instrument is sufficiently valid and reliable to measure distraction due to mobile phone use in operating rooms. The present instrument can be used to study distraction due to mobile phone use so that more effective steps can be taken to eliminate the problems that can occur as a result of this in operating rooms.

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