

Confirmatory Factor Analysis of Patient Safety Culture in an Iranian Hospital: A Case Study of Fatemeh Zahra Hospital in Najafabad, Iran

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ARTICLE INFO	ABSTRACT
<p>Article type: Original Article</p> <hr/> <p>Article history: Received: 20-July-2015 Accepted: 10-Aug-2015</p> <hr/> <p>Keywords: Factor analysis Hospital Patient safety culture Structural equation modeling</p>	<p>Introduction: Transformation of patient safety culture towards developing an open culture can be the greatest challenge for achieving a safe healthcare system. This study aimed to carry out a structural analysis of the Persian translation version of a questionnaire assessing patient safety culture.</p> <p>Materials and Methods: The study was conducted to evaluate the Persian translation of patient safety culture questionnaire, developed by the National Patient Safety Agency. The questionnaire includes seven sections and 43 items investigating 12 dimensions of patient safety culture. The reliability of this questionnaire was confirmed with Cronbach's alpha ($\alpha > 0.8$). The questionnaire was distributed among employees of the Fatemeh Zahra Hospital in Najafabad, Iran, 2015. The collected data were analyzed using SPSS 18 and Amos 18.</p> <p>Results: Sufficiency of the sample size, as determined by Kaiser-Meyer-Olkin measure, was 0.809, which was significantly associated with zero; therefore, performing factor analysis was acceptable and justifiable. The value of Bartlett's test was 696, P-value was less than 0.001, and degree of freedom was equal to 91. In the final model, the relative Chi-square was equal to 1.75 and P-value was less than 0.001. Also, parsimony normed fit index, parsimony-adjusted comparative fit index, and root mean square error of approximation were equal to 0.571, 0.621, and 0.065, respectively.</p> <p>Conclusion: Based on the results of fitting indices for the model and the questionnaire used in the present study for assessing patient safety culture, it can be stated that the Persian translation of this instrument is valid and hospitals can use it to monitor patient safety culture improvement.</p>

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Introduction

Publication of America Institute of Medicine report entitled "To err is human: building a safer health system" in 2000 can be considered as a turning point in patient safety enhancement (1). The World Health Organization (WHO) has paid special attention to patient safety and has followed it around the world as an important public health issue. In 2002, WHO members agreed on the solutions in relation to patient safety.

Patient safety is defined as the process undergone by healthcare organizations for providing safer patient care and services. Estimates show that in developed countries, one out of 10 patients is harmed while receiving care. In developing countries, on the other hand, the healthcare risks are more than those in the

developed ones and imposes greater costs (between 6 and 21 billion dollars a year) on some of these countries (2).

Given the significance of patient safety as one of the critical dimensions of healthcare quality, it has been emphasized that healthcare organizations should focus on patient safety culture as one of their main objectives and promote it among their employees (1).

Safety culture is a culture in which employees have awareness of things that can happen by mistake (3).

It is believed that cultural change is the biggest challenge for moving towards creating a safe healthcare system (4).

Safety culture is a group-level mentality, which refers to the values and beliefs shared by members of a

group or organization in relation to safety and safe behaviors.

Promotion of safety culture in healthcare organizations to reduce medical errors and injuries to patients and staff is of utmost importance (5). Safety culture is characterized as giving warnings to employees and those responsible for lowering risk, finding and identifying errors as opportunities to improve the system safety, creating a safe and non-punitive environment in which employees report errors in comfort, communicating in an honest and open manner, having the ability to maintain confidentiality of information, reporting errors and learning from errors through specific mechanisms, paying compensation to people affected by medical errors, and making a commitment to values and responsibilities (6).

Safety culture in an organization originates from individual and group values, attitudes, perceptions, competencies, behavior patterns determining commitment, as well as the style and performance of safety management in an organization. Positive safety culture in an organization can be established through bilateral communication based on trust, common understanding of the importance of safety, and ensuring the effectiveness of preventive measures (7). Some benefits of safety culture assessment are determination of an organization's status in relation to adverse events, helping to make decisions for improving patient safety, understanding safety culture, increasing the stakeholders' awareness and knowledge, assessing patient safety interventions and tracking changes over time, benchmarking internally and externally, as well as helping to meet legal and other kinds of requirements (7-8). Therefore, some efforts were made and many studies were conducted to identify and promote patient safety culture. Various dimensions of patient safety culture were mentioned and diverse instruments were employed to assess organizations' status of patient safety culture. For instance, Sexton proposed teamwork climate, job satisfaction, perceptions of management, safety climate, working conditions, and stress recognition as dimensions of patient safety culture (9).

In order to design a patient safety climate scale in Japan, the dimensions of free flow of information, continuous improvement, reporting errors, patients' family participation, organizational safety leadership, professional safety leadership, patient safety committee leadership, and access to equipment and regulations were taken into account (10). One of the most widely applied tools to measure patient safety culture is the questionnaire developed by the National Patient Safety Agency assessing patient safety culture in hospitals.

The Agency for Healthcare Research and Quality measures patient safety culture from the dimensions of management expectations and practices, organizational learning, teamwork between units and wards, open communication, non-punitive responses to errors,

hospitals' administrator and employees, and handoffs and transitions of patients (11).

Numerous studies were conducted in Iran on the assessment of patient safety culture using this tool such as the study by Baghaie performed in the teaching hospitals affiliated to Uromiyeh University of Medical Sciences (8) and the study by Abdi carried out in the teaching hospitals affiliated to Tehran University of Medical Sciences (12). Also, a multitude studies was carried out around the globe on patient safety culture including the study by Walston et al. performed in four hospitals in Saudi Arabia (13) and the study of Kim on nurses' perception of error reporting and patient safety culture in South Korea (14). All these studies were of descriptive type.

In the study of Hellings conducted in five hospitals in Belgium (15), the effectiveness of measures taken to promote patient safety culture was investigated. The strengths of this study were its large study population and the use of logistic regression to analyze the effects of these measures. Although the results of this study were not generalizable to other hospitals, considering the use of similar methods and instrument in the present study, the results of these studies are comparable.

Fatemeh Zahra Hospital in Najafabad as a non-governmental public hospital affiliated to the Social Security Organization with 150 available beds provides health services to all patients, especially those covered by the social security insurance program. This hospital has the International Standard Organization (ISO) quality management system on which several studies were conducted to evaluate patient safety culture (16-17). Although the data collection instrument applied in the present study was utilized in a relatively large number of studies, some issues can be raised regarding the dimensions of this tool including whether these dimensions can be presented in a model. To the authors' best knowledge this is the first study carried out on the dimensions of patient safety culture. Therefore, the present study aimed to study the dimensions of patient safety culture questionnaire developed by the National Patient Safety Agency using Structural Equation Modeling (SEM).

Materials and Methods

This study aimed to carry out a structural analysis of the Persian translation of a questionnaire assessing patient safety culture in Fatemehh Zahra Hospital, Najafabad, Iran, 2015.

The required data were collected using library studies and through taking notes from the international and WHO documents pertinent to patient safety culture.

To investigate the current status of patient safety culture in the field study, the translated questionnaire assessing patient safety culture in the hospitals, developed by the National Patient Safety Agency, was used. The study population consisted of all the hospital staff. Given the limited number of staff, no sampling

was performed and the questionnaire was distributed among all the staff. In each department, one person was selected as the coordinator. All the coordinators were informed of the benefits, application, and confidentiality of the information by the researchers. The questionnaires were delivered to each coordinator for all of the personnel employed in clinical and paraclinical departments including physicians, nurses, and other employees in different work shifts, and were gathered after completion by the personnel.

The questionnaire consisted of seven sections, the first to sixth of which included 43 items measuring patient safety status from the dimensions of management expectations and practices, organizational learning, teamwork within units and wards, open communication, non-punitive responses to errors, hospitals' administrator and employees, and transfer and transition of patients. The items were rated using a five-point Likert scale; the demographic characteristics of the participants were determined using eight items. The questionnaire focused on issues related to patient safety and reporting errors and events. Seven dimensions of patient safety culture are management expectations and practices, organizational learning, teamwork within units, open communication, non-punitive responses to errors, feedback on errors, and staffing. These dimensions were reviewed at the level of units and wards.

Three dimensions of patient safety including hospital managers' support of patient safety, teamwork between

units, and transfer and transition of patients investigated the relevant issues at hospital level.

Finally, the four dimensions of overall perception of patient safety, the frequency of reporting errors, the level of patient safety, and the number of reported events examined patient safety outcomes.

In general, 225 questionnaires were distributed from which 177 were analyzed. The reliability of this questionnaire was confirmed by Cronbach's alpha ($\alpha > 0.8$). The collected data were analyzed using SPSS, Version 18, through performing descriptive and analytical statistics.

P-value less than 0.05 was considered statistically significant. Furthermore, the collected data were analyzed through Structural Equation Modeling (SEM) using Amos 18.

Results

The response rate in the present study was 78%. Most studied employees were nurses (64 persons or 36%). As shown in Table 1, among seven dimensions of patient safety culture at the level of units and wards, the highest and lowest percent scores were related to management expectations and practices (76.28%) and staffing (37.86%), respectively.

Three dimensions of patient safety culture the highest and lowest percent scores pertained to hospital managers' support for patient safety (63.86%) and teamwork between units (53.92%), respectively Table 1.

Table1: The percent scores of patient safety culture dimensions

	Dimensions	No.	Min	Max	Mean	Std. deviation	Percent score
Level of units and wards	Teamwork within units and wards	177	.00	4.00	2.8915	.62301	72.28
	Management expectations and actions	177	.00	4.00	3.0515	.65414	76.28
	Organizational learning	177	1.00	4.00	2.9101	.52852	72.75
	Feedback on errors	177	1.00	4.00	2.8507	.61220	71.26
	Open communication	177	.00	4.00	2.6397	.74715	65.99
	Staffing	177	.00	3.75	1.5146	.59193	37.86
	Non-punitive responses to errors	177	.00	4.00	1.7123	.87746	42.80
Level of hospitals	Hospital managers' support for patient safety	177	.00	4.00	2.5547	.73442	63.86
	Teamwork between units	177	.25	4.00	2.1568	.73382	53.92
	Handoffs and transitions of patients	177	.50	4.00	2.3452	.66101	58.63
Level of patient safety outcomes	The level of patient safety	177	1.0	5.0	3.440	.7898	68.8
	The number of reported events	177	1.0	6.0	1.930	1.0980	32.17
	Overall perception of patient safety	177	.00	4.00	2.5667	.61948	64.16
	The frequency of reporting errors	177	.00	4.00	2.7053	.72073	67.63

Regarding the level of patient safety in hospitals, which is one of the patient safety culture dimensions of patient safety outcomes, 2% (four) of the employees stated that the status quo was unacceptable, while 8.6% (15) considered it as weak, 40.4% (71) acceptable, 39.7% (70) very good and 9.3% (16) excellent.

Considering the number of events reported, 45.3% of the employees had not reported any events.

Furthermore, 30.8% of the employees had reported only one or two errors, 13.2% three to five errors, 6.9% 6-10 errors, and 1.9% 10 or more errors. According to Table 1, among the four dimensions of patient safety

culture at the level of the patient safety outcomes, the highest and lowest percent scores were related to the level of patient safety (68.8%) and the number of reported events (32.17%). The adequacy of sample size was determined by Kaiser-Meyer-Olkin measure and Bartlett's sphericity test the results of which are presented in Table 2. The results presented that performing factor analysis was acceptable and justifiable.

Table2: Kaiser-Meyer-Olkin measure and Bartlett's test

Kaiser-Meyer-Olkin (KMO) Measure	0.809
Approx. Chi-Square	696
Bartlett's sphericity test	Df 91
	P-value <0.001

The results of confirmatory factor analysis performed at the level of units and wards indicated that teamwork within units and wards (Standard Regression Weight [SRW] =0.61), management expectations and practices (SRW=0.68), organizational learning (SRW=0.85), feedback on errors (SRW=0.67), open communication (SRW=0.79), staffing (SRW=0.15), and non-punitive

responses to errors (SRW=0.44) were significantly associated with patient safety culture.

Besides, the results of confirmatory factor analysis performed at the levels of hospitals and patient safety outcomes showed that hospital managers' support for patient safety (SRW=0.67), teamwork between units (SRW=0.66), handoffs and transitions of patients (SRW=0.40), overall perception of patient safety (SRW=0.68), frequency of reporting errors (SRW=-0.08), level of patient safety (SRW=0.60), and the number of reported events (SRW=0.31) were significantly associated with patient safety culture.

In the final model, the relative Chi-square was equal to 1.75 and P<0.001.

Also, Parsimony Normed Fit Index (PNFI), Parsimony Comparative of Fit Index (PCFI), and Root Mean Square Error of approximation (RMSEA) were equal to 0.571, 0.621, and 0.065, respectively. The overall results of model fitting indices are exhibited in Table 3.

Table3: The results of model fitting indices

Absolute indices			Comparative fit indices					Parsimonious fit indices			
CMIN	df	P-value	GFI	IFI	RFI	CFI	TLI	CMIN/df	PNFI	PCFI	RMSEA
106	61	0.001	0.925	0.93	0.778	0.927	0.89	1.75	0.571	0.621	0.065

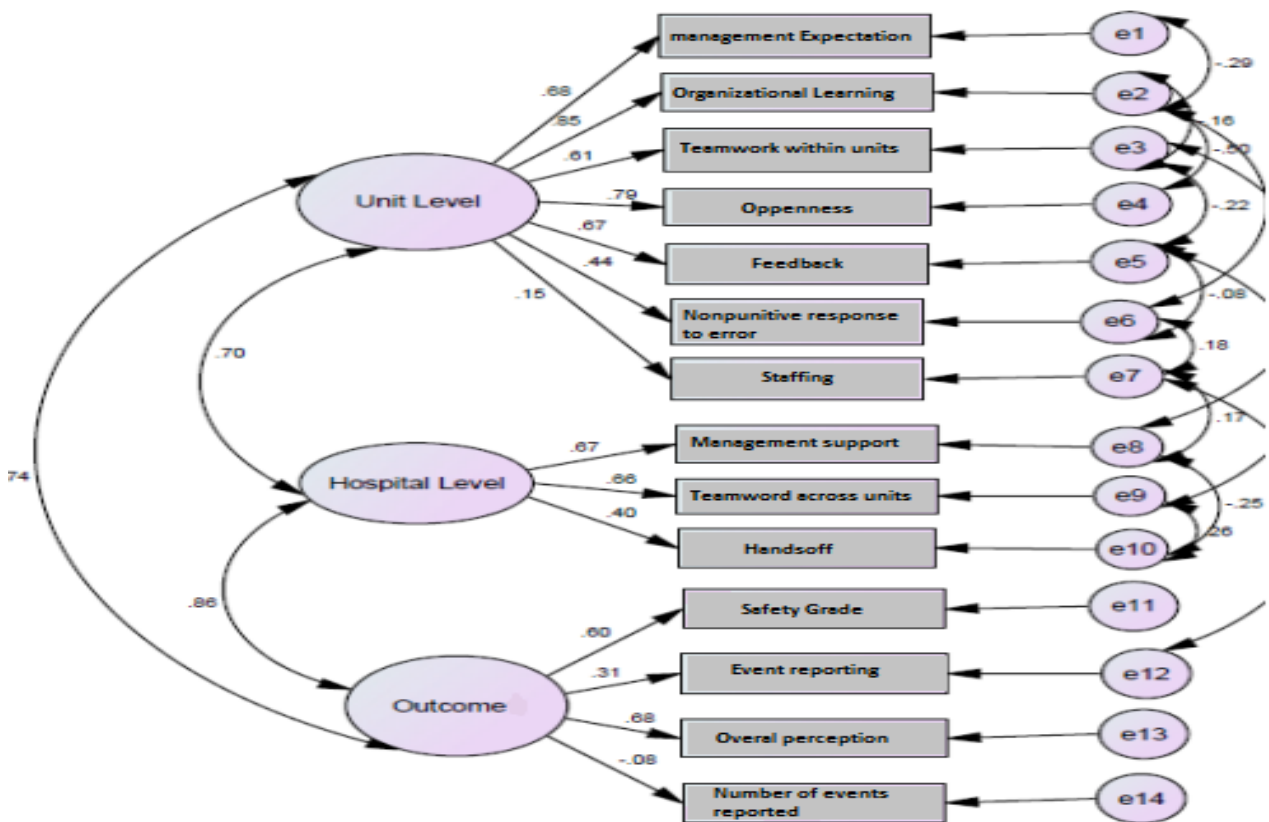


Figure1: The final model of patient safety culture dimensions at various levels in the studied hospital.

Discussion

This study purported to perform a structural analysis of the Persian translation of a questionnaire evaluating patient safety culture in a hospital in Iran. This questionnaire was used in relatively a large number of studies conducted in hospitals of Iran (8, 12, 16-17).

The results presented that among the seven dimensions of patient safety culture at the level of units and wards, the highest percent score belonged to management expectations and practices, which might be due to the fact that patient safety culture in the studied hospital was strongly supported by the administrators and managers so that several evaluations of patient safety culture were performed in this hospital (16-17). Also, the lowest percent score was related to staffing (37.86%). Staffing is one of the dimensions that often get the lowest score in studies on patient safety culture (18).

Among the three dimensions of patient safety culture at the level of hospitals, the highest and lowest percent scores were related to hospital managers' support for patient safety and teamwork between units and wards, respectively. The results of Smits (19) and Hellings (15) confirmed those of the present study.

According to the results of the present study, the dimensions of patient safety culture at unit, ward, hospital, and patient safety outcomes levels were significantly linked to patient safety culture. Interestingly, the SRW of the frequency of reporting errors was -0.08, which indicates that despite the efforts made to improve patient safety culture in the studied hospital, its status is far from the favorable and still a lot should be done to improve it. In other words, although the frequency of reporting errors was high, the number of reported errors was low so that nearly half of the employees did not have any error reporting.

As can be noted in Table 5, the value of relative Chi-square was very good (between 2 and 3). The values of comparative indices (higher than 0.9) can be interpreted as acceptable values. The values of PNFI and PCFI were acceptable as they were higher than 0.05. Also, the value of RMSEA was acceptable because it was close to 0.05. Finally, this model can be considered as an acceptable model.

Organizational learning explained patient safety culture at the level of units and wards more than other dimensions (SRW=0.85). In other words, organizational learning had the greatest impact on explaining patient safety culture, which signifies the importance of enhancing organizational learning, followed by open communication (SRW=0.79), management expectations and actions (SRW=0.68), and other dimensions.

However, the non-punitive responses to errors were not much effective from the employees' view point (SRW=0.44). The changes of the non-punitive responses to errors are only available to administrators

and managers and this dimension can be improved by making modifications to hospital management and its direction.

The lowest impact was related to staffing (SRW=0.15). The shortage of staff is one of the most common complaints. Considering low regression weight of staffing, hospital administrators are recommended to employ adequate number of employees. However, it should be noted that improvement of patient safety culture should not depend on staffing and improvement should not be neglected because of shortage of staff. Although it seems that having an adequate number of employees is important, its SRW in the current study was the lowest one among other dimensions.

Kim in a study conducted in South Korea used a similar questionnaire to investigate the status of patient safety among nurses and reported that error reporting and coordination among the units and wards had the highest priority (14), which is consistent with the results of the present study. The results of Walston from four hospitals in Saudi Arabia showed that except for the hospital managers' support for patient safety, other dimensions such as reporting system and staffing required immediate modifications and improvements (13), which is similar to the results of the present study. The results of the study of Hellings conducted in five hospitals in Belgium revealed that non-punitive responses to errors and staffing required prompt revisions and improvements (15), which is congruent with our results.

In the present study, hospital managers' support for patient safety, teamwork between units and wards, and handoffs and transitions of patients were identified as factors affecting patient safety at hospital level. Hospital administrators should strengthen their constructive role in promoting patient safety culture.

The role of administrators and managers' in improving safety measures and outcomes as well as safety culture is emphasized (20) as they should monitor the progress of their system. The information about all types of medical errors and adverse events should be used to improve the system.

Making modifications to the system can have more long-term effects than establishing training programs for employees to work better (20). Error reporting score indicates that the hospital system established for reporting errors should be enhanced; additionally, promoting teamwork and providing more efficient training programs can help reduce errors. Establishing a computer system for drug prescription and disclosing and reporting adverse events are some factors that should be considered to improve patient safety.

The overall perception of patient safety (SRW=0.60) and overall employee perception of patient safety culture (SRW=0.68) were significantly related to

patient safety outcome. SRW of frequency of reporting errors was 0.30. The number of reported events had the lowest SRW (0.08), which needs to be strengthened.

Staff training, the use of an appropriate system for encouraging employees, as well as publishing reports of errors and learning from them can enhance patient safety culture. The results of Abdi showed that non-punitive responses to errors (17.8%) and teamwork between units and wards (18.2%) had the lowest scores (12). Also, in the study of Baghaie non-punitive responses to errors, staffing, and teamwork between units and wards received the lowest scores (8), which confirm the results of the present study.

Conclusion

In conclusion, it can be stated that the dimensions of patient safety culture at the levels of units and wards,

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