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The relationship between nurses' perception of patient safety culture and self-report of adverse events in teaching hospitals in Isfahan

Running title: Nurses' perception of patient safety culture and self-report of adverse events

Abstract

In many countries, patient safety culture is a strategy to reduce medical errors. However, there is still not adequate evidence about the effectiveness of this strategy, and few studies have addressed it in Iran. This study aimed to examine the relationship between nurses' perception of patient safety culture and adverse events.

This descriptive-cross-sectional study was conducted in 2020-2021 on 425 nurses from different departments in Isfahan teaching hospitals. The nurses were selected through random convenience sampling. The 42-item Hospital Survey on Patient Safety Culture (HSOPSC) was used to evaluate nurses' perceptions of patient safety culture. Besides, the frequency of six adverse events that often occur in the hospital was evaluated by self-report data. The collected data were analyzed using descriptive statistics and multiple logistic regression in SPSS22 software.

The mean score of patient safety culture from the nurses' perspective was 3.04±0.28 out of 5. Continuous improvement of organizational learning (3.48±0.67) was identified as one of the organization's strengths. Moreover, handoffs and transitions (2.52±0.71) needed improvement as one of the weaknesses. The logistic regression analysis results showed that patient safety culture has a significant relationship with adverse events, and the incidence of adverse events decreases with the improvement in patient safety culture ($p<0.001$).

Hospitals can improve the quality of services provided by focusing on the strengths and resolving the weaknesses of patient safety culture, and also by improving communication and handoffs and transitions, and providing a safe environment for patients. The findings of the study highlighted the need to pay more attention to the promotion of the patient safety culture to prevent the occurrence of adverse events.

Keywords: *Patient Safety, Safety Culture, Adverse Events, Nurses, Hospitals*

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Introduction

Since patient safety is considered the core of healthcare quality, it has received special attention in the health sector of different countries in recent decades. Patient safety culture results from individual and group values, attitudes, perceptions, competencies, and behavior patterns. It can be valuable when it reflects the organization's commitment, practices, and skills in safety management [1].

The important features of a safety culture include the existence of an error reporting system, using data from the reporting system to improve processes, reducing blaming people, teamwork, not hiding errors, effective communication between colleagues to improve the patient condition, organizational management, and training healthcare staff on patient safety [2]. On the other hand, many adverse events occur annually in health care, more than half of which are preventable [2-4]. Adverse events are harmful events that have been intensified due to the growth and complexity of healthcare systems. Thus, there is a greater need to provide safe care to patients, healthcare staff, and people in general [1,3]. Adverse events happen due to individual errors and system weakness in health services [4, 5]. These events have become global problems and are also considered one of the basic indicators of patient safety [4]. The average incidence rate of adverse events in the treatment system of developed countries such as the USA, Canada, [6], and Sweden [7] is 3.5%, 9.2%, and 12.3%, respectively. Bagheri Hosseinabadi et al. (2015) reported the rate of adverse events in Iran as equal to 76.1%, 66.2%, 59%, and 57.7% for blood infections, pressure ulcers, patient falls, and hospital infections [8].

Different studies have estimated 0.9% to 5.2% of hospital deaths as potentially preventable, accounting for 1735, 11859, and 210,000 to 400,000 deaths per year in Dutch, British and American hospitals, respectively [7]. The cost of hospital care related to adverse and harmful events in the United States is estimated at 324 million dollars. The costs related to preventable events are estimated to be about 119 million dollars out of 324 million dollars [9]. A study by Hoonhout et al. (2010) in the Netherlands estimated the annual direct costs of all adverse events at 355 million euros, of which 161 million euros are preventable [10-11].

The American Institute of Medicine states that, in addition to individual factors, the occurrence of preventable accidents is influenced by factors such as insufficient skills and knowledge

of physicians and nurses and system errors caused by management, workplace, and personnel problems, which account for a significant number of preventable adverse events [12]. Given the inevitability of individual errors, the focus has shifted from blaming people in the organization to improving systems [13]. Various solutions have been proposed to improve systems, especially in healthcare organizations, and one of these initiatives is to promote patient safety culture [14-15].

Patient safety culture in healthcare organizations, especially hospitals, involves communication formed based on mutual trust, correct flow of information, communication openness, the overall perception of patient safety, organizational learning, management commitment and leadership, and nonpunitive response to errors [16].

The studies conducted in Iran reported a rate of 53% of medical errors, 22-44% of which led to patient death. Most errors are medication errors, preventive measures, and treatment and management measures [17]. Several studies have evaluated patient safety culture in Iranian hospitals [13-19], but limited studies have addressed the frequency of adverse events and the relationship between them and patient safety culture. The first step to creating a correct safety culture is to evaluate the current culture using a suitable tool [20-22]. Nurses are also a prominent group in providing medical services to patients. Accordingly, this study aimed to examine the relationship between patient safety culture and adverse events among nurses working in hospitals affiliated with Isfahan University of Medical Sciences.

Materials and Methods

This descriptive-analytical cross-sectional study was conducted from September 2020 to late March 2021. The protocol for this study was approved with the code of ethics R.MUI.RESEARCH.REC.1397.277 by the Student Research Committee of Isfahan University of Medical Sciences. The participants were selected using random sampling from clinical staff (nurses) working in 11 government hospitals affiliated with Isfahan University of Medical Sciences. The criteria for entering the study were to have at least a bachelor's degree in nursing and one year of clinical experience. The exclusion criteria were failing to complete and not returning the questionnaires. The sample size was estimated based on Morgan's table at a 95% confidence level and 5% accuracy. The initial sample size was estimated to be 384 persons. Assuming a response rate of 15% and the sample size was estimated to be 442 persons. Finally, a total of 425 questionnaires were completed.

The data were collected using a questionnaire that contained three sections: Demographic variables, the Hospital Survey on Patient Safety Culture (HSOPSC), and the frequency of adverse events.

The first section of the questionnaire assessed seven demographic variables, including age, gender, marital status, service records, education, ward, and working hours per week. The Hospital Survey on Patient Safety Culture (HSOPSC) was also used to evaluate the patient safety culture. This survey was developed in 2004 by the Agency for Healthcare Research and Quality and has been used many times to evaluate patient safety culture in different countries. Sorra and Dyer revised the instrument in 2010. It contains 42 items and 12 dimensions, including frequency of event reporting, organizational learning, communication openness, management support for staff, feedback and communication about errors, nonpunitive response to errors (each with three items), the overall perception of safety, management support for patient safety, teamwork within units, staffing issues, teamwork across units, and handoffs and transitions (each with four items). The items in the survey were translated into Persian. Cronbach's alpha coefficient for its dimensions was reported from 0.57 to 0.80. [20]. The items were scored on a 5-point Likert scale (totally disagree, disagree, undecided, agree, and agree) based on the frequency of events (never, rarely, sometimes, often, and always). Besides, 18 items were scored in reverse (Table 2).

This study assessed six adverse events that often occur in the hospital [15,21,22]. These six events were pressure ulcers, and patient falls, drug side effects, surgical wound infections, reaction to injection or blood transfusion, and complaints from patients and their families. The frequency of each event was measured using six options (0 = never, 1 = several times a year, 2 = once a month, 3 = several times a month, 4 = once a week, 5 = several times a week, and 6 = daily).

The data in this study were analyzed with SPSS22 software using descriptive statistics, including frequency, percentage, mean and standard deviation, and inferential statistics. The six adverse events were assessed in two groups of nurses who had never experienced them and nurses who had experienced them (with varying frequency). In the next step, logistic regression analysis was used to examine the relationship between the level of patient safety culture (as an independent variable) and adverse events (as a dependent variable). The confounding effect of other variables (age, gender, marital status, education, work experience, workplace, and working hours per week) was also controlled in the model. A significance level of 5% was considered for statistical analysis.

Results

The results indicated that 50.1% of nurses aged 31-40 years. The nurses' mean age was 34.73 years. Besides, the nurses work for 10.32 years on average. Ninety-two nurses (21.6%) were men, and 333 nurses (78.4%) were women. Moreover, 325 nurses (76.5%) were married, and 100 nurses (23.5%) were single. Most nurses (186 nurses; 43.8%) worked for ten years or more. In addition, 90.1% of nurses had a bachelor's

degree, and 324 nurses (76.2%) were working 44 hours or less per week (Table 1).

A comparison of 12 components of patient safety culture showed that constant improvement of organizational learning (3.48±0.67) was the organizational strength and handoffs and transitions (2.52±0.71) were the organizational weakness that needed improvement, followed by the supervisor/manager expectations and actions promoting safety (2.6±0.59). Overall, the mean score of patient safety culture was 3.04±0.28 (Table 2).

The strengths of the patient safety culture in Isfahan hospitals were continuous improvement of organizational learning, feedback and communication about errors, nonpunitive response to errors, teamwork within hospital units, frequency of event reporting, and management support for staff safety. In contrast, the weaknesses of the patient safety culture in Isfahan hospitals were handoffs and transitions, supervisor/manager expectations and actions promoting safety, communication openness and honesty in establishing communication, and overall perception of patient safety. Moreover, the most frequent adverse events were complaints from patients or their families, with 6 cases per day (3.8%), and the least frequent event was patient falls (0%). As can be seen in Table 4, most of the participants (44.2%) reported no patient fall during the last year.

The results of logistic regression analysis for the relationship between patient safety culture and six adverse events are presented in Table 3. By controlling the confounding effect of demographic variables, there was a significant relationship between patient safety culture and drug side effects and pressure ulcers.

Discussion

Assessing patient safety culture plays a key role in determining the capabilities of healthcare organizations in handling and reducing the occurrence of risks for patients. It can improve patient safety and promote the quality of healthcare services. The data in the present study showed patient safety culture in the university hospitals of Isfahan was at a moderate level (Table 4), and more satisfactory services can be provided by reinforcing the strengths and resolving the weaknesses.

In the present study, 76.2% of nurses worked more than 44 hours weekly (Table 1). A study on the effects of nurses' working hours on patient safety culture in the USA, Japan, and Taiwan (2011) indicated that nurses who work more than 60 hours per week have a poorer rating in patient safety culture. Long working hours affect "staffing issues" and "teamwork within hospital units" [20].

Some studies that have addressed the relationship between patient safety culture and adverse events in China [23], Palestine [3], Norway [6], and the USA [25] reported similar results. Wang et al. (2014) examined 463 Chinese nurses in 28 inpatient and emergency departments in 7 level-3 general hospitals, and 47.8% to 75.6% of the nurses reported they had experienced adverse events in the past year. The logistic regression data in Table 4 suggest that the continuous improvement of organizational learning significantly reduces the occurrence of adverse events such as pressure ulcers and thus reduces the frequency of complaints from patients and their families. Moreover, the frequency of event reporting was significantly related to medical errors and fewer pressure ulcers. The results also indicated that improving patient safety culture is associated with reducing adverse events [23].

Mardon et al. (2010) evaluated the relationship between 15 variables related to patient safety culture and eight patient safety indicators in 179 American hospitals, controlling the hospital size and ownership. Their findings indicated that all patient safety culture variables had a negative relationship with the patient safety indicators, and seven were significantly associated with them. These findings supported the idea of the association of improved patient safety culture with a lower number of adverse events [25].

Farup (2015) also retrospectively compared the patient safety culture and adverse events in two treatment departments of two separate hospitals with the participation of 185 employees and 272 patient medical cases and showed a negative relationship between the patient safety culture and adverse events [4].

Moreover, Najjar et al. (2015) evaluated the patient safety culture in Palestine, and the findings showed a positive patient safety culture in the hospital was associated with fewer adverse events [2]. Most studies have indicated that teamwork within the hospital units is the most important factor contributing to improving hospital healthcare services.

A study in 2014 in Saudi Arabian hospitals also showed that teamwork within units was the strongest dimension of safety culture and nonpunitive response to errors, and handoffs and transitions were the weakest components of patient safety culture [26].

Most of the nurses in this study agreed on the impact of continuous improvement of nurses' organizational learning on patient safety culture, confirming the significance of continuing and implementing learning programs and improving safety in hospitals, as indicated in other studies [27-28].

The weakest components were handoffs and transitions before the change of shifts. Salavati et al. reported that feedback and communication about errors and the frequency of event reporting had the lowest association with patient safety culture, as confirmed in the present study [29]. Interdisciplinary teamwork is one of the requirements for achieving a patient-centered approach. Hence, paying attention to it can contribute to empowering healthcare staff. The coherent functioning of

treatment teams can lead to better clinical outcomes and greater patient satisfaction.

The nurses in this study had a moderate perception of patient safety. Thus, holding training courses can improve nurses' attitudes toward patient safety culture. Kantelhardt et al. (2017) showed that the main reason for nurses' unwillingness to report errors was their fear of managers' blames. Thus, strong managerial commitment and support for reporting adverse events and nursing errors can promote the reporting culture [30-33].

Overall, the reasons for not reporting errors can be divided into two organizational and individual reasons, including managers' feedback and reaction, disciplinary action, unawareness about errors, and fear of the consequences of reporting, such as blaming and revenge.

Thus, future studies need to address the causes and factors affecting the poor performance of hospitals in reporting adverse events caused by staff. Furthermore, creating a safe environment for nursing staff can minimize the frequency of their errors. In addition, working conditions should be changed to prevent human errors, improve patient safety culture, and encourage staff to report their mistakes without fearing the consequences [34].

Moreover, it is necessary to create and promote a culture of error tolerance and error reporting, encourage staff to report possible errors, and a nonpunitive policy for healthcare centers.

The limitations of this study were the cross-sectional nature of the study, the short length of the study, the use of self-evaluation of adverse events, and the focus of the study on government hospitals. Thus, more studies need to be conducted on larger hospitals and groups to improve the generalizability of the findings.

Conclusion

Following the study findings, promoting effective, clear, and face-to-face communication and facilitating handoffs and transitions before changing shifts can promote patient safety culture in hospitals and improve patient service quality. Similar to previous studies, the data in this study highlighted patient safety culture as one of the predictors of adverse events. Thus, promoting this culture can reduce the frequency of adverse events. This study's results underlined the need to pay more attention to improving patient safety culture to prevent adverse events such as pressure ulcers and drug side effects. Besides, handling complaints from patients and their caregivers can reduce adverse events and improve patient safety. Hospitals can improve the quality of services provided by reinforcing the strengths and weaknesses of the patient safety culture, such as improving communication, adopting a standard approach to establishing effective interactions among staff and across different hospital units, and providing a safe environment for patients. Thus, factors such as management support for patient safety in the hospital, raising nurses' awareness of patient safety culture by holding training courses, and improving teamwork across hospital units can effectively promote the patient safety culture.

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Conflict of interest: The authors declared no conflict of interest in this study.

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Table 1. The participants' demographic characteristics

Demographic characteristics		Frequency	Percentage
Gender	Male	92	6.21
	Female	333	4.78
Marital status	Married	325	5.76
	Single	100	5.23
Age group	21-30	126	6.29
	31-40	213	1.50
	41≤	86	2.20
Service records	1-5	122	7.28
	6-10	117	27.5
	10≥	186	8.43
Education	Bachelor's	383	1.90
	Master's and higher	42	9.9

Ward	CCU, ICU, NICU, PICU, post ICU	86	2.20
	Emergency department	75	6.17
	General wards	264	1.62
Working hours per week	44≥	324	2.76
	44≤	101	8.23

Table 2. Descriptive statistics for the components of patient safety culture

Patient safety culture components	Min	Max	Mean	SD
Frequency of event reporting	1.33	5	3.22	0.72
Overall perception of patient safety	1.25	4.25	2.99	0.45
Supervisor/manager expectations and actions promoting safety	1	5	2.60	0.59
Continuous improvement of organizational learning	1.33	5	3.48	0.67
Teamwork within units	1	5	3.20	0.80
Communication openness and honesty in establishing communication	1	4.67	2.78	0.60
Feedback and communication about errors	1	5	3.31	0.70
Nonpunitive response to errors	1	5	3.36	0.84
Staffing issues	1	5	3.02	0.65
Management support for employee safety	1	5	3.13	0.57
Teamwork across units	1.25	5	3.0.3	0.43
Handoffs and transitions	1	5	2.52	0.71
Patient culture mean score	2.16	4.05	3.04	0.28

Table 3. The frequency (%) of adverse events

Adverse events	**Not occurred (%)**	**Occurred Frequency (%)**					
	Never	Several times a year	Once a month or less	Several times a month	Once a week	Several times a week	Daily
Pressure ulcers	119(28)	115(1.27)	99(3.23)	54(7.12)	20(7.4)	14(3.3)	4(9.0)
Patient falls	188 (2.44)	181(6.42)	33(8.7)	8(9.1)	6(4.1)	9(1.2)	0
Drug side effects	74(4.17)	196(1.46)	96(6.22)	33(8.7)	17(4)	8(9.1)	1(2.0)
Surgical wound infection	131(8.30)	129(4.30)	86(2.20)	58(6.13)	16(8.3)	4(9.0)	1(2.0)
Reaction to injection or blood transfusion	164(6.38)	178(9.41)	50(8.11)	18(2.4)	10(4.2)	3(7.0)	2(5.0)

Complaints from patients or families	70 (516)	128(1.30)	111(1.26)	51(12)	26(1.6)	23(4.5)	16 (8.3)

Table 4. The relationship between patient safety culture and adverse events (logistic regression)

Dependent variable	**Independent variable**	**OR**	**95% CI**	**P-value**
Pressure ulcers	Patient safety culture	41.0	(0.18- 0.94)	P= 0.017
Bed falls	Patient safety culture	1.22	(0.58- 2.55)	P< 0.001
Drug side effects	Patient safety culture	0.33	(0.13-0.83)	P= 0.013
Surgical wound infection	Patient safety culture	0.58	(1.28-0.26)	P< 0.001
Reaction to injection or blood transfusion	Patient safety culture	0.62	(1.31-0.29)	P< 0.001
Complaints from patients or families	Patient safety culture	0.12	(2.19-0.35)	P< 0.001