ORIGINAL ARTICLE

The most frequent and important events that threaten patient safety in intensive care units from the perspective of health-care professionals'

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Background: Patient safety is a priority in all health-care centers across the world. This study aimed to determine the frequency of events that threaten patient safety and the grade threating of events from the perspective of the health-care professionals in the intensive care units (ICUs). **Materials and Methods:** This cross-sectional study was conducted in 2016. The participants were 306 members of health-care professionals (physicians and nurses) with at least 1 year of work experience in ICUs of educational hospitals affiliated to Isfahan University of Medical Sciences. Data were collected using a three-section self-made questionnaire. Data analysis was done using descriptive statistics (frequency distribution and percentage) and version 16 of SPSS software. **Results:** A total of 306 questionnaires were completed out of 320 questionnaires handed out among participants. During the last month, 91.2% of the participants had reported at least a case of medication error, 75.6% had reported at least a case of ventilator-associated pneumonia, and 74.2% had reported at least a case of catheter-induced urinary infection in ICUs. **Conclusion:** The occurrence of events threatening the patient safety in ICUs warrants proper planning by administrators of health-care centers. Medication error was the most frequent and important event of threat to patient safety and falling was the least frequent event of threat to patient safety in ICUs. Considering the frequency and magnitude of medication error in ICUs, a well-adjusted preventive plan should be designed and implemented to improve the patient safety.

Key words: Delivery of health care, intensive care units, nurses, patient safety, physicians

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INTRODUCTION

Patient safety is a priority in all health-care centers across the world,[1] and it is a key step in providing a high quality of care.[2] Patient safety is the prevention and reduction of adverse outcomes or injuries arising from the processes of health care.[3] Studies suggest that patients tolerate unsafe care during receiving treatment in the intensive care units (ICUs).[4] In the ICUs, patients are most vulnerable to being exposed to incidents as a result of high complexity in care, severe illness, underlying disease, and providing life-sustaining treatment.[5,6] Therefore, the provision of safe medical and nursing care to critically ill patients in ICUs is faced with major challenges.[7]

Numerous events threat the patient safety in ICUs. One estimate is that 148,000 life-threatening serious errors occur in critical care areas of teaching hospitals in the US annually.[8] In the US, it is estimated that 80,000 cases of infection by catheters with direct exposure to blood happen in ICUs, 28,000 deaths have been reported for these infections.[9] Moreover, there are 48,600 cases of infection of central vein catheter lines in ICUs of the US hospitals which lead to 17,000 annual cases of deaths.[10] According to the studies conducted in Iran focusing on events that threaten the patient safety in

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ICUs, medication errors occurrence with 80%,[2] prevalence of hospital infections with 10.85%,[11] and the prevalence of pressure ulcer (bed sore) with 10.1%–21%[12] are first to third in the rankings of life-threatening events. These figures or digits and statistics are just part of the events that threaten the patient safety.

Compared to general wards, ICUs are more susceptible to errors due to a number of specific factors such as noise, overcrowding, and admission of patients with comorbidities.[13] A different combination of treatments and health-care providers in ICUs leads to events involving patient harm or risk of harm (near misses). These errors are often preventable, but their nature and diversity are interprofessionally.[4]

To promote the patient safety, first, those events that threaten the patient safety must be identified to form a platform for further development and implementation of appropriate plans. There are no clear and accurate records on the frequency of events that threaten the patient safety in ICUs of educational hospitals affiliated to Isfahan University of Medical Sciences. Therefore, this research attempts to find out the frequency of threats to the patient safety in ICUs and their magnitude from the viewpoints of the health-care members to provide the decision-makers with basic information for the preparation and employment of preventive solutions.

MATERIALS AND METHODS

Study design and participants

This paper presents the findings from part of a larger study in the form of dissertation. The larger study employed a sequential mixed methods design to develop interprofessional program to promote the patient safety in ICUs. This research was carried out as a cross-sectional, descriptive study in 2016. The setting of study includes 16 internal, surgical, poisoning, burn, and cardiac ICUs of 7 educational hospitals affiliated to Isfahan University of Medical Sciences located in Central Iran with a total of 190 beds. The participants were 306 members of a health-care team (physicians and nurses) with at least 1 year of work experience in ICUs. Sampling was convenience. The sample size was calculated by $n = 625$, $Z = 1.96$, $P = 0.5$, and $d = 0.04$. The sample calculated using the formula: $n = NZ^2P\ (1 - P)/Nd^2 + Z^2P\ (1 - P)$. In the end, the eligible participants were estimated a total of 306 members.

Study instrument

Data were collected using a three-part self-made questionnaire through reporting of the participants from June to September 2016. For developing the questionnaire, resources, literature, and indicators of patient safety were used. The questionnaire included demographic characteristics (5 questions), events that threaten the patient safety (36 items), and the magnitude of these threats (36 items). The questionnaires were scored based on a 5-part Likert scale. Frequency distribution of the events threatening based on 0, 1, 2–3, 4–5, and 6 and more and the grade of the events threatening based on very low, low, moderate, high, and very high were scored. The content validity of the questionnaires was verified by a panel of experts. First, the draft of the questionnaire was presented to the 10 members of the health-care team and the faculty members (physicians and nurses) who had acquired sufficient experience and specialty in the field of intensive care and patient safety. Cronbach's alpha was employed to verify the reliability of the questionnaire. Cronbach's alpha was calculated 0.98. After liaising with the administrators of educational hospitals, the researchers handed out the questionnaires among the eligible participants and demanded them to answer the items based on their last month experiences.

Statistical analysis

Data analysis was done using descriptive statistics (frequency distribution and percentage) and the Statistical Package for the Social Sciences software (version 16, SPSS Inc., Chicago, IL, USA).

The Ethics Committee of Isfahan University of Medical Sciences approved the study (IR. REC.1395.3.267). Verbal and written informed consent was obtained from participants. After the introduction of the researcher and stating the importance and the objectives of the survey, the allowance of participants was obtained. Participants confided that the information would remain confidential. We used numeric codes in place of personal names to secure the anonymity of the questionnaire. Participants were assured that in the study will not mention the name of the hospital and participants. The participants were free to withdraw from the study anytime.

RESULTS

The results showed that the most participants were females (77.3%). Means of age and work experience of participants were 34.6 ± 7.8 and 6 ± 4.9 years, respectively. Other demographic characteristics of the participants and their working conditions are presented in Table 1. The most important and frequent events that threaten patient safety ICUs from the health-care team perspectives were medication error, ventilator-associated pneumonia (VAP), and catheter-induced urinary infection, respectively. During the last month, 91.2% of the participants had reported at least a case of medication error, 75.6% had reported at least a case of VAP, and 74.2% had reported at least a case of catheter-induced urinary infection in ICUs [Table 2].

Table 1: Frequency distribution of participants' characteristics

Demographic characteristics	*n* (%)
Gender	
Female	238 (77.77)
Male	68 (22.23)
Profession	
Physician	51 (16.7)
Nurse	255 (83.3)
Education	
BSc	230 (75.16)
MSc	25 (8.17)
Upper MSc	51 (16.67)

The participants mentioned medication errors, VAP, and sepsis as the most important threats to the patient safety in ICUs [Table 3].

DISCUSSION

For the first time, this study aimed to determine the frequency of adverse events that threaten patient safety and the grade threating of events from the perspective of the health-care provider in ICUs of educational hospitals affiliated to Isfahan University of Medical Sciences in Isfahan, Iran. The findings show that the patients suffer from numerous adverse events during their stays in ICUs, and here, we wish to address the most important and frequent of these events. Of these, medication errors and health-care-acquired infections (HAIs) (VAP, catheter-induced urinary infection, surgical surface infection, and sepsis) repeatedly pose serious threats to the patient safety.

Medication error forms the most important and frequent safety-threatening events with at least a case of such event during the last month based on the reports of 91.2% of the participants. Moyen *et al*. reported medication errors as the leading cause of mortality of patients hospitalized in ICUs. They asserted that in ICUs, on average, patients exposed to 1.7 errors/day and medication errors account for 78% of serious medical errors.[14]

In recent years, the delivery of care in ICUs has demanded more of a team effort and interprofessional collaboration (IPC). The team includes physicians, nurses, respiratory therapists, physical therapists, nutritionists, social workers, and other skilled professionals. With regard to the situation and needs of patients, the variety and the number of professions involved in patient care.[8] Considering the underlying causes of medication errors such as weak interaction and communication between the health-care members,[15] the development of IPC helps to improve patient safety. IPC is a process through which professionals from different professions work together as a team to achieve a shared goal (improving health care).[16]

In this study, HAI formed another category of events which threatened the patient safety. The risk of development HAI is 30% with a mortality rate of 44%.[17] This risk is even higher in ICUs because of the severity of the conditions of the patients, invasive procedures, and frequent interactions of the patients with health-care providers.[18]

In this research, VAP was the second important threat event that compromised the patient safety in ICUs. This type of pneumonia which a leading cause of mortality of the patient as well as the most important type of infections acquired in the hospital dramatically increases the health-care costs.[17,19] In a 6-year report derived from a number of studies including 422 ICUs in 36 countries in Latin America, Asia, Africa, and Europe, a 15.8% rate of VAP was observed per each 1000 days of connection to the ventilator while catheter-induced urinary infection was reported 6.3% for each 1000 cases of insertion of urinary catheters.[20]

The frequency of the identified events requires the development of interprofessional preventive programs and close monitoring of these programs to enhance the patient safety. Since medication errors are the most important events that threaten the patient safety, the researchers are designing and conducting a study to prepare an interprofessional program for reduction and prevention of medication errors in ICUs.

The tendency of the participants to underreport the errors because of the fears of possible consequences was a major limitation of this research. This was partially addressed through reassuring them about the confidentiality of the questionnaires, the fact that only the researchers would have access to the collected data and notifying them that data would be analyzed collectively.

CONCLUSION

The frequency of the events that threatened the patient safety was categorized based on patient safety indicators, and views of the ICUs specialists show that in spite the fact that the health-care team exercises a large amount of efforts to provide the patients with safe medical services, the patient safety is put at stake as a result of the occurrence of threat events such as medication error. Preserving and improving the patient safety in ICUs require the meticulous attention and efforts of both the health-care administrators and the members. It is suggest that interprofessional preventive programs must be designed and implemented in regard to the identified events, in particular, medication errors, VAP, catheter-induced urinary infection, and sepsis with the ultimate goal of reduced hospitalization time, decreased medical interventions to address the side effects, lowered treatment costs, and improved patient outcomes.

Table 2: Frequency distribution of the events threatening patient safety in intensive care units from the perspective of the health-care team (%)

Events threatening patient safety	0	1	2-3	4-5	6 and more
Medication error	8.8	17.6	25.8	25.8	21.9
VAP	24.4	24.1	27.1	11.5	12.9
Catheter-induced urinary infection	25.8	31.1	27.5	8.3	7.3
Sepsis	31.9	26.2	24.8	10.1	7
SSI	31.9	29.2	27.6	6.3	5
False report laboratory results	33.2	32.2	18.9	9	6.6
Hematoma or bleeding after surgery	32.5	29.8	26.5	8.3	3
Inappropriate fluid therapy	29.8	40.4	17.5	6.3	6
Pressure ulcer after hospitalization	33.8	33.8	20.5	8.6	3.3
Complications of anesthesia (airway obstruction, atelectasis, pneumonia, pneumothorax, and air embolism)	34	35.3	19.5	7.6	3.6
Inappropriate communication with patient	40.7	28.5	20	6.2	4.6
Unnecessary antibiotic therapy	44.4	25.2	18.2	7.3	5
False documentation	42.1	28.9	22	3.6	3.3
Administration of excessive oxygen	44.4	32.8	13.2	7	2.6
Incorrect choice of respiratory mode	44.6	32.8	14.5	5.4	2.7
ADR	40.2	38.9	15.7	4.6	0.7
Events associated with endotracheal intubation (incorrect insertion, excessive dilation of cuff, and sudden withdrawal of endotracheal tube)	44.3	34.6	13.1	6.4	1.7
The wounds caused by equipment such as pulse oximetry probe, chest lead, and so on	45.5	32.8	13.7	6	2
Complications of chest tube insertion	48	31.8	12.6	4.6	3
Pneumothorax caused by carelessness health care after inserting an CVC line	48.2	31.7	13.2	4	3
DVT after surgery or due to immobilization	47.7	31.9	13.8	5	1.7
Pulmonary embolism after surgery	48.5	30	15.8	3.4	2.4
Improper diet such as NPO keeping	50	29.5	15.2	3.3	2
Skin lesions caused by surgical techniques including heart surgery	54.3	23.6	16.1	4.6	1.4
Rupture and perforation of the artery during catheterization	58.6	23.4	11.2	4.9	2
The reaction caused by blood transfusion	58.9	26.8	9.3	3.6	1.3
False reporting of radiology results	62.3	23.3	8.7	3.7	2
Catheter and tubing misconnections	60.1	26.8	9.1	3	1
Improper use of equipment such as infusion pumps	61.4	27.5	8.1	2	1
Incorrect insertion of nasogastric tube	64.8	27	4.9	2	1.3
False patient identification	73.8	18.4	4.3	3.3	0.3
Complications of TPN	74.1	19.1	4.1	2.4	0.3
Blood transfusion errors	77	15.7	4	2.7	0.7
Complications of pacemaker insertion	82.4	12.5	3.1	1.7	0.3
Injection in arterial line	84.5	9.9	3	2	0.7
Falling	85.5	9.2	3.3	1.3	0.7

VAP = Ventilator-associated pneumonia; SSI = Surgical surface infection; ADR = Adverse drug reaction; DVT = Deep vein thrombosis; CVC = Central venous catheter; TPN = Total parenteral nutrition; NPO = Nil per os (Nothing by mouth)

Table 3: The grade of the events threatening patient safety in intensive care units from the perspective of the health-care team (%)

Events threatening patient safety	Very low	Low	Moderate	High	Very high
Medication error	5.2	12.8	17.4	26.2	38.4
VAP	10.3	10.3	23.3	30.7	25.3
Sepsis	11.9	11.6	22.8	25.4	28.4
Complications of anesthesia (airway obstruction, atelectasis, pneumonia, pneumothorax, and air embolism)	11.8	20.1	20.4	21.7	26
Pulmonary embolism after surgery	13.8	18.9	20.9	17.5	29
SSI	10.9	14.1	28.3	32.2	14.5
False report laboratory results	11.6	18.8	25.7	22.8	21.1
Catheter-induced urinary infection	8.9	15.1	33.4	29.5	13.1
ADR	8.9	23.9	22.6	29.2	15.4
Blood transfusion errors	28.7	15.2	5.9	10.2	39.9

Contd...

Table 3: Contd...

Events threatening patient safety	Very low	Low	Moderate	High	Very high
The reaction caused by blood transfusion	16.4	20	19	19.7	24.9
Pneumothorax caused by carelessness healthcare after inserting an CVC line	16.1	22.3	19	18	24.6
Hematoma or bleeding after surgery	10.6	20.6	29.9	24.6	14.3
DVT after surgery or due to immobilization	15.5	17.8	25.6	22.6	18.5
Rupture and perforation of the artery during catheterization	20.7	17	18.4	20.7	23.3
Events associated with endotracheal intubation (incorrect insertion, excessive dilation of cuff, and sudden withdrawal of endotracheal tube)	17.8	22.1	18.2	18.5	23.4
Pressure ulcer after hospitalization	13.1	16.8	33.9	25.5	10.7
Complications of chest tube insertion	17.7	19.3	22.3	23.3	17.4
False patient identification	31.4	13.5	10.2	11.2	33.7
Inappropriate fluid therapy	12.9	21.5	32.3	22.1	11.2
Injection in arterial line	36	10.2	7.9	15.2	30.7
Incorrect choice of respiratory mode	15.8	22.2	28.3	19.2	14.5
Falling	33.9	10.3	9	22.3	24.6
Unnecessary antibiotic therapy	15.8	19.5	35.3	19.5	9.9
False reporting of radiology results	18.7	24.6	20.7	23	13.1
False documentation	18.9	22.2	27.8	19.2	11.9
Administration of excessive oxygen	15.9	22.9	32.9	19.9	8.3
Incorrect insertion of nasogastric tube	25.1	21.5	16.2	22.8	14.5
Catheter and tubing misconnections	25.6	21.3	20	17.4	15.7
Skin lesions caused by surgical techniques including heart surgery	18.6	19.7	37.6	18.3	5.9
Complications of TPN	26.1	19	25.1	21.4	8.5
Improper diet such as NPO keeping	19.9	22.6	35.9	15.3	6.3
Complications of pacemaker insertion	34.2	16.4	16.4	15.8	17.1
Inappropriate communication with patient	20.6	28.8	27.8	14.1	8.8
Improper use of equipment such as infusion pumps	25.5	24.2	23.8	18.5	7.9
The wounds caused by equipment such as pulse oximetry probe, chest lead, and so on	21.5	27.5	35.8	12.6	2.6

VAP = Ventilator-associated pneumonia; SSI = Surgical surface infection; ADR = Adverse drug reaction; DVT = Deep vein thrombosis; CVC = Central venous catheter; TPN = Total parenteral nutrition; NPO = Nil per os (Nothing by mouth)

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Conflicts of interest

There are no conflicts of interest.

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