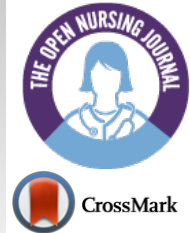




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## RESEARCH ARTICLE

### Identification and Evaluation of Nursing Errors in Kowsar Hospital by SHERPA

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#### Abstract:

##### Background:

Medical errors, including human errors, are one of the most important and sensitive issues in the health system. Human errors can endanger patients' life during health service provision. Therefore, healthcare workers should ensure the safety by reducing human errors. This study aimed to identify and evaluate human errors among nurses working at an Iranian Hospital.

##### Methods:

This is a cross-sectional study which was carried out using SHERPA method in 2018. After explaining the purpose of the study, data were collected by observation and interview. Using the hierarchical analysis method, tasks and subtasks were determined, and finally, the worksheet on SHERPA was completed and analyzed.

##### Results and Discussion:

Thirty-two tasks covering 252 subtasks related to the nursing profession were investigated, of which 252 errors were detected. Identified errors included errors of action, revision, retrieval, communication, and selection which were responsible for 60, 23, 3, 12, and 2 percent of errors, respectively. In terms of the level of error risk, 16 were unacceptable, 96 were undesirable, 107 were acceptable, which need revision, and 33 were acceptable with no need for revision.

##### Conclusion:

Nurses' errors are more action errors because of the nature of their work, so hospital authorities for safety and prevention should prioritize these errors.

**Keywords:** Identification of errors, Evaluation of errors, Errors, SHERPA, Patient safety, Evaluation of nursing.

#### Article History

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## 1. BACKGROUND

Nowadays, human errors in the medical field are one of the most important and sensitive issues which lead to many unacceptable risks for societies and are considered a serious

and inevitable threat to patients and hospital staff [1, 2]. Human errors are defined as the deviation of human performance from the specified rules and tasks, which exceed the acceptable level of the system and have an adverse effect on the system's performance. Obviously, these errors are due to human errors and the weakness of systems [3].

Regarding the nature of human errors in the medical field and the very devastating effects of these errors, patient's safety

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has become one of the global concerns. Patient safety involves reducing or eliminating harm to patients due to the wrong way of treatment and providing health services. Endangering patient safety is continually one of the inherent concerns in medical professions, although there are scattered warnings and recommendations in this regard, organized formal response to improve patients' safety has been limited [4, 5].

Previous studies indicate that human errors in medical occupations impose high financial and human losses on communities. Health workers' mistakes result in patient's lack of trust, increased stress and complaints of patients [6, 7]. Institute of Medicine report in 2000 showed that between 44 and 98 thousand people die annually in US hospitals due to medical errors [8]. Another report of the institute of medicine in 2008 indicated that, on average, one million people around the world annually injure due to medical errors imposing 17 million dollars' financial loss [6, 7]. According to WHO, one out of every 10 patients is affected by medical errors [7 - 10]. The good news is that 70% of medical errors are preventable [11].

Human errors occur for various reasons covering a combination of system and hidden errors [12]. Preventing errors will increase patient and staff's satisfaction, reduce surgical costs, and increase the credit of service providers. In most organizations, the costs of error prevention are significantly lower than the costs of events arising from it [13].

Nurses who carry out various activities in the hospital are one of the medical teams who might incur mistakes in their work. In a study conducted at the University of Pennsylvania, 30% of nurses reported having committed at least one error per day [14]. Various factors can cause medical errors [15], including fatigue [16], quality of work-life [17], age [18], level of education [19], degree of respect to safety principles [20], experience [21], leadership and organization [22], organizational structure [23], patients demographic characteristics [24] and changing work tasks [25].

Although developing countries are relatively facing more medical errors than developed countries [26], due to weak reporting systems and complicated legal requirements for creating a database, there is absolutely no precise estimation [27]. An Iranian study by Panjvini concluded that 16.7 percent of nurses committed medical [28]. In another Iranian study, 64.5% of nurses admitted that they had committed medical errors [29].

Different methods are used to identify human errors, including FMEA and RCA methods. FMEA (FAILURE MODE & EFFECTS ANALYSIS) is an analytical technique based on the law of "prevention before it happening" used to identify potential failure factors. Root cause analysis (RCA) is also a structured investigation and research process whose purpose is to know the real cause(s) of a problem and to find ways to eliminate this cause(s) [30]. The SHERPA technique is one of the error detection techniques which is designed to identify human errors in terms of type of error, likely outcomes, and control and prevention strategies. Identifying and analyzing medical errors provides an opportunity to share experiences for improving the safety of patients and employees [31]. This

study was conducted to identify and evaluate human errors in the nursing job of Kowsar Medical Center, which is the only specialized and referral obstetrics and gynecology center in Qazvin Province. This hospital provides 15,000 inpatients and more than 36,000 outpatients care annually.

## 2. METHODS

This cross-sectional study was conducted to identify and evaluate human errors among nurses of Qazvin Kowsar Hospital in 2018. Several techniques are used to identify, evaluate and predict human potential errors in dynamic systems. Among these, the SHERPA technique is one of the most common methods of checking errors, which can be used to study human errors in terms of error type, probable outcomes, and control and prevention strategies and can be studied in a set of subtasks forming each job [32].

## 3. SHERPA STUDY

This technique was first created and developed by Emberi in 1986. Today, this method is widely used in hazardous industries, including nuclear, oil and gas, electricity transmission and distribution and petrochemical. Lyon *et al.* mentioned this technique as one of the seven techniques used to evaluate the performance of healthcare providers [33]. This method is performed in 8 stages, including analysis of task hierarchy, task classification, identification of human errors, outcome analysis, error retrieval, error analysis, crisis analysis and analysis of corrective strategies [34]. After analyzing the hierarchy of duties and implementing the eight stages of the SHERPA using the 882D MIL-STD standard, risks' classification was performed [35], and finally, practical solutions were proposed to reduce and control some of the identified errors.

The tasks of nurses were divided into two parts: general tasks (related to all departments) and specialized tasks (related to specific departments of the hospital). The tasks were analyzed according to the Iranian nursing service standards reference book and the written tasks that nurses performed during the day, which were well known to the nurses participating in the study and according to what was done in the hospital, and the sub-tasks were determined. A total of 24 nurses, 3 in each department, were included in the study. The selection of the tasks was based on the opinion of the hospital officials, and included the most important tasks as well as the daily and routine tasks of the hospital nurses. We studied 32 tasks of nursing jobs, such as: General nursing tasks: patient admission, medication administration, CPR, nursing report registration, ward delivery, discharge with personal consent, and patient discharge. Specialized nursing tasks in the NICU department: connecting the ventilator to the patient, disconnecting the ventilator from the patient, caring for the patient under mechanical ventilation, suctioning, tracheostomy care, tracheal suction, and tracheal tube placement. Specialized nursing tasks in the ICU department: chest tube insertion, chest tube removal, patient monitoring, and NGT placement. Specialized nursing tasks in the neonatal department: admission of the newborn and placement of the umbilical

catheter. Specialized tasks of nursing in the delivery department: anesthesia (spinal-epidural). Specialized nursing tasks in the operating room department: admitting the patient to the operating room, avoiding wrong connections of tubes, sounding (inserting a urinary catheter), and accepting the patient under observation. and changing the dressing. Specialized tasks of nursing in the emergency department: treatment of eclampsia in the emergency room and treatment of vaginal bleeding (first half of pregnancy) in the emergency room. Specialized tasks of nursing in the antenatal ward: sending the patient and taking an ECG from the patient. Specialized nursing tasks in the post-partum ward: placing a Foley catheter for hospitalized and atony patients. Following the formation of team, the required training was provided to the team members. After stating objectives and training the methodology using the hierarchical analysis method, tasks and subtasks of the nursing were determined, and the worksheets of SHERPA were completed through observation and interview. After that, worksheets were entered into Excel for analysis. Frequency and type of error (action: injection, retrieval: receiving information through the monitor, reviewing: guiding and managing a process, selection: choosing a route or other route according to medical command and communication: Conversation with Hospital departments) *via* worksheet SHERPA and risk level of errors using a matrix of

classification of errors were specified.

We conducted interviews based on the Sherpa checklist and worksheet. The method’s reliability and validity have previously been approved [32]. This method has previously been applied in Iran’s healthcare setting and has been proven useful in recognizing errors [30, 36]

**4. RESULTS**

Thirty-two tasks were divided, and finally, 252 errors related to the activities of nurses were identified. Actions, communication, retrieval, revision and selection errors constituted 60%, 23%, 3%, 12% and 2% of the errors, respectively (Table 1).

The cases were categorized based on risk level as follows: unacceptable risk with 16 errors, undesirable risk level 96 errors, acceptable risk level which needs revision with 107 errors, and acceptable risk level which does not need revision with 33 errors. As it is illustrated in Table 2, an acceptable risk, which needs revision, has the most percentage, and unacceptable errors have the least percentage (Table 2). Table 3 shows the frequency and percentage of errors in terms of the risk level.

Among retrieval errors, according to Table 4, the most non-revision errors from action errors were with 90 errors and the least non-revision errors of selection errors were 3 errors.

**Table 1. Frequency and percentage of error type.**

Total	Selection Error	Communication Error	Retrieval Error	Revision Error	Action Error
Number (Percentage)	Number (Percentage)	Number (Percentage)	Number (Percentage)	Number (Percentage)	Number (Percentage)
252 (100%)	6 (2%)	30 (12%)	7 (3%)	57 (23%)	152 (60%)

**Table 2. Frequency and percentage of error risk level.**

Total	Acceptable Without Need For Revision	Acceptable With Need For Revision	Undesirable	Unacceptable
252	33	107	96	16
100%	13%	42%	38%	6%

**Table 3. Frequency and percentage of errors in terms of risk level.**

Total	Selection Error	Communication Error	Retrieval Error	Revision Error	Action Error	-
16	1 (6%)	2 (13%)	1 (6%)	2 (13%)	10 (62%)	Unacceptable
96	2 (2%)	10 (10%)	1 (1%)	15 (16%)	68 (71%)	Undesirable
107	3 (3%)	10 (9%)	4 (4%)	35 (33%)	55 (51%)	Acceptable With Need For Revision
33	0 (0%)	8 (19%)	1 (3%)	5 (15%)	19 (58%)	Acceptable Without Need For Revision
252	6	30	7	57	152	Total

**Table 4. Frequency and percentage of revision errors/lack of revision.**

Total	Selection Error	Communication Error	Retrieval Error	Revision Error	Action Error	-
120 (47%)	4 (1%)	23 (9%)	4 (1.5%)	27 (11%)	62 (25%)	With Retrieval
132 (52%)	3 (1%)	7 (3%)	4 (1%)	28 (11%)	90 (36%)	Without Retrieval

## 5. DISCUSSION

The most frequent errors of nurses were related to action errors with a frequency of 60%, which is consistent with Dastaran, Kermani, Krughdeh, Ghassemi [5, 36 - 40]. Revision errors came next, which happened due to the nature of the nursing job and its task.

Based on the level of risk, approximately 44% of the identified errors were unacceptable and undesirable; the unacceptable level of risk only allocated 6% of these errors, which are consistent with the study of Dastaran, Kermani and Krughdeh [5, 36, 37]. The highest "probability of errors" was for the possible errors and the least was for repeated errors, and the major part of "severity of error" was at the border level, and a lower percentage of them placed in the catastrophic and critical level, which is consistent with the study of Dastaran [5].

A significant part of the errors was identified at an undesirable risk level (38%) and acceptable with the need for revision (42%), which increases the importance and necessity of preventive and control measures. These measures include voluntarily reporting systems of error, improvement of diagnostic equipment and systems [39], guidelines, policies and related checklists [40]. Also, more attention to improving processes is recommended.

The risk levels of some errors were as follows: forgetting to assess the patient's respiratory conditions in the hospitalization task with a risk level of A3 (unacceptable); controlling the patient in terms of symptoms and immediate complications in the medication task with a risk level of A3 (unacceptable); control of vital signs in the task of connecting the ventilator to the client with risk level A3 (unacceptable); placing the baby in the right place in the chest for intubation with risk level D3 (acceptable with the need for revision); recording the actions taken in the patient file In monitoring the patient with risk level D3 (acceptable with the need for revision); lack of hand washing or disinfection in the task of placing the umbilical catheter with a risk level of B3 (unfavorable); and timely presence of all personnel in the task of delivering the ward with a risk level of C4 (acceptable without the need for revision).

Since a major part of errors do not have retrieval opportunities, and given that in the national accreditation system, lots of attention is paid to the issue of patient safety, it is considered as the national validation spirit. In addition to the measures and standards, another specific score is generally considered for hospitals. Therefore, the need for holding training courses at all levels of hospitals, especially at the level of senior managers, to justify and to gain their commitment to this issue is felt. Also, to prevent errors that had the most frequency, it is necessary to pay attention to standards, documents, hospital policies and in-service training.

In the general tasks of nursing, administering medication with a high-risk level and in the specialized tasks, connecting the ventilator to the patient, suctioning the trachea, monitoring the patient, and taking an ECG were among the high-risk tasks. However, the effective factors in the occurrence of errors were multi-factorial and related to people, equipment, and their organizations. In general, paying attention to the following

items could be effective in reducing errors:

1-Equipment: Redesign or modification of the existing equipment, the establishment of standard reporting systems, and use of new medical technologies

2- Training: Employing experienced nurses and providing continuous training

3- Instructions: Providing new instructions, modifying old instructions, and preparing standard checklists

4- Organization: Making changes in the organization's policy, reviewing and improving management, and monitoring systems, stress management and standard teamwork

One of the limitations of this study is the lack of time to fully review all the duties of a nursing job and to study nursing errors in the hospital.

## CONCLUSION

Most of the duties of nurses are related to provide healthcare and practical actions. Therefore, hospital authorities should pay more attention to functional errors and prioritize these errors in patient safety. It is recommended to include and implement specific measures in the field of patient safety culture in hospital standards to prevent errors. The SHERPA approach can be a good way to identify and evaluate medical errors.

## LIST OF ABBREVIATIONS

**SHERPA** = Systematic Human Error Reduction and Prediction Approach

## AUTHORS' CONTRIBUTIONS

M M contributed to data collection and agreed to be accountable for all aspects of the work.

S: contributed to substantial contributions to the conception or design of the work and agreed to be accountable for all aspects of the work.

M A drafted the work or substantively revised it and agreed to be accountable for all aspects of the work.

B A contributed to analysis and interpretation of data and agreed to be accountable for all aspects of the work.

S A drafted the work or substantively revised it and agreed to be accountable for all aspects of the work.

K K contributed to the conception or design of the work, analysis and interpretation of data, drafted the work or revised it critically for important intellectual content, approved the final version to be published, and agreed to be accountable for all aspects of the work.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The present study is part of a dissertation titled "Identifying and Evaluating Human Errors in Personnel of Kowsar Hospital by SHERPA Method" in the Department of Health Services Management, Faculty of Health, Qazvin University of Medical Sciences. Its code of ethics is

IR.QUMS.REC.1396.72, which has been approved by the Faculty's ethics committee.

### HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

### CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

### STANDARDS OF REPORTING

STROBE guidelines were followed.

### AVAILABILITY OF DATA AND MATERIAL

The data supporting the findings of the article is available in the (Comprehensive description of nursing tasks) at [<https://arakmu.ac.ir/file/download/page/1599473321-.pdf>].

### FUNDING

None.

### CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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### REFERENCES

- Stock GN, McFadden KL, Gowen CR III. Organizational culture, critical success factors, and the reduction of hospital errors. *Int J Prod Econ* 2007; 106(2): 368-92. [<http://dx.doi.org/10.1016/j.ijpe.2006.07.005>]
- Rubin G, George A, Chinn DJ, Richardson C. Errors in general practice: Development of an error classification and pilot study of a method for detecting errors. *Qual Saf Health Care* 2003; 12(6): 443-7. [<http://dx.doi.org/10.1136/qhc.12.6.443>] [PMID: 14645760]
- Ramiro JS, Aisa PB. Risk Analysis and Reduction in the Chemical Process Industry. Springer Science & Business Media 2012.
- Orland FJ. William John Gies: His Contribution to the Advancement of Dentistry. William J. Gies Foundation for the Advancement of Dentistry with the special assistance of the International Association for Dental Research 1992.
- Dastaran S, Hasheinejhad N, Shahravan A, Baneshi M, Faghihi A. Identification and assessment of human errors in postgraduate endodontic students of Kerman University of Medical Sciences by Using the SHERPA Method. *J Occup Hyg Eng* 2016; 2(4): 44-51. [<http://dx.doi.org/10.21859/johe-02046>]
- Classen DC, Resar R, Griffin F, *et al*. 'Global trigger tool' shows that adverse events in hospitals may be ten times greater than previously measured. *Health Aff* 2011; 30(4): 581-9. [<http://dx.doi.org/10.1377/hlthaff.2011.0190>] [PMID: 21471476]
- Van Den Bos J, Rustagi K, Gray T, Halford M, Ziemkiewicz E, Shreve J. The \$17.1 billion problem: the annual cost of measurable medical errors. *Health Aff* 2011; 30(4): 596-603. [<http://dx.doi.org/10.1377/hlthaff.2011.0084>] [PMID: 21471478]
- Weingart SN, Gibberd RW, Harrison B, Harrison B. Epidemiology of medical error. *West J Med* 2000; 172(6): 390-3. [<http://dx.doi.org/10.1136/ewjm.172.6.390>] [PMID: 10854389]
- Pahlevan D, Jandaghi J, Shaeeri M, Razavi M, Abdollahpour A, Kermani A. Classification and assessment of medication errors in the emergency unit of a hospital in Iran by SHERPA. *Middle East J Fam Med* 2018; 16(4): 107-12.
- World alliance for patient safety progress report 2006-2007. World Health Organization 2008.
- Mohammadfam I, Bashirian S. Evaluation and management of human errors in critical processes of hospital using the extended CREAM technique. *Iran J Health Saf Environ* 4(4): 851-8.
- Ghiyasi S, Heidari M, Hoda A, Azimi L. Human error risk assessment of clinical care in emergency department with SHERPA approach and nurses safety climate analysis. *Salamat-i Kar-i Iran* 2018; 15(3): 134-40. [In Persian].
- Hofer TP, Hayward RA. Are bad outcomes from questionable clinical decisions preventable medical errors? A case of cascade iatrogenesis. *Ann Intern Med* 2002; 137(5\_Part\_1): 327-33. [[http://dx.doi.org/10.7326/0003-4819-137-5\\_Part\\_1-200209030-00008](http://dx.doi.org/10.7326/0003-4819-137-5_Part_1-200209030-00008)] [PMID: 12204016]
- Mor V, Gruneir A, Feng Z, Grabowski DC, Intrator O, Zinn J. The effect of state policies on nursing home resident outcomes. *J Am Geriatr Soc* 2011; 59(1): 3-9. [<http://dx.doi.org/10.1111/j.1532-5415.2010.03230.x>] [PMID: 21198463]
- Parry AM, Barribal KL, While AE. Factors contributing to Registered Nurse medication administration error: A narrative review. *Int J Nurs Stud* 2015; 52(1): 403-20. [<http://dx.doi.org/10.1016/j.ijnurstu.2014.07.003>] [PMID: 25443300]
- Unver V, Tastan S, Akbayrak N. Medication errors: Perspectives of newly graduated and experienced nurses. *Int J Nurs Pract* 2012; 18(4): 317-24. [<http://dx.doi.org/10.1111/j.1440-172X.2012.02052.x>] [PMID: 22845630]
- Rathert C, May DR. Health care work environments, employee satisfaction, and patient safety. *Health Care Manage Rev* 2007; 32(1): 2-11. [<http://dx.doi.org/10.1097/00004010-200701000-00002>] [PMID: 17245197]
- Fasolino T, Snyder R. Linking nurse characteristics, team member effectiveness, practice environment, and medication error incidence. *J Nurs Care Qual* 2012; 27(2): E9-E16. [<http://dx.doi.org/10.1097/NCQ.0b013e318241da17>] [PMID: 22218262]
- Vogus TJ, Sutcliffe KM. The impact of safety organizing, trusted leadership, and care pathways on reported medication errors in hospital nursing units. *Med Care* 2007; 45(10): 997-1002. [<http://dx.doi.org/10.1097/MLR.0b013e318053674f>] [PMID: 17890998]
- Westbrook JI, Rob MI, Woods A, Parry D. Errors in the administration of intravenous medications in hospital and the role of correct procedures and nurse experience. *BMJ Qual Saf* 2011; 20(12): 1027-34. [<http://dx.doi.org/10.1136/bmjqs-2011-000089>] [PMID: 21690248]
- Westbrook JI, Woods A, Rob MI, Dunsmuir WT, Day RO. Association of interruptions with an increased risk and severity of medication administration errors. *Arch Intern Med* 2010; 170(8): 683-90. [<http://dx.doi.org/10.1001/archinternmed.2010.65>] [PMID: 20421552]
- Manojlovich M, DeCicco B. Healthy work environments, nurse-physician communication, and patients' outcomes. *Am J Crit Care* 2007; 16(6): 536-43. [<http://dx.doi.org/10.4037/ajcc2007.16.6.536>] [PMID: 17962497]
- Mark BA, Belyea M. Nurse staffing and medication errors: Cross-sectional or longitudinal relationships? *Res Nurs Health* 2009; 32(1): 18-30. [<http://dx.doi.org/10.1002/nur.20305>] [PMID: 18825733]
- Picone DM, Titler MG, Dochterman J, *et al*. Predictors of medication errors among elderly hospitalized patients. *Am J Med Qual* 2008; 23(2): 115-27. [<http://dx.doi.org/10.1177/1062860607313143>] [PMID: 18305099]
- Clendon J, Gibbons V. 12h shifts and rates of error among nurses: A systematic review. *Int J Nurs Stud* 2015; 52(7): 1231-42. [<http://dx.doi.org/10.1016/j.ijnurstu.2015.03.011>] [PMID: 25910955]
- Mohammad Nejad S, Hojjati H, Ehsani R. The amount and type of

- medication errors in nursing students in four teaching hospitals of Tehran. *J Med Ethics Hist Med* 2008; 88.
- [27] Carlton G, Blegen MA. Medication-related errors: A literature review of incidence and antecedents. *Annu Rev Nurs Res* 2006; 24(1): 19-38. [<http://dx.doi.org/10.1891/0739-6686.24.1.19>] [PMID: 17078409]
- [28] Penjvini S. Investigation of the rate and type of medication errors of nurses in Sanandaj Hospitals. *Iran J Nurs Res* 2006; 1(1): 59-64.
- [29] Cheragi MA, Manoocheri H, Mohammadnejad E, Ehsani SR. Types and causes of medication errors from nurse's viewpoint. *Iran J Nurs Midwifery Res* 2013; 18(3): 228-31. [PMID: 23983760]
- [30] Kermani A, Mazloumi A, Naslseraji J, Ghasemzadeh F. Identification and evaluation of human errors using SHERPA method in Emergency Physicians working in Semnan Amiralmomenin Hospital. *Occupational Medicine Quarterly* 2014; 5(3): 87-78. [In Persian].
- [31] Spănu F, Băban A, Bria M, Lucăcel R, Florian IȘ, Rus L. Error communication and analysis in hospitals: The role of leadership and interpersonal climate. *Procedia Soc Behav Sci* 2013; 84: 949-53. [<http://dx.doi.org/10.1016/j.sbspro.2013.06.680>]
- [32] Stanton N, Salmon P, Baber C. Human factors design & evaluation methods review-Human error identification techniques" SHERPA. *Appl Ergonomics* 2004; 140-8.
- [33] Lyons M. Towards a framework to select techniques for error prediction: Supporting novice users in the healthcare sector. *Appl Ergon* 2009; 40(3): 379-95. [<http://dx.doi.org/10.1016/j.apergo.2008.11.004>] [PMID: 19091307]
- [34] Mohammad Fam I. *Engineering of safety*. Tehran: Fanavaran 2001.
- [35] SP800 N. *Risk Management Guide for Information Technology Systems*.
- [36] Kermani A, Mazloumi A. Identification and evaluation of human errors using SHERPA technique among nurses at emergency ward of an educational hospital in Semnan city, Iran. *Occup Med Quart J* 2013; 40(4): 29-43.
- [37] Kroghdeh J. Identification and Evaluation of Human Errors in Surgery part in Kerman hospital by using SHERPA Method. Kerman: Kerman University of Medical Science 2013.
- [38] Bunn JR, Berentsen R, Glittum E, Steinsvik LK. A Human Factors Approach to Reduce Hydrocarbon Leakages on the Norwegian Continental Shelf. SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production. [<http://dx.doi.org/10.2118/126469-MS>]
- [39] Spencer FC. Human error in hospitals and industrial accidents: Current concepts. *J Am Coll Surg* 2000; 191(4): 410-8. [[http://dx.doi.org/10.1016/S1072-7515\(00\)00691-8](http://dx.doi.org/10.1016/S1072-7515(00)00691-8)] [PMID: 11030247]
- [40] Ghasemi M. Survey of Ergonomic Human Error. Control Room of Petrochemical Industry by SHERPA. Health School of Tehran University Of Medical Science 2009; pp. 2-150.

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