Classification and assessment of medication errors in the emergency unit of a hospital in Iran by SHERPA

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Abstract

Background: Human errors are of the most important causes of accidents in the medical profession and impose exorbitant costs on societies. Therefore, the present research was carried out in order to classify and assess medication errors in the emergency ward of a hospital in Iran by SHERPA.

Method: In a cross-sectional study, first the aims and procedures were instructed to physicians and then with their cooperation and presence in the unit and by viewing the activities, the errors were identified and analyzed using standard and authentic technique SHERPA.

Results: According to results, 60 errors were identified including 23 errors (38%) related to physicians' tasks and 37 errors (62%) related to nurses' tasks. In both groups, the functional errors had the highest percentage. In the nurse group, both functional errors (69%) and reviewing errors (40.5%) were higher than the doctors (respectively 49% and 17.3%). Moreover, in both groups, acceptable errors with modification were higher and unfavorable errors were secondary.

Conclusion: In both occupations, functional errors (with the most frequency) and reviewing errors should be considered as priorities for controlling such errors.

Key words: Emergency ward, SHERPA technique, health care staff

Introduction

Since human resources are the most important asset of any system, omitting human roles, especially in complex and service systems such as medical jobs is not possible. On the other hand, according to the inherent fallibility of humans and also considering some limiting characteristics such as limited memory for recalling information, loss of judgment and decision-making in stressful and sensitive situations, it seems the only option available to prevent and reduce human errors is to minimize the vulnerability of the system and processes relative to human errors, and the implementation of appropriate methods for the detection and prediction of possible human errors and providing appropriate control methods. It should be said the best and most practical option, is the application of appropriate techniques to predict and identify the types of human errors, analyze their root causes and detect appropriate methods for controlling them (1,2).

In 2004, a cognitive taxonomy of medical errors was presented by Zhang and colleagues in which the classification scheme of medical errors in people and their interaction with technology, the use of cognitive theories of human errors and human performance were investigated in order to develop theoretical principles of classification and the building of classification structures, instruction in classification structures, localizing the classification by examples of medical errors, identifying cognitive mechanisms for each group of human errors in and their application in such problems (1).

Many of the major medical error studies have highlighted medication errors as a cause of adverse events suffered by patients (Bates et al., 1995; Leape et al., 1995; Brennan et al., 1991; Kohn et al., 1999). Ferner and Aronson (2000) defined a medication error as 'a failure in a drug treatment process that leads to, or has the potential to lead to, harm to the patient'.

Wolf (1993) pointed out that nurses make medication errors regardless of their specialty and that errors occurred on medical and surgical floors, postpartum units, emergency units and intensive care units.

There are several different methods of classifying medication errors; two are given here.

The first is based on psychological theory and divides errors into four types: knowledge-based errors, rule based errors, action-based errors and memory-based errors (3, 4). This classification gives insights into potential methods of prevention.

The second is the classification proposed by the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP, Table 1), according to the intensity of the resulting harm (6, 7).

Inter-rater agreement when using the NCC MERP system has been determined in a study in which 550 users of the MEDMARX system were asked to categorize 27 medication scenarios using the NCC MERP index and were randomly assigned to one of three tools (the index alone, a paper-based algorithm, or a computer-based algorithm) to assist in categorization. Of 119 positive responses, 101 completed surveys were returned. Overall inter-rater agreement for the participants, regardless of group assignment, was 0.61 and there was no difference among the kappa values of the three study groups and the tools used to aid in medication error classification. (8)

According to American Institute of Medicine (USAIM) in 2008, more than 225 million deaths occurred only due to medical errors. Of these, 7,000 deaths were caused by medicine prescription errors and over 106,000 of them were caused by side effects of medicines (9).

The results of consistent studies done by USAIM show that medication errors affect at least 1.5 million people yearly in which 400 thousand errors are preventable and 800 thousand are related to prescription drugs for long-term admission patients and 350 thousand are related to outpatient medicine-related needs (10).

Since study of medical errors, and in particular investigating medication errors by standard techniques, are very scarce and given the importance of identifying and preventing these errors on patients' health and reducing the length of treatment as well as reducing the cost of treatment, this study was done.

Materials and Methods

This study was cross-sectional and was designed in order to identify, classify and evaluate medication errors and provide control approaches in the emergency unit. This study was performed using standard and authentic technique "SHERPA" (Systematic Human Error Reduction and Prediction Approach). One of the important reasons for choosing this method was that various studies were conducted worldwide using this method and its popularity is confirmed by researchers. We refer to a few examples: Lyons et al. (2004), mentioned this technique as one of the seven techniques used for assessing health workers. (Chance analysis, FMEA, HAZOP, SHERPA, EVENT TREE, FTA and effect diagram) (11)

In 2005, Novil using SHERPA technique, evaluated hospital errors. This study stated that the versatility of this method to all health processes is one of SHERPA's strengths (1). In 2005, Stanton and Harrison presented an article titled "Using Hierarchical Analysis Method for Medicine Management Errors". This study investigated patients' medication errors management in hospital. As medicine management is a complex and dangerous task and many frequent errors can occur in this process, SHERPA was used to identify them(5)

Bhuvanesh and colleagues (2008) used SHERPA for the process of medicines prescription in a cardiac telemetry unit and concluded that the method adopted is useful for hospital managers to plan and use the primary different technologies useful to improve the medicine prescription process (12).

Implementation of SHERPA:
There are 8 steps for implementationof this method:

1. Hierarchical task analysis (HTA(
The process begins by analyzing administrative activities. In reality, analyzing begins by considering the ultimate goal and dividing it into smaller components. Then the final component which cannot be divided into smaller components is used by SHERPA Method.

2. Task Classification
Every stage of the work at the lowest level of analysis for error classification can be considered as follows:
(A) Action: for example, opening a door
(B) Recovery (error detection and diagnosis): receiving information through regulations, guidelines, circulars, monitor and....
(C) Checking (review): leading and managing an investigation process
(D) Selection: Choosing a different approach with respect to the higher official recommendation.
(E) Information Exchange: Communicating with other sectors or groups

3. Human error identification:
At this stage, the types of human errors tabled in the SHERPA method (Appendix B) is used (13).

4. Consequence analysis
The investigation of each error on system is the next vital step and has applicable results for critical errors. It is necessary for analyst to provide a full description of the results, as well as error detection.

5. Error detection analysis (Recovery analysis)
At this point, the analyst should specify the possibility or impossibility of identified errors potential detection.

6. Analysis of the risk of error (Ordinal probability analysis)
At this stage, errors are usually classified into low, medium and high groups. If the error did not occur, it is classified in the low group. In the case it occurred sometimes in the past, it is classified in the medium group and if it has occurred repeatedly, places it in the high group.

7. Analysis of criticality or severity of error (Criticality analysis)
If the results were considered extreme or critical or led to unacceptable events, it must be considered. When an error is classified as a critical error it has led to a severe incident that results in damages for the structure of organization, industry, product and personnel (13). In medical jobs, risk level related to human errors can be easily determined regarding the symptoms, and consequences of each error in terms of intensity, likelihood and frequency. Similar studies have been presented in the pattern of this work. In this study, in order to have a better and more comprehensive evaluation and analysis of errors and determination of their risk level for steps 6 and 7, theMIL- STD 88213 standard was used. In this standard, the error classification was put into four groups based on severity: Catastrophic (1), Critical (2), Borderline (3) Details (4). The errors were classified into four groups based on the possibility: Frequent (A) Likely (B), Occasionally (C) Very few (rare) (D) Unlikely (E). Finally with the combination of probability and severity of errors, the potential hazards are divided into four groups: unacceptable, unfavorable, acceptable with modification and acceptable without modification (safe) and necessary decisions are taken to prevent errors. (14).

8. Analysis modifying or providing control methods (Remedy analysis)
At this stage, error education approaches are presented. These approaches are in the form of changing suggestions in the work system which is provided to prevent errors. The guidelines are divided into 4 groups:
(A) Equipment: Redesign or modifications in equipment
(B) Education: Education or a change in education trend or process
(C) Guidelines: Presenting new guidelines or revising them
(D) Organization: Making changes in organization policy (13)

All identified errors and the obtained data are recorded in the techniques worksheet. For this purpose, first we formed a team of doctors and nurses working in this unit and then trained them regarding the objectives and methods. Then, with their cooperation and presence in the unit and viewing the activities and tasks and use of instructions and circulars, we identified and analyzed the errors. After that, we registered them in the relevant worksheet. Finally, in order to ensure the accuracy of data, we consulted with experts and other people.

Results

A total of 60 errors relating to the tasks of doctors and nurses were identified. 38% (23 errors) were related to the task of doctors and 62% (37 errors) of errors related to nurses' duties. As can be seen nurses' errors rate were higher than doctors. In both groups, the functional errors were in first place and reviewing errors were in second place and other errors were in the following ranks. In the nurses' group, both functional errors (69%) and reviewing errors (40.5%) were more than doctors. (Respectively 49% and 17.3%) (Table 1)

Table 1. The frequency, percentage and types of doctors and nurses' errors

Error type Occupation	Action N (%)	Checking N (%)	Retrieval N (%)	Communication N (%)	Selection N (%)	Total N (%)
Physician	11 (48)	4 (17.4)	2 (8.6)	3 (13)	3 (13)	23 (38.4)
Nurse	24 (65)	5 (13.5)	2 (5.5)	3 (8)	3 (8)	37 (61.6)
Total	35 (58.4)	9 (15)	4 (6.6)	6 (10)	6 (10)	60 (100)

Table 2: The frequency, percentage and types of doctors and nurses' error risk levels

Error type Occupation	Unacceptable N (%)	Unfavorable N (%)	Acceptable, with modifications N (%)	Acceptable, without modifications N (%)	Total N (%)
Physician	0 (0%)	6 (26)	17 (74)	0 (0)	23 (38.4)
Nurse	0 (0%)	19 (51.3)	17 (46)	1(2.7)	37 (61.6)
Total	0 (0%)	25 (41.7)	34 (56.7)	1 (1.6)	60 (100)

According to risk level of errors, in bothgroups, acceptable errors with modification took the first place and unfavorable errors took the second place but unacceptable errors were not seen. Acceptable errors with modification in doctors' group (74%) were more than nurses' group (60%) but unfavorable errors in nurses' group (3.51%) were more compared to doctors' (26%) (Table 2).

Discussion

Due to the nature of the job and responsibilities of nurses and doctors, the results seem real because the nurse in charge of implementing medical directives (pharmaceuticals) and patient care, and the diversity and amount of activities and responsibilities of nurses are more than doctors.

According to investigations conducted, similar studies with this method or other standard methods have not been done to allow results to be compared with them.

In this study, the most important identified medication errors included errors in the name of medicine, errors in the choice of medicines, errors in medicine prescriptions, errors in medicine injection, error in reading the expiry date, medicine dose error , forgetting the medicine use or not timely use.

According to research done, medication errors are mostly due to excessive work pressure, interventions in nursing tasks, unfit shift patterns, poor communication, hard work at home, lack of information and skills in calculating the medicine dose, insufficient experience, aging, job complexity, hastiness and stress and unfolding emergency care (5 and 15).

Other causes of these errors can also be mentioned, such as resemblance in naming, similarity in medicine appearance, illegibility of medication orders, lack of control and information check list and information registration, lack of detailed records and history investigation, lack of information on medicine, wrong medicine calculation (9 and 16) etc.

In this regard, several studies have been done and we mention some of them:

Kelly Gonzales evaluated medicine prescriptions and management errors for aged people through systematic research and found that factors involved in occurrence of errors in the field are prescription of different doses of a medicine, prescription of wrong dose, non-prescription of standard dose, organ largeness (17).

Zane Robinson Wolf and colleagues, examined medicine prescriptions errors in nursing students in a descriptive study using the NCC MERP index (classification of medicines errors index) according to the prescriptions reports in MEDMARX system (Pharmacology database on patient safety program in the US). In this study, of 1305 students, about 3% had errors leading to patient injury. Most of these errors were errors of omission as a result of a mistake in students' performance (18).

Patricia van den Bemt et al, investigated medication errors in nursing homes that distributed medicines using an automated system by a retrospective observational study in New Zealand and found that most errors were related to wrong method of using medicines (inappropriate medicine crushing and lack of supervision on using medicines) and using medicine at the wrong time (19).

In a survey done on Canadian anesthesiologists, from 687 people who responded to questionnaires, 85 % reported at least one mistake during their practice but 98% of these cases did not have very serious consequences but 4 deaths were also reported. The most common error was the injection of muscle relaxants instead of conscious anesthesia drugs and the most common cause was syringe displacing (70.4%) and label false identification (% 46.8). 97.9% of professionals reported that they usually read the label but also label color is a very important factor (20).

In another study in Canada, anesthesia errors resulting in complaints cases recorded from 1998 to 2002 were investigated in which medication errors are put in the first place. The study, which looked at 232 cases of medication errors included: delay in medicine prescription, wrong prescription, wrong dose and mistake in patients' monitoring which accounted for 120 of the 232 cases (21).

In 2006, Kopp and colleagues, in a study based on direct observations, determined the incidence of medicine errors, and identified three reasons in this regard including 1- lack of medicine information, 2- having problem in memorization 3- medicine recognition (22).

Conclusion

The important thing that should be mentioned is that control of functional and reviewing errors and errors with unfavorable risk review should be prioritized.

In this regard, the most important control measures based on the research are reported.

The authors gave numerous recommendations for actions to prevent errors, including the following:
• use of a pediatric formulary;
• use of a uniform system of weight-related dosing (e.g. mg / kg);
• inclusion in the prescription of the child 's weight, the dose, and the volume to be given;
• provision of checks and balances;
• avoidance of abbreviations;
• use of leading zeros to the left of the decimal point (eg 0.1 mg rather than .1 mg);
• avoidance of terminal zeros to the right of the decimal point (e.g. 5 mg rather than 5.0 mg);
• watching for look-alike and sound-alike medications and storing such medicines apart;
• knowing the antidote to each medication and ensuring that it is immediately available in the right dose;
• improved communication between physicians, pharmacists and nurses;
• Acknowledgement and reporting of medication errors in a blame-free environment. (23)

Also, USAIM has noted the following points for the removal and reduction of medication errors:
1. Food and Medicine Ministry cooperates with customers and manufacturers to redesign packaging and the contents to be easily readable.
2. Medications must be labeled according to standards.
3. The names of medicines that have a different use should not be similar.
4. The tablets need to be constructed in such a way that avoids confusion, especially those that have different purposes.
5. All doctors and pharmacists should become familiar with electronic prescribing systems that can reduce medication errors in writing and can automatically detect hidden medicine interactions.
6. Customers should have the necessary information for their medication (24).

In one study it was shown that computerized medical systems can reduce medication errors by 80% and, more importantly, reduce the damage to 55% of patients (25).
In another study it was shown that the standard loading system of medicine distribution system may reduce medication errors by 25% (26).

Points such as access to up to date resources like valid pharmacology books, adequate training of nurses, careful attention to the expiration date by customers and nurses, avoidance of no use of acronyms and paying attention to the effects of similar medicines, spelling out the exact name of medicines, careful attention to tags and labels, Medicine susceptibility testing, training of patients, providing appropriate equipment and facilities for the preparation of medicines such as adequate lighting, and medicine delivery by a skilled technical director, management and supervision on the method of distribution of medicines, reduce medication errors (27).

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