

## Investigating the Usefulness of a New Electronic Error- Reporting System in Medical Error Management in the Shohadaye Haftom Tir Hospital in 2019-2020

Shirin Nasrolahnejhad Tasouj<sup>1</sup>, Fatemeh Mohammadi<sup>2</sup>, Mehdi Nouri<sup>3</sup>, Reza Mosaddegh<sup>2</sup>, \*Samira Vaziri<sup>2</sup>

1. Shohada-e Haftom-e Tir Hospital, Tehran University of Medical Sciences, Tehran, Iran. PhD Nursing Student.

2. Emergency Medicine Management Research Center, Health Management Research Institute, Iran University of Medical Sciences, Tehran, Iran.

3. Department of Occupational Health, School of Public Health, Ahvaz Jundishapur University of Medical Science, Ahvaz, Iran.

| ARTICLE INFO   | ABSTRACT  |
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| <p><b>Article type:</b><br/>Original</p> <hr/> <p><b>Article History:</b><br/><b>Received:</b> 25 May 2022<br/><b>Accepted:</b> 06 Oct 2022</p> <hr/> <p><b>Keywords:</b><br/>Electronic Error-reporting System, Error, Medical error, Medication error</p>  | <p><b>Introduction:</b><br/>Providing health services in medical centers is associated with risks and medical errors for recipients. In many cases, despite medical experts' ethical and professional commitment to disclose errors, the error report among treatment staff is less than the actual rate. Therefore, the present study was conducted to investigate using a new electronic error-reporting registration system method in Shohadaye Haftom Tir Hospital in 2018-2019.</p> <p><b>Materials and Methods:</b><br/>This was a descriptive cross-sectional study. Errors reported in 2018 and 2019 were investigated using the paper-based method and electronic error-reporting system, respectively. Data were analyzed using SPSS software (version 22) after classifying errors.</p> <p><b>Results:</b><br/>In the electronic method, 194 errors were reported, of which medication errors accounted for 33% and medical errors for 22% of the total errors. Hospital congestion was one of the major causes of the error. Nurses were more likely to make medical errors than other groups. In the paper-based reporting error method, out of 44 cases, about 37% were technical-related errors. The most important cause of the error was a lack of proper communication with the patient (30%). Findings suggested that the error percentage significantly increases in both methods due to the causes, specific sectors, and job categories.</p> <p><b>Conclusion:</b><br/>Findings have shown the efficiency of the electronic system in detecting errors. Managers' attention and actions toward using the electronic system can greatly affect the health and treatment of patients.</p> |
| <p>► <b>Please cite this paper as:</b><br/>Nasrolahnejhad Tasouj S, Vaziri S. Investigating the Usefulness of a New Electronic Error- Reporting System in Medical Error Management in the Shohadaye Haftom Tir Hospital in 2019-2020. <i>Journal of Patient Safety and Quality Improvement</i>. 2022; 10(3):105-113. Doi: 10.22038/PSJ.2022.65765.1358</p> |   |

**\*Corresponding Author:**

Emergency Medicine Management Research Center, Health Management Research Institute, Iran University of Medical Science, Tehran, Iran. E-mail: samiravaziri155@yahoo.com

## Introduction

Medical-related errors are unintended events that lead to adverse events and, in some cases, harm the patient (1,2). A large number of patients around the world are being harmed by medical care errors and the resulting adverse events every year. Various actions have been taken to ensure patient safety and create a safer health system (3). Healthcare organizations in the United States have placed more emphasis on developing and implementing integrated patient safety programs (4). The basis of the patient safety program is the voluntary reporting of actual errors as well as near-miss events (5,6).

The aim of the treatment staff is patient care (7). However, clinical errors affect performance and patients care (8). In this regard, it is important to provide a solution to minimize medical experts' errors to prevent recurrence and ultimately increase patient safety (9,10).

Hundreds of thousands worldwide die every year due to medical errors (11). In many cases, medical errors have been preventable (12). Research suggests that up to 3.7% of hospitalized patients suffer from injury or disease due to errors (13). It kills 210,000 to 440,000 people, and more than a million are injured annually in the United States (14,15). One of the key steps in managing medical errors is to detect, identify, and report medical errors (16). Studies have shown that to take effective measures to reduce the rate of errors; it is necessary to identify the causes and nature of errors (17).

One way to identify and manage nurses' clinical errors is to report and record errors (15). However, despite healthcare providers' ethical and professional commitment to exposing their work errors, the error rate among nurses and physicians is much lower than their actual rate (18).

They are reluctant to report errors because of their working conditions, perceptions, and interests (19-21). In developing countries, it is difficult to estimate the error rate due to the lack of a proper reporting system and research in this area (22). The biggest obstacle to reporting errors was the lack of knowledge about how to report errors, the types of errors, and the recording

and sending errors process (23). Research has shown that electronically registering an error report has led to a dramatic increase in reports of common errors in hospitals, ultimately improving the error report. This improvement in error reporting leads to the implementation of a wide range of innovations in the quality of care and minimizes errors at different stages (24). Regarding the points mentioned above, the present study was designed and launched with the help of a new electronic error-reporting registration system method.

## Methods and Materials

### Study design

This study was done in Shohadaye Haftome Tir Hospital, affiliated with the Iran University of Medical Sciences and Health Services, in 2018 and 2019. A paper-based error recording approach and an electronic error-reporting system were designed to send error reports to the hospital. After analysis and design, the hospital's technology team and patient safety coordinator implemented, designed, and analyzed a system with a patient-centered structure.

### Inclusion and exclusion criteria

All the employees working in the hospital have access to the systems, and if they make a mistake or witness an error, they can register it in the system. Inclusion criteria include personnel who could work with the system. One exclusion criterion was the inability to work with the system and computer.

### Error-Reporting System

Users and different user groups, saving changes in system history, and user access levels were defined in this program.

In the electronic error reporting unit, data access was defined solely for the security expert and technical officer with confidentiality.

This electronic system replaced paper-based registration and error reporting in March 2019. All computers in the hospital were equipped with an error reporting system, and without the use of the Internet, all nurses and hospital staff could access this system, record, and send reports. The form

approved by the Ministry of Health was designed to record and report errors electronically in this system. On the standard page, to collect error information, the input sections were divided into two sections "error recording" and "reporting the reporter's details if desired". It can be implemented in hospitals without a time limit. Access to the system is free of charge, available on the web, and can be used for years.

### **Error recording method**

In the paper-based recording system method, errors were recorded by inserting them in the error report. In the electronic system method, by selecting the error registration option, access to the type, domain, date, and description of the error in the system will be provided. Each section included menu options including near-miss cases, incidents, adverse events, and hazards.

To make identifying errors easier and select the correct type of error, when placing the mouse over the option, the definition of each error is inserted below it. Error domain included medical, pharmaceutical, documentation, nursing, and registration options.

The error date and time section allow them to enter the date of the error, the date of the error report, the treatment section, and the shift in which the error occurred. (It was optional to record the reporter's identity, and each reporter entered his or her personal information if desired.). The next option was the patient's demographics, admission date, and unit name. Finally, the "final registration" option was selected after completing all the steps.

### **Data collection**

In the paper-based method, data were available in the error log file. The data was stored in a central server in the electronic system. Access to input data reports was possible through Android and iOS mobile phones or web software.

Also, the ability to extract data in standard formats to work in statistical software such as SPSS was available. After uploading the data, the submitted errors will be scrutinized by the expert and technical

manager of the hospital, and necessary measures will be taken to correct them. In the committee, the root cause analysis will be reviewed and shared electronically in the other part of the software, and all medical staff can access and view the file using the hospital's computers. Data were available in various formats, including Excel, Word, Pdf, Print, and Photo.

### **Statistical analysis**

Data analysis was performed using SPSS software version 22 to compare the variables of error reports in the study groups. An independent t-test was used to achieve analytical and comparative objectives of variables. A significant level of 0.05 was considered.

### **Findings**

In total, 194 errors were recorded as errors determined by the electronic system, and 44 errors were recorded and investigated in the paper-based system. Electronic errors were about five times more than the paper-based method. In the paper-based error report, out of 44 cases, 15 cases (about 37%) were technical-related errors.

In the electronic system, out of 194 cases, the highest error rate was medication-related errors reported through e-ERS. Medication errors (33%), medical errors (22%), technical errors (17%), registration and reporting-related errors (13%), and diagnostic errors (10%) were the most common, respectively (Table 1).

According to Table 2, in the paper-based error report, the most important cause was the lack of proper communication with the patient (30%) and the crowded unit (20%). In the electronic system, the study of the cause of error showed that crowded shifts (15% of cases) were one of the most important causes of error.

Personnel negligence, with 14%, and similarity of form or name of drugs (11%) were the second and third causes of error, respectively. Studies have shown that the error causes in the two methods were significantly different ( $P = 0.04$ ).

**Table 1:** The number and percentage of types of errors reported on paper and electronically

| Type of Error                  | Cause of Error                                 | Electronic 2019 |                  | Paper-Based 2018 |                  |
|--------------------------------|--|-----------------|------------------|------------------|------------------|
|                                |  | Percentage      | Total percentage | Percentage       | Total percentage |
| Medication-related Errors      | Fail to follow instructions of high risk drugs | 9               | 33               | 0                | 20               |
|                                | Using the wrong form of drug                   | 2               |                  | 0                |                  |
|                                | Improper dose                                  | 6               |                  | 7                |                  |
|                                | Wrong medicine                                 | 12              |                  | 9                |                  |
|                                | Don't taking medicine as directed              | 1               |                  | 2                |                  |
|                                | Wrong Patient                                  | 1               |                  | 0                |                  |
|                                | Wrong time                                     | 1               |                  | 0                |                  |
| Recording and reporting errors | Delay / delete / repeat / continue medication  | 1               |                  | 2                |                  |
|                                | Not recording Errors                           | 6               | 13               | 12               | 26               |
|                                | Recorded in a wrong file/Cardex/form           | 5               |                  | 7                |                  |
|                                | Not record/report telephone orders             | 1               |                  | 7                |                  |
| Technical Errors               | Non-compliance with instructions or guidelines | 14              | 17               | 35               | 37               |
|                                | Insufficient skills in working with equipment  | 1               |                  | 0                |                  |
|                                | Insufficient skills in executing processes     | 2               |                  | 2                |                  |
|                                | Lack of attention to pipes and fittings        | 21              | 22               | 4                | 5                |
| Treatment errors               | Fail follow safe surgical instructions         | 1               |                  |                  |                  |
|                                | Surgery / procedure on the wrong body part     | 0               |                  | 0                |                  |
|                                | Other medical Errors                           | 0               |                  | 1                |                  |
| Diagnostic errors              | Delayed diagnosis                              | 1               | 10               | 7                | 7                |
|                                | Wrong diagnosis                                | 1               |                  | 0                |                  |
| Systematic error               | Missed diagnosis                               | 8               |                  | 0                |                  |
|                                | Inadequate monitoring                          | 5               | 5                | 0                | 5                |
|                                | Other systematic errors                        | 0               |                  | 5                |                  |
| Total percentage               |  | 100             | 100              | 100              | 100              |

**Table 2:** Report the causes of errors in paper and electronic form

| Cause of errors                                   | Electronic<br>2019 | Paper-based<br>2018 | Significance |
|---|--------------------|---------------------|--------------|
|   | percentage         | percentage          |              |
| Crowded units                                     | 20                 | 20                  |              |
| Personnel negligence                              | 17                 | 7                   |              |
| Similarity of form or name of drugs               | 13                 | 4                   |              |
| Long shiftwork                                    | 11                 | 9                   |              |
| Fail to follow instructions of high risk drugs    | 9                  | 0                   | 0/04         |
| Negligence in following the doctor's instructions | 6                  | 4                   |              |
| Inadequate initial assessment                     | 6                  | 0                   |              |
| Technical defects of equipment                    | 0                  | 6                   |              |
| Lack of proper communication with the patient     | 5                  | 30                  |              |
| Medication dosage miscalculations                 | 2                  | 0                   |              |
| Staff shortages                                   | 3                  | 0                   |              |
| Inaccuracies in medication process                | 2                  | 6                   |              |
| Similarity of patient names                       | 2                  | 0                   |              |
| Lack of timely reporting to the doctor            | 2                  | 4                   |              |
| Insufficient skills in working with equipment     | 2                  | 4                   |              |
| Night- work                                       | 0                  | 3                   |              |
| Illegibility of doctor's instructions             | 0                  | 1                   |              |
| Total   | 100                | 100                 |              |

**Most errors**

The classification of errors in the paper-based method indicated that the highest error, 43% of cases, was related to near-miss errors, and no harm event errors were the second type of error reported. However, in the electronic method, the highest percentage of errors was related to adverse event errors. No harm events and near-miss

errors were in the next positions (Table 3). Also, 9% (18 cases) of sentinel event errors were reported in the electronic method, while in the paper-based method, these errors were not reported. Error classification was significantly different between paper-based and electronic methods ( $p = 0.018$ ).

**Table 3:** Errors classification

| Error classification | Electronic 2019 | Paper-based 2018 | Significance |
|----------------------|-----------------|------------------|--------------|
|                      | Percentage      | percentage       |              |
| Adverse event        | 54              | 21               |              |
| Near miss            | 16              | 43               |              |
| No harm event        | 18              | 36               | 0/018        |
| Sentinel event       | 9               | 0                |              |
| Total                | 100             | 100              |              |

**The highest error rate in different units**

The highest error rate in the paper-based method was related to the men's section (39%) followed by the ICU (19%). Reviewing the electronic method in error rate in different units suggested that ICU

(40%), surgery (19%), emergency department (15%), and women's section (13%) had the highest error report (Table 4). Statistical findings suggested that errors rate were different in the two methods, which was statistically significant ( $p = 0.03$ ).

**Table 4:** Finding related to error rate in different sections

| Error rate in different units | Electronic<br>2019 | Paper-based<br>2018 | Significance |
|-------------------------------|--------------------|---------------------|--------------|
|                               | percentage         | percentage          |              |
| ICU                           | 40                 | 19                  | 0/03         |
| Surgery                       | 19                 | 0                   |              |
| Emergency                     | 16                 | 9                   |              |
| Men`s unit                    | 0                  | 39                  |              |
| Clinic                        | 0                  | 3                   |              |
| Women`s section               | 13                 | 16                  |              |
| Operating room                | 6                  | 0                   |              |
| Oncology                      | 1                  | 5                   |              |
| Imaging                       | 1                  | 3                   |              |
| Pharmacy                      | 0                  | 3                   |              |
| Total                         | 100                | 100                 |              |

In the paper-based method, nursing staff (64%) and pharmaceutical (12%) had the highest number of errors. In the electronic method, the findings related to the erroneous occupational category indicated that the nursing staff (60%), physicians (19%), and paramedics (11%) had the

highest number of error reports (Table 5). Statistical findings of the t-test suggested that the erroneous occupational category was different in the two methods, and this difference was statistically significant ( $p = 0.009$ ).

**Table 5:** Findings related to erroneous job category

| Erroneous occupational category | Electronic 2019 | Paper-based 2018 | Significance |
|---------------------------------|-----------------|------------------|--------------|
|                                 | Percentage      | Percentage       |              |
| Nursing staff                   | 60              | 64               | 0/009        |
| Physicians                      | 19              | 9                |              |
| Paramedic                       | 13              | 3                |              |
| Pharmaceutical staff            | 2               | 12               |              |
| Imaging staff                   | 2               | 3                |              |
| Operating room staff            | 3               | 0                |              |
| Laboratory staff                | 0               | 6                |              |
| Facilities                      | 0               | 1                |              |
| Other personnel                 | 1               | 0                |              |
| Total                           | 100             | 100              |              |

Statistical analysis indicated that in both methods, error reporting had a significant relationship with the error causes ( $p = 0.034$ ), the section in which the error

occurred ( $p = 0.13$ ), and the erroneous occupational category ( $p = 0.028$ ). these findings indicated that the error percentage increased significantly ( $p < 0.05$ ).

**Table 6:** Analysis of t-test related to the study groups

|               | Cohort                | P-value | 95% CI      |             |
|---------------|-----------------------|---------|-------------|-------------|
|               |                       |         | Lower Bound | Upper Bound |
| Error reports | Error cause           | 0.034   | 4.91        | 12.40       |
|               | Section               | 0.013   | 7.24        | 28.726      |
|               | Occupational category | 0.028   | -0.710      | 19.24       |

## Discussion

By reporting errors, we can learn from mistakes and use appropriate methods to prevent their recurrence in the future (17). The present study showed that medication-related errors (33%), treatment errors (22%), technical errors (17%), recording and reporting errors (13%), and diagnostic errors (10%) were the most common types. In similar studies, medication-related errors are among the first medical errors (25).

In the current study, nurses and physicians had the highest number of errors. Several studies have shown the major role of nurses and physicians concerning medical errors in Iran and the world, and this issue needs to be further investigated (26, 27). Our study also showed that error reporting had a significant relationship with the error causes, the section in which the error occurred, and the erroneous occupations. McKaig et al. (2014), in their study, attempts to determine the effect of an electronic error reporting system on pharmaceutical reporting rate and care processes. Their study suggested that immediately after the implementation of the electronic error recording system, reported errors increased to 19.4% every month. The change in the slope of the reported error trend was estimated to be 0.76. Near-miss errors and patient injury errors accounted for 90% of the total errors while reporting errors that increased patient supervision or temporary patient injury accounted for 9% and 1%, respectively. Nurses reported more errors than others, and physicians reported errors that resulted in serious injury to the patient. Medical care units accounted for almost half of the hospital-reported errors. The results of this study suggested that a significant reduction in medical errors was observed for 26 months (24). Research suggests that although there are no recorded statistics on the amount and type of errors in Iranan

hospitals, experts speculate that the rate is too high. The growing number of referred cases of people complaining about physicians and nurses to the medical council and the court is proof of this claim (28).

An important issue mentioned in this study was the difference between the reported errors in the two methods. These two methods differed in terms of the number of variables, cause of errors, error classification, error rate in different sections, erroneous job category, and the number of errors. This issue clears the importance of the electronic system in error recording. In the electronic method, sentinel event errors were reported, but in the paper-based method, these errors were not reported, indicating the electronic method efficiency. The efficiency of the electronic reporting system in recording medical errors has also been observed in other studies (29, 30).

The present study focuses on the efficiency and effectiveness of error reporting methods. Despite the importance of the influencing factors in not reporting errors, these factors were not considered (31). Shahabi et al. (2015) indicated that nursing staff's barriers to self-expression of clinical errors were related to the fear of reporting consequences, managerial factors, reporting processes, and ethical factors, respectively. The results showed that fear of reporting consequences is an important barrier to the self-expression of errors by nurses (32). This issue has been mentioned in other similar studies (33).

Findings related to error reporting in the ECU show that error reporting among physicians, pharmacists, and nurses is influenced by many factors, including understanding what the error is, fear of reprisal, lack of confidentiality, professional identity, time, and information gap (34). A platform should be provided in which nurses' error reporting is reflected in their

work environment to increase error reporting. It makes nurses believe that reporting errors cause positive system changes (35). To improve the reporting of errors in hospitals, the reporter's burden must be reduced, the reporting culture must be strengthened by providing adequate training on the importance of reporting, and the reporter must be given timely feedback (36). Based on the results of the present study, the reports can be improved by the electronic reporting system.

One of the limitations of the present study was the number of variables in the total population. For example, the nursing staff made the most mistakes, but the ratio of nursing staff to other treatment groups is higher, which should be examined more closely in future studies. The second issue is to continue reviewing the trend of errors over the years. This review could help with error detection efficiency.

## Conclusion

Findings have shown the efficiency of the electronic system in detecting errors. The relationship between the studied variables and the error rate can provide meaningful solutions to error reduction. The results of this study were maintaining complete confidentiality of the reporter, eliminating the sense of fear and punishment from reporting errors, not identifying the revealer, significant increase in the number of error reports, identifying strengths and weaknesses of the system, and finally improving quality of patient care. By using the new method of electronic reporting system, the rate of error reporting increases, so it will be easier to identify and correct hospital processes. Applying the right solutions and implementing corrective procedures could reduce the rate of errors. As a result, the need for attention and action of managers to use the electronic system can greatly affect the health and treatment of patients.

## Limitation

Limitations: lack of computer literacy, the busyness of the department and increased work of personnel who may not have enough time to enter errors in the system, and lack of belief in recording errors by personnel.

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