Frequency and influential factors on occurrence of medical errors: A three-year cross-sectional study

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Abstract:

BACKGROUND: Despite efforts to improve patient safety, medical errors (MEs) continue to recur. Proper utilization of reported MEs can be effective in preventing their recurrence. This study investigated the errors reported in 3 years and examined the factors affecting them.

MATERIALS AND METHODS: This descriptive analytical study was conducted using the errors reported in 20 hospitals under the auspices of one of Iran's medical universities from 2018 to 2020. All reported errors were investigated by an expert panel.

RESULTS: In total, 6584 reported errors were grouped into four main categories based on the type of error. The highest reported errors were related to the management and treatment procedures. Analyses of the factors influencing medical errors revealed that 15 factors affected the occurrence of errors. An increasing trend of error was found in 9 of the 15 identified factors. Incorrect documenting of the physician's order in the nursing Kardex and noncompliance with the patient identification guide were the highest with 16.03 and 15.47%, respectively.

CONCLUSION: The most identified factor was the incorrect registration of the physician's prescription on the nursing card; therefore, it seems that the use of computerized physician order entry should be considered. Furthermore, the mere existence and training of patient safety guides cannot help prevent errors. Not only should the underlying causes of errors be carefully identified and investigated but it also requires serious determination to follow the patient's safety instructions from the highest to the lowest levels of the health system.

Keywords:
Cross-sectional studies, medical errors, medication errors, patient safety

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Background

Medical errors (MEs) are considered unavoidable in health systems that can adversely affect patient safety.[1] Years after the American Institute of Medicine's prominent report, "To err is Human,"[2] which for the first time addressed the importance of MEs, there are still serious concerns about patient safety.[3] Similar mistakes occur frequently in different environments; as a result, patients continue to be affected by the adverse outcomes of preventable errors.[4]

To improve patient safety, it is essential to understand the frequency and root cause of these errors. This knowledge is obtained by analyzing data collected through error-reporting systems.[5] Therefore, the existence of a regular reporting system in the health system seems necessary, and awareness of the occurrence of MEs is the right of patients and duty of health service providers.[6] In Iran, there are no published formal statistics on the rate of ME. Different studies have reported contradictory results.[7] While based on a systematic review conducted in 2019, the prevalence of MEs was 50%.[1] However, the reported percentage of patient complaints

revealed that the rate would not be low and does not seem to be lower than the errors practiced in the health systems of the developed countries.[8,9] The first movement toward patient safety in Iran was the clinical governance program that was formed in 2009.[10] Before the program, patient safety measures and MEs did not have a well-structured error-reporting system. In continuation of the clinical governance program, with the beginning of the accreditation program of hospitals in 2012, patient safety measures were reflected in all accreditation standards in the new editions. According to the accreditation standards, hospitals are committed to record and report errors. Reported errors had to be reviewed and analyzed by the hospital's patient safety team. They were also required to share the identified errors appropriately with the target group, which was the most significant purpose of recording and reporting errors. Meanwhile, serious errors had to be radically analyzed, and the solutions extracted from the root analysis had to be shared in hospitals. In 2014, patient safety guidelines derived from international patient safety guidelines were communicated to all hospitals by the Ministry of Health and Medical Education.[11]

Nevertheless, errors still occur for which there are detailed guidelines and from which learning is expected.[12] It also appears that the measures currently being used to reduce MEs have not been sufficiently coherent. In this study, 6584 recorded errors were investigated; however, no similar studies have examined this high number of errors in a 3-year period (also in the reporting system of Iran) in the form of specialized groups. In addition, by providing a comprehensive picture of the factors influencing the occurrence of MEs in a 3-year period, this study can help the health system in planning patient safety challenges designing interventions.

Materials and Methods

Study design and setting
This descriptive analytical study was conducted based on secondary data implemented in 20 hospitals affiliated to one of the medical universities in Iran.

Study participants and sampling
The sample included errors reported by hospitals during a period of 3 years from 2018 to 2020. All health workers in the hospitals were trained to report MEs. In addition, error registration forms included error descriptions, reasons, and suggestions to prevent errors.

Data collection tools and technique
The paper-based reporting system was the main error-reporting mechanism in the studied hospitals. In addition, some hospitals were formed local electronic reporting system to collect errors.

Reporting errors process was anonymous. All errors were collected monthly by the patient safety officers (PSOs) who worked at the hospitals and reported to the deputy of treatment in excel file. Errors received by two full-time employees with health services management expertise and more than 5 years of experience in the field of patient safety were reviewed and initially classified.

Based on the study by Parihar and Passi,[13] the initial classification consisted of four categories: errors related to administration, treatment procedures, clerical procedures, and medication.

After the initial screening and categorizing, a 12-member specialized committee consisting of patient safety specialists from educational, noneducational, private, and social security hospitals was formed, under the supervision of the treatment deputy. The team reviewed the factors influencing the occurrence of errors during the same period, at quarterly intervals.

The Delphi technique was used to obtain expert opinions on the influential factors identified by the expert committee. Due to the high number of errors and effective factors, the relevant checklist was provided to the panel members for scoring before the round was held, and the panel examined the differences.

After the first screening, a special working group was formed to assess the related factors. The grouping was performed by a specialized patient safety team consisting of 12 experts from the deputy of treatment and PSOs working at educational, private, and social security hospitals. Two rounds of the Delphi method were conducted to review relevant factors. In the first round, all factors were assessed by using international and national patient safety guidelines. Then, the factors affecting the error occurrence were assessed by the nominal group technique (NGT). After the first round, all comments were summarized; subsequently, items with more than 75% agreement were accepted, and those with 50–70% compromise were reassessed. In addition, items with less than 49% agreement were excluded. Then, the frequency of each factor was determined annually. Finally, to determine the changes of each one by year, its percentage compared to others in that year was calculated, and the trend of error in the 3 years studied was determined. This research process is shown in Figure 1.

Ethical considerations
All information was recorded in the error registration forms without mentioning the name of the patient and the person who committed the error, and the information was completely confidential. This article is taken from the doctoral dissertation of Health Services Management
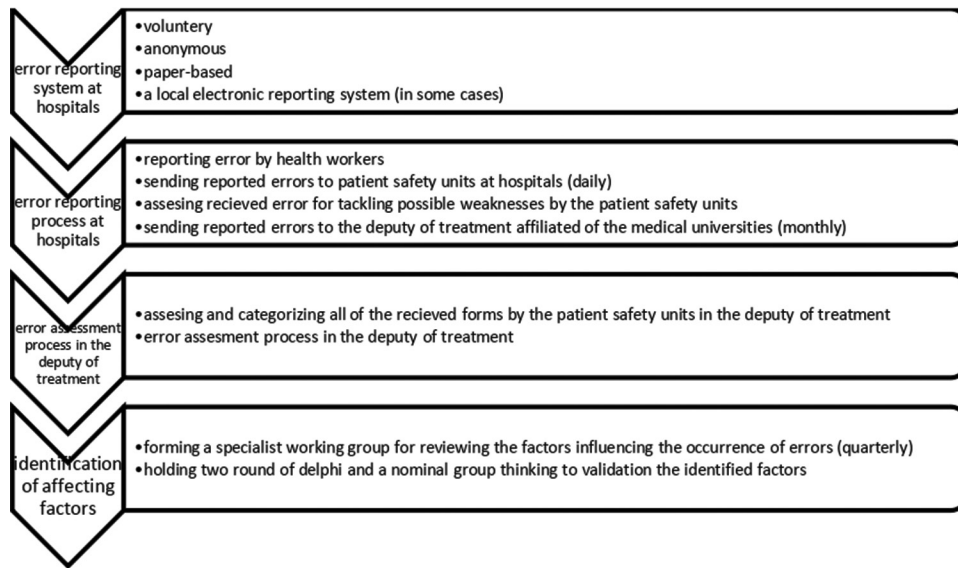
Figure 1: The research process

from Iran University of Medical Sciences, Iran, which has an ethics code number IR.IUMS.REC.1399.774 from the ethics committee of Iran University of Medical Sciences, which can be found at the university's research site https://research.iums.ac.ir, which is available in Persian with permission.

Results

In this study, a total of 20 hospitals participated in three areas: 1—public (teaching), 2—public (noneducational and social security), and 3— private. The highest rate of reported errors was related to public (educational) hospitals (51%) and the lowest was related to private hospitals with 5.7% [see Table 1].

In total, 6584 errors were collected during the 3 years of study. The reported errors included four main categories: error-related management (48.42%), treatment (62.25%), clerical (19%), and medication (6.9%) [see Table 2].

According to the examples of recorded errors, the most reported errors were "providing medicine to the wrong patient" (528 cases), which was in the group of administration-related errors. In the following, "the wrong test report" and need to repeat with 351 cases and "recording wrong order in nursing cards" with 335 cases were the most recorded errors, which were in the groups of errors related to clerical and treatment procedures, respectively [see Table 3].

23.93% of errors were reported in the first year, 38.54% in the second, and 37.51% in the third.

In the second year of the study, a 16% increase in error reporting was observed; however, in the third year, the

Table 1: Number of reported medical errors according to type of hospitals

Years	2018	2019	2020
Type of hospitals			
Public (teaching)	832	1215	1320
Public (non-educational and social security)	677	1153	1053
Private	77	153	104

Table 2: Classification of reported errors

Classification of errors	Number (%)
Errors related to administration	3188 (48.42)
Errors related to treatment procedures	1687 (25.62)
Errors related to clerical procedures	1251 (19)
Errors related to medication	458 (6.9)

trend in the reported errors was almost 1% lower. It seems that the Covid-19 pandemic has been effective in reducing the registration of errors.

After completing the initial classifications and placing the errors in their respective groups that shown in Tables 2 and 3, a specialized working group was formed, and after performing the NGT, a total of 15 factors related to the occurrence of medical errors were identified. Factors and their trends are shown in Table 4.

All the errors based on which the expert working group determined the factors related to error repetition are shown in Table 5. This table shows what errors are included in each factor related to the occurrence of medical errors.

Discussion

This study aimed to investigate error frequency and identify the factors affecting the occurrence of errors.

Table 3: Details and number of errors reported in 2018–2020

Instances of errors	Number	Instances of errors	Number
Errors related to administration			
Wrong patient visit	37	Transportation of the patient without a suitable wheelchair or stretcher	44
Giving medicine to the wrong patient	528	The patient falls from the bed/operating room/emergency room/stretcher	104
Wrong blood transfusion to the patient	21	The patient falls from a wheelchair	8
Blood transfusion to the wrong patient	18	The patient falls while going to the bathroom	128
Sending the wrong patient to perform para-clinical procedures (radiology, laboratory, etc.)	83	The patient falls into the bathroom	66
Taking a blood sample from the wrong patient	68	The patient falls while walking	28
Inter-patient transfer with another patient file	49	No marking of action position	153
Perform therapeutic action for the wrong patient	94	Remaining things in the patient's body	27
Incorrect insertion of patient name on blood sample	121	Wrong symmetrical organ action	2
Lack of proper transfer of patient clinical information between two shifts (unsafe handover)	98	Lack of necessary preparations for the patient before the operation, such as fasting, not removing dentures and jewelry, etc.	53
Oxygen-free transfer of the patient	58	Lack of operating room equipment	13
Delivery of the patient to the operating room, radiology, and laboratory without a nurse (unsafe transportation)	241	Insufficient blood reservation	22
Delivery of the patient to the ward without a file	89	Lack of label and date on patient connections	34
Empty oxygen capsule leads to injury to the patient	8	Lack of proper fixation of patient connections	53
Lack of medical equipment leads to injury to the patient	24	Failure to properly remove patient connections	12
Lack of timely patient visits	184	Failure to establish the correct connection path	42
Lack of on-time medication	247	Expire of patient connections	23
Absence of timely presence during patient CPR	23	Missing test specimen in laboratory	74
Lack of timely response to advice	55	Not reporting critical test results	46
Lack of timely control of the patient's vital signs	71	Wrong patient surgery	3
Failure to perform the requested para-clinical procedures in time	87	Cancellation of the patient's surgery	73
Error related to treatment procedures			
Wrong surgery	11	Sampling of a hand with a splint or hand attached to the serum	105
Unsafe anesthesia	3	Sampling leads to blood clotting	95
Wrong calculation of drug doses	118	Wrong test result needs to be repeated	351
Simultaneous injection of drugs with drug interactions	139	Disproportionate instructions and incomplete instructions	125
Misdiagnosis	177	Improper use of medical equipment leads to injury to the patient	39
Failure to obtain a valid history	85	Infusion of the drug at an inappropriate rate	88
Failure to perform drug combination	44	Injecting the drug incorrectly	252
Errors related to clerical procedures			
Registering the wrong way of medicine in nursing card	141	Record the wrong dose of the drug in nursing card	253
Record wrong medication time in nursing card	73	Failure to register the command in nursing card	217
Wrong drug registration in HIS	146	Registration of wrong medicine or wrong para clinical prescription in nursing card	335
Incorrect registration of para clinical procedures in HIS	86		
Errors related to medication			
Delivering the wrong medicine to the patient because of the apparent resemblance to the original medicine	118	Delivering the wrong medicine to the patient because of the auditory similarity to the original medicine	21
Delivering the wrong medicine to the patient because of the written similarity with the original medicine	281	Provide the wrong high-risk drug to the patient	38

In total, 6584 reported errors were grouped into four main categories based on their type. The highest share of reported errors was related to management and treatment procedures. According to the analysis of error-related factors, 15 factors were identified as those affect the occurrence of errors. In a study by Baghaei *et al.*,[14] 84 errors were identified during 2014. Most errors were related to medication errors and the least frequent were surgical errors. In addition in another study by Asgari *et al.*,[15] during a period of 6 months, 183 MEs were identified according to the review of medical records data. But in our study with 6584 errors,

Table 4: Frequency and percentage of errors

Factors	Year 2018 *n* (%)	Year 2019 *n* (%)	Year 2020 *n* (%)
Improper documenting or nondocumenting of physician's instructions in the nursing cards	326 (20.68)	460 (18.12)	273 (11.05)
Noncompliance to the guideline on patient identification	224 (14.21)	401 (15.79)	394 (15.95)
Incorrect execution of medication instructions and lack of knowledge of the nurse about the medication	155 (9.83)	244 (10.48)	376 (15.22)
Delay in providing timely services	160 (10.15)	261 (10.25)	319 (12.91)
Laboratory diagnostic errors or incorrect test reports	120 (7.61)	202 (7.95)	149 (6.03)
Noncompliance to the look-alike, sound-Alike medication names (LASA)	94 (5.96)	168 (6.61)	158 (6.39)
Noncompliance to the guideline on communication during patient handover	115 (7.29)	160 (6.30)	175 (7.08)
Misdiagnosis or incorrect or incomplete physician's order	86 (5.45)	141 (5.55)	130 (5.26)
Noncompliance to the preventing patient fall guideline	74 (4.69)	105 (4.13)	155 (6.27)
Noncompliance to the safe surgery guideline	83 (5.26)	115 (4.53)	95 (3.84)
Doing wrong registration or not registering actions in the HIS system	49 (3.1)	80 (3.15)	103 (4.17)
Noncompliance to the avoiding catheter and tubing misconnection guideline	24 (1.52)	72 (2.83)	68 (2.75)
Noncompliance to the assuring medication accuracy at transitions in care guideline	30 (1.90)	65 (2.56)	34 (1.37)
Not being familiar with the way medical equipment works	27 (1.71)	25 (0.98)	29 (1.17)
Noncompliance to high alert medication guideline	9 (0.57)	17 (0.66)	12 (0.48)

most of errors were related to administration, but our classification was different. In a study by Saravi *et al.*,[16] most errors were related to surgery. According to the study of Asadi *et al.*,[17] the highest number of errors in the field of hospital care was related to the field of intra-labor care. In our study, surgical errors were tenth in frequency.

The study by Jindal and Raziuddin[18] showed that the implementation of electronic records and electronic medicine could reduce costs, increase productivity and effectiveness, and better manage patients' health by reducing MEs. However, there are several barriers to the acceptance and implementation of an electronic health record. Strategic planning for the creation and adoption of EHR in the country, creating a team of experts to assess the potential barriers, developing strategies to eliminate them, and allocating financial resources can help overcome the most important barriers to the adoption of EHR.[19]

One review showed that although most studies have shown a statistically significant reduction in patient identification errors, the overall quality of the evidence was considered very low, suggesting that nurses should recognize the importance of patient identification practices as part of their overall commitment to promoting patient safety.[20] A study by de Assis *et al.*[21] about adherence to the correct identification of patient showed that despite the increasing debates about patient safety, there are still gaps in the effective implementation of safety targets. The need for the greater involvement and responsibility of professionals, managers, and patients in the identification process is necessary.

Incorrect execution of medication instructions and lack of knowledge of the nurse about the medication were

the third factors that had an increasing trend. A study by Di Simone *et al.*[22] showed that the skills that nurses must possess in pharmacology are still increasing, both because of the safety of drug therapy and the increasing number of drugs available, and nurses must update their knowledge regularly. It is necessary that, at the beginning of nurses' work, in addition to in-service training, experienced nurses constantly monitor their performance for a certain period and officially begin their activities after confirming their performance.

In a study by Janatolmakan *et al.*,[23] delayed attendance of the CPR team and start of CPR was one of the barriers to CPR success, and these barriers can be minimized by measures such as empowerment of the CPR team and providing the necessary facilities and equipment. Factor of delay in providing timely health services shows that effective systems for taking timely action are still flawed and need to be carefully reviewed.

Errors such as malpractice, negligence, and preventive errors were in laboratory diagnostic errors. Plebani *et al.*[24] analyzed and discussed the trends and factors affecting the frequency and types of errors in laboratory services. Effective automation and information technology integration can allow clinical laboratories to detect, control, and reduce errors throughout the testing process; however, collaboration and communication between physicians and other stakeholders are essential to improving patient safety.

Several strategies have been suggested to reduce LASA medication errors, including the use of tall man lettering,[25,26] computerized provider order medication, medication reconciliation processes, barcode systems, and package changes by placing special labels on the packaging of high-risk drugs, identifying

Table 5: Errors placed in factors related to medical errors

Factor 1: Improper documenting or non-documenting of physician's instructions in the nursing cards: errors related to clerical procedures

    Registering the wrong way of medicine in nursing card

    Record the wrong dose of the drug in nursing card

    Registration of wrong medicine or wrong para clinical prescription in nursing Card

    Record wrong medication time in nursing Card

    Failure to register the command in nursing card

Factor 2: Noncompliance with the correct patient identification guide: errors related to administration

    Wrong patient visit

    Inter-patient transfer with another patient file

    Perform therapeutic action for the wrong patient

    Sending the wrong patient to perform para-clinical procedures (radiology, laboratory, etc.)

    Giving medicine to the wrong patient

    Wrong blood transfusion to the patient

    Blood transfusion to the wrong patient

    Taking a blood sample from the wrong patient

Factor 3: Incorrect execution of medication instructions and lack of knowledge of the nurse about the medication: errors related to treatment procedure

    Failure to perform drug combination

    Infusion of the drug at an inappropriate rate

    Wrong calculation of drug doses

    Simultaneous injection of drugs with drug interactions

    Injecting the drug incorrectly

Factors 4: Delay in providing timely health services: errors related to administration

    Lack of timely patient visits

    Lack of timely response to advice

    Failure to perform the requested para-clinical procedures in time

    Absence of timely presence during patient CPR

    Lack of on-time medication

    Lack of timely control of the patient's vital signs

    Cancellation of the patient's surgery

Factor 5:Laboratory diagnostic errors or incorrect test reports: errors related to administration

    Incorrect insertion of patient name on blood sample

    Not reporting critical test results

    Wrong test result and needs to be repeated

    Sampling of a hand with a splint or hand attached to the serum

    Missing test specimen in laboratory

    Lack of label and date on patient connections

    Sampling leads to blood clotting

Factor 6: Failure to follow the instructions of look-alike and sound-alike medication (LASA): errors related to medication

    Delivering the wrong medicine to the patient because of the apparent resemblance to the original medicine

    Delivering the wrong medicine to the patient because of the auditory similarity to the original medicine

    Delivering the wrong medicine to the patient because of the written similarity with the original medicine

Factor 7: Noncompliance with the guideline on communication during patient handover: errors related to administration

    Delivery of the patient to the ward without a file

    Delivery of the patient to the operating room, radiology, and laboratory without a nurse (unsafe transportation)

    Oxygen-free transfer of the patient

    Lack of proper transfer of patient clinical information between two shifts (unsafe handover)

Factor 8: Misdiagnosis and incomplete physician order: error related to treatment procedure

    Misdiagnosis

    Disproportionate instructions and incomplete instructions

Factor 9: Noncompliance with the patient fall prevention guideline: Errors related to administration

    Transportation of the patient without a suitable wheelchair or stretcher

    The patient falls while walking

    The patient falls into the bathroom

    The patient falls from a wheelchair

    The patient falls while going to the bathroom

    The patient falls from the bed/operating room/emergency room/stretcher

Contd...

Table 5: Contd...

Factor 10: Nonbeing familiar with the way medical equipment works: errors related to administration

    Lack of operating room equipment

    Empty oxygen capsule leads to injury to patient

    Lack of medical equipment leads to injury to the patient

    Improper use of medical equipment leads to injury to the patient

Factor 11: Failure to follow the safe surgery guide: errors related to administration

    No marking of action position

    Wrong symmetrical organ action

    Wrong patient surgery

    Lack of necessary preparations for the patient before the operation, such as fasting, not removing dentures, and jewelry

    Wrong surgery

    Remaining things in the patient's body

    Cancellation of the patient's surgery

    Insufficient blood reservation

    Unsafe anesthesia

Factor 12: Doing wrong registration or not registering actions in the HIS system: errors related to clerical procedures:

    Incorrect registration of para clinical procedures in HIS

    Wrong drug registration in HIS

Factor 13: Noncompliance with the avoiding catheter and tubing misconnection guideline: errors related to administration

    Lack of proper fixation of patient connections

    Failure to properly remove patient connections

    Failure to establish the correct connection path

    Expire of patient connections

Factor 14: Noncompliance to the assuring medication accuracy at transitions in care guideline: error related to treatment procedures

    Failure to obtain a valid history

Factor 15: Failure to follow the guidelines for high-alert medication: errors related to medication

    Provide the wrong high-risk drug to the patient

and updating the list of LASA drugs, and teaching eight rights of medication administration to health providers.[26-28] Although the importance of this issue has been sensitized, due to the lack of serious provisions, such as computerized provider order medication, errors related to the LASA still occur.

The study by Simamora and Fathi[29] showed the value of utilizing educational programs for nursing in handoff communication settings and emphasized that such standard training programs must be considered to train nurses to communicate effectively. In another study, lack of supervision and weakness in communication skills have been cited as factors that influence the recurrence of errors.[30]

Diagnostic error and failure to diagnose the nature of a disease in a timely and accurate manner occur in 5% of adults in US outpatient settings. Approximately half of these errors resulted in severe damage. In the case of incomplete physician orders based on the seventh fact announced by the World Health Organization, incomplete or delayed diagnosis is one of the most common causes of injury to the patient and affects millions of patients.[31] To function effectively in this environment, future physicians, including medical students, need educational programs that incorporate the theory and practice of teams and teamwork.[32] In our

study, the error trend was almost constant, indicating that the actions were not practical.

Errors related to the factor of noncompliance with the patient fall prevention guideline show an increasing trend. Due to their great importance, falls are considered in the category of "never events" errors. Preventive strategies should be selected based on the patient's condition, which is performed by nurses following a purposeful approach.[33] Despite the transparency of the guidelines and training provided in the studied hospital through an accreditation program in Iran, this study revealed an increasing trend in the number of falls. Lack of proper evaluation of patients at the beginning of admission and lack of re-evaluation of patients in particular circumstances are the reasons for the frequent occurrence of falls in hospitals.[34]

Despite the need to use the safe surgery checklist, errors related to this factor are still occurring, but the trend has been decreasing. For safe surgery, universal guidelines are available to hospitals as safe surgery guidelines. This case is also in the category of never events due to its great importance. Despite the existence of strict protocols covering a wide range, including the safe surgical checklist, sensitizations to mark the operation site, counting items used during the operation, and correct identification of the patient candidate for surgery,

it seems that other factors also should be considered to render a further decline in this group. According to the World Health Organization, unsafe surgical care methods cause complications in up to 25% of patients. As a result of improved patient safety measures, mortality from surgical complications has decreased over the past 50 years. However, this rate remains two to three times more likely in low- and middle-income countries than in high-income countries.[31] Two studies identified organizational barriers to implementation of WHO safe surgery checklist such as poor communication between the anesthetic and surgeon, lack of leadership, inappropriate timing for checking an item, time taken up by checklist completion, and difficulty in identifying the role and responsibility of each staff member.[35,36]

Registration of para clinical and medication instructions in the Hospital Information Systems (HIS) by nurses has a pivotal role in receiving time care for patients. Ignoring this issue leads to postponing proper service and consequently causes a longer length of stay. The occurrence of these preventable errors showed an upward trend during the 3-year study period. Palabindala *et al*.[37] reported that hospitals must commit to regular system upgrading and corresponding training for all users to reduce the risk of errors and adverse events.

Tubing and catheter misconnections can lead to incorrect medication routes, resulting in serious injuries or death to the patient. These errors are highly preventable and can often be averted easily. The increasing trend of errors in this category indicates the low effectiveness of the preventive measures. Nevertheless, there do not seem to be sufficient requirements to perform preventive actions.

Despite abundant evidence and consensus among organizations and agencies, tubing misconnections in the United States remain a pervasive risk to patient safety. The healthcare industry has been unable to eliminate deadly and obvious threats to patients.[38]

In terms of requiring teaching hospitals to obtain accurate patient histories, the medical education system has compensated to some extent for the lack of correct history. However, registration and reporting are still insufficient and there are no serious requirements for drug integration. The application of electronic patient records to detect drug interactions could be helpful in this regard.[39]

Due to the high rate of failure of medical equipment due to misuse, there is a need for periodic training and monitoring of the performance of clinical staff in this regard. Although the recorded errors were in the range of fewer than 30 cases, they indicate the need for intervention. The design of equipment and

procedures, personnel, supplies and materials, and the environment in which we work must be continuously examined and improved to reduce errors and minimize their effects.[40]

The existence of a global high-alert medication guideline, which is constantly updated, shows the seriousness of these preventable errors due to the very high risk and even fatality of any mistake. Because high-risk drugs are labeled separately in red, the importance of double-checking them and sensitization, the number of reported cases, is not high. Although errors with these drugs may not be more common than those with other medications, their consequences can be more devastating.[41] However, the labeling of high-risk drugs in hospitals is performed manually, which must be performed by pharmaceutical factories from the beginning.

Limitation and recommendation

Due to the use of a large number of errors recorded in 20 hospitals, this study was able to more reliably identify the factors related to the occurrence of MEs and the course of their occurrence in three consecutive years. However, the higher registration of MEs in some hospitals and the lower registration in others led to the creation of heterogeneity, which made it impossible to compare hospitals in terms of factors related to the occurrence of errors. The lack of an integrated system for reporting MEs and the lack of access to patients' medical records were other weak points of the study.

Conclusion

In this study, the highest rate of reported errors was related to management and treatment procedures, respectively. Factors of nondocumenting or incorrect documenting of the physician's order in the nursing Kardex and nonattention to the correct patient identification guideline were the frequently reported errors. Nine of the 15 factors identified had an upward trend over the 3 years. Failure to register or incorrectly record the physician's prescription in the chart by the nurse has been the most common among other factors. Although the incidence of these errors has been declining, their frequency indicates that, in addition to training, sensitization, and monitoring, the existence of serious and deterrent barriers should be considered. It appears that the lack of electronic registration of physician's orders and the lack of electronic medicine can be the root causes of frequent errors belonging to this category. It seems that the interventions that have been made available to the medical staff in the form of patient safety training and patient safety instructions have not been effective enough and the frequent repetition of errors in most of the factors discussed in this study confirms the existence of this issue. It seems most of

the identified factors are associated with negligence and carelessness. Therefore, it appears that in addition to error prevention strategies identified by literature, it is of utmost importance to address the underlying and root causes of in-hospital errors and not just doing Root Causes Analysis (RCA). On the same basis, serious obstacles in preventing error recurrences should be at the top of the agenda. Not only the underlying causes of errors should be carefully identified and investigated, but also it requires a serious determination to follow the patient's safety instructions from the highest to the lowest levels of the health system.

Conflicts of interest
There are no conflicts of interest.

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