Factors affecting the incidence of medication errors from the perspective of nurses working in teaching hospitals in Ilam, 2025

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Article Info	ABSTRACT
Article type: Original article	**Introduction**: Medication errors are one of the most important patient safety challenges and can increase mortality, length of stay, and costs. This study aimed to identify factors affecting the occurrence of medication errors in teaching hospitals in Ilam in 2025.

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Materials & Methods: This descriptive-cross-sectional study was conducted among nurses working in teaching hospitals in Ilam. Data were collected using a questionnaire including demographic information and Medication Error Factors Questionnaire, the validity and reliability of which had been previously confirmed by Ghanadi et al. (2010). Simple Random sampling was performed from the list of nurses working in different departments of hospitals, and the sample size was 383 people. After data collection, the data were analyzed using statistical software (SPSS version 18) and descriptive statistics (mean, standard deviation, frequency) as well as analytical tests such as the Chi-square test and independent t-test and Pearson correlation tests. The level of statistical significance was set at $p < 0.05$.

Results: 73% of nurses had no errors in the past year, while 15.1% had made errors once, 7.3% twice, 2.7% three times, and 1.1% had made errors four times. The most influential factors on the occurrence of errors were related to personal and psychological conditions (21.94 ± 5.34), followed by management processes (20.32 ± 4.84), and ward conditions (18.98 ± 5.04); while the role of medication and physicians was evaluated lower 15.39 ± 3.73). From an individual perspective, economic problems (4.08 ± 1.14) and fatigue due to excessive work (4.00 ± 1.05) had the highest average. The occurrence of errors was significant with employment status ($p = 0.048$), overtime ($p < 0.001$), age ($p = 0.009$), and job history ($p = 0.024$).

According to the hospital directors and managers surveyed, in the field of leadership competencies, "relevance" had a higher average score compared to "capability level," with a significant difference between them. Based on the opinions of the health directors and managers, the highest learning priority was given to "leadership competency" development.

Conclusion: Nursing errors are multidimensional and fatigue, economic problems, excessive overtime, and inexperience play the most important roles. Appropriate shift management, continuous training, and the use of electronic technologies can reduce the incidence of errors.

Keywords: Medication errors, Nurses, Patient Safety

Introduction

Medication errors are one of the most common clinical errors that are used as an important indicator for assessing safety in hospitals (1,2). Some studies have shown that about a quarter of hospital injuries are caused by medication errors (4,3). According to the World Health Organization report in 2023, harm to patients caused by unsafe care is one of the leading causes of death and disability worldwide. Studies have shown that about 50% of preventable harms in medical care are related to medications and treatment procedures. The prevalence of preventable harms caused by medications is also estimated at about 5%, of which a quarter are severe enough to threaten the lives of patients. This prevalence has been reported in low- and middle-income countries (7%) almost twice as high as in high-income countries (4%) (5). In Canada, about 7% of hospitalized patients suffer complications due to medication errors (6). In Iran, 8% of hospital treatments have resulted in hospital complications, including medication complications (7). In addition to threatening patient health, medication errors also have wide economic consequences. Direct medical costs, such as the need for additional medications, unnecessary diagnostic procedures and surgeries, as well as legal costs resulting from patient complaints, are among the consequences of these errors. On the other hand, indirect costs, such as reduced labor productivity and psychological effects on health workers (the second victim phenomenon), should also be considered (8, 9). It has been estimated that the global cost of medication errors is approximately $42 billion annually (10). The National Association for Reporting and Prevention of Medication Errors defines a medication error as any preventable incident resulting from the incorrect use of medication that results in harm to the patient, while this incident could have been controlled by the treatment team or even the patient himself (3). In Iran, different studies report the prevalence of these errors with different percentages (11, 12). Due to structural weaknesses in the health system and the lack of accurate recording of errors, the actual rate of these errors is probably much higher than official statistics (13, 14).

Since medication administration and administration is a complex and sensitive process, nurses, who are responsible for a large part of the medication therapy process, play a very important role in patient safety (16, 15). About 40% of nurses' clinical activities in hospitals are dedicated to medication administration, and medication errors are considered one of the most common problems in the nursing profession (3). In one study, the incidence of medication errors in nurses was reported to be between 14.9 and 32.4% (7). In another study, the average occurrence of medication errors within 3 months for each nurse was 15.2 (14). Medication errors can occur at any stage of the medication administration and consumption process. The most common ones include taking more than the prescribed dose, not following the correct route of administration, incorrect drug concentration, and giving the wrong drug to the wrong patient due to misidentification (18,17,14). Most of these errors occur at the stage of drug delivery to the patient (15,19,3). The severity of the consequences of these errors varies and can range from mild problems to life-threatening conditions (20).

The consequences of medication errors are not limited to the patient and his family, but have extensive psychological, social and professional consequences. These errors can lead to increased mortality, length of hospitalization, treatment costs, decreased patient confidence and even stress and ethical conflicts for staff (3, 19, 21). Also, decreased public confidence in the health system, anxiety, depression and hopelessness in patients and their families are among the social consequences of errors (8, 19, 22, 23). On the other hand, nurses, as the second victim, suffer from feelings of guilt, shame, burnout and mental disorders, which in the absence of psychological support can lead to quitting their jobs or a decrease in their quality of life (8, 22). The first step towards patient safety and the correct

implementation of medication therapy is to be aware of the existing conditions and determine the type and causes of medication errors. Several reasons have been mentioned for the occurrence of medication errors in nurses. Rapid advances in medical technology, inadequate nursing education, high expectations of society, shortage of personnel, fatigue, work pressure, lack of equipment, similarity of drugs, doctors' bad writing, and failure to observe the correct principles of drug therapy are among these factors (15, 19, 20, 24). Studies have shown that work environment and management factors play a greater role in the occurrence of errors than the experience or education level of nurses (25). Tang has mentioned the causes of medication errors as ignoring the five correct principles of drug therapy, distraction, and inexperience (26). Numerous studies have stated that 3 basic areas of error occurrence are factors related to nurses, departments, and management (15, 19, 3).

Since the occurrence of medication errors is known as an indicator for determining the level of hospital safety, identifying the factors affecting its occurrence in nurses is one of the research priorities of the health system. Despite various studies at the global and national levels on the factors affecting the occurrence of medication errors, local, cultural, and organizational conditions play an important role in the occurrence of errors and how they are reported. Considering the impact of local, cultural, and organizational conditions in each region, it is necessary to conduct the present study in the teaching hospitals of Ilam University of Medical Sciences. Therefore, the researcher and other colleagues decided to conduct a study with the aim of investigating the factors affecting the occurrence of medication errors from the perspective of nurses working in teaching hospitals in Ilam, 2025.

Materials and methods

Study Design

This study was a descriptive-analytical cross-sectional study conducted in 2024 on nurses working in teaching hospitals in Ilam city. The study population included all nurses with a bachelor's degree and higher(n=715) who were directly involved in patient care.

Setting and Participants

Nurses working in teaching hospitals of Ilam University of Medical Sciences who had at least a bachelor's degree in nursing, at least six months of clinical work experience, and were willing to participate in the study were included in the study. Nurses who incompletely completed the questionnaire, were on leave or in non-clinical departments at the time of the study, or were unwilling to continue their cooperation were excluded from the study.

Sampling

The sample size was calculated as 383 individuals using the sample size determination formula for cross-sectional studies, based on a prevalence of medication errors of 48.2%, with a 95% confidence level and a 5% margin of error. The sampling method was stratified proportional to volume; the share of each hospital and each department was determined according to the number of nurses, and individuals were selected by simple random sampling using a lottery method. The distribution of nurses and the number included in the study were as follows: Hospital 1: 150 of 280 nurses, Hospital 2: 123 of 229 nurses, Hospital 3: 73 of 136 nurses and Hospital 4: 37 of 69 nurses. Finally, 13 incomplete questionnaires were excluded, and 370 questionnaires were analyzed.

Data collection tools

Demographic tool

This tool was included age, gender, marital status, level of education, job history, name of the department where the nurse worked, work history in the current department, employment status, history of taking a training class in the field of medication administration, history of taking a training class in the field of patient safety, type of shift, working in one or

more hospitals beyond the required hours, working in a job other than nursing, history of taking medication, history of having a disease, history of providing direct clinical nursing care to patients hospitalized in a medical center in the last year, history of medication errors in patients under care in the last year.

Medication errors

The data collection instrument was the Medication Error Factors Questionnaire developed by Ghanadi et al. (2010). This questionnaire includes 31 items designed to evaluate the factors influencing the occurrence of medication errors from the perspective of nurses. These factors are categorized into five dimensions, as follows:(1) management process–related errors (items 1–7),(2) nurses' professional errors (items 8–14),(3) errors related to nurses' personal and psychological conditions (items 15–20),(4) medication- and physician-related errors (items 21–25), and(5) errors related to patients and ward conditions (items 26–31). Each item was scored on a five-point Likert scale ranging from 1 (very low) to 5 (very high). A higher score in each dimension indicated a greater impact of that factor on the occurrence of medication errors from the respondent's perspective. The minimum possible total score was 31, and the maximum possible total score was 155. The face and content validity of this questionnaire was confirmed in a study by Ghanadi et al. (2010) through consultation with experts and specialists, and its reliability was calculated through test-retest with a correlation coefficient of 0.73 (27). Before conducting the main study, the validity and reliability of this questionnaire were re-examined. To examine the content and face validity, the questionnaires were provided to 8 faculty members and expert nurses, and necessary amendments were made. To measure reliability, the test-retest method was used on 30 nurses working in Ilam teaching hospitals; the questionnaires were completed by these individuals in two rounds, two weeks apart. The reliability of the questionnaire for the overall score was 0.90.

After obtaining the necessary permissions and written informed consent, the questionnaires were distributed in person in four teaching hospitals in Ilam city in March 2024. Nurses completed the questionnaires voluntarily and anonymously. The collection was carried out within a month.

Ethical considerations

The code of research ethics was obtained from the Ethics Committee of Ilam University of Medical Sciences (IR.MEDILAM.REC.1403.216). Participants were free to withdraw from the study at any time, and all information remained confidential.

Statistical and Data analysis

The data were analyzed with SPSS version 18 software. Statistical indicators (mean, standard deviation, frequency and percentage) were used to describe the data, and chi-square, independent t-test and Pearson correlation tests were used to test the hypotheses. The significance level in all analyses was considered $p<0.05$

Results

The average age of the participants was 31.2 years and the average work experience was 7.3 years. The highest proportion of nurses were female (66.8%), married (51.1%), with a bachelor's degree (90.8%), and in formal employment status (52.2%). Also, 27% of nurses reported that they had made a medication error at least once in the past year (Tables 1, 2).

Table 1. Frequency and percentage distribution of nurses' demographic variables

Variables	Categories	Frequency (N)	Percentage (%)
Gender	Male	123	33.2
	Female	247	66.8
Marital status	Married	189	51.1

	Single	177	47.8
	Divorced	2	0.5
	Widowed	2	0.5
Educational level	Bachelor's degree	336	90.8
	Master's degree	32	8.6
	Doctoral degree	2	0.5
Employment status	Internship (Trainee)	54	14.6
	Contract-based	122	33.0
	Permanent	193	52.2
	Temporary	1	0.3
History of attending medication administration classes	Yes	276	74.6
	No	94	25.4
History of attending safety classes	Yes	315	85.1
	No	55	14.9
Work shift type	Morning shift	26	7.0
	Evening shift	17	4.6
	Night shift	4	1.1
	Rotating shifts	323	87.3
Working overtime (beyond required hours)	Yes	126	34.1
	No	244	65.9
Having a second job (other than nursing)	Yes	44	11.9
	No	326	88.1
History of taking specific medications	Yes	15	4.1
	No	355	95.9
History of specific diseases	Yes	16	4.3
	No	354	95.7
History of medication errors (past year)	Yes	100	27.0
	No	270	73.0

Table 2. Descriptive statistics of quantitative demographic variables.

Variables	Mean ± SD	Minimum	Maximum
Age (years)	31.24 ± 6.49	21	64
Work experience (years)	7.32 ± 6.23	0.08	32.5
Work experience in the current ward (years)	2.92 ± 3.61	0.08	30.33
Number of medication errors (in the past year)	0.47 ± 0.96	0	7
Number of reported medication errors (in the past year)	0.18 ± 0.55	0	4

Examination of the questionnaire dimensions showed that the highest mean was related to "nurse's personal and psychological conditions" (21.94 ± 5.34) and then "management processes" (20.32 ± 4.84), while " medication and physicians " had the lowest mean (15.39 ± 3.73). These results indicate that from the nurses' perspective, individual and organizational factors play a more prominent role in the occurrence of errors (Table 3). The findings indicate that some individual and organizational factors play a more prominent role in the occurrence of errors from the respondents' perspective. Specifically, "nurses' economic problems" with a mean and standard deviation of (4.08 ± 1.14) and "fatigue due to

overwork" (4.00 ± 1.05) have obtained the highest mean and have been proposed as the most important factors underlying medication errors from the nurses' perspective. Also, "type of nurses' work shifts" (3.66 ± 1.08), "feeling of unmotivation due to job discrimination" (3.65 ± 1.17) and "illegibility of doctors' handwriting" (3.52 ± 1.12) are also considered factors with relatively high mean.

The results of inferential tests showed that nurses who had a history of errors had higher mean scores in the Medication error questionnaire dimensions of "management processes" (p=0.002), "patient and ward conditions" (p=0.019), and " medication and physicians " (p=0.038). Also, a significant relationship was observed between the total score of effective factors and history of errors (p=0.010). In

addition, a positive and significant correlation was observed between the frequency of errors and the dimensions of "professional errors of nurses", " medication and physicians", and "conditions of the ward and patient" (p<0.05). These findings indicate that increasing organizational problems and environmental conditions are associated with an increase in the incidence of errors (Table 3). The results of the chi-square test showed that "employment status" (p=0.048) and "nursing work more than required hours" have a statistically significant relationship with the likelihood of medication errors in nurses (p<0.001). Casual nurses are more likely to make errors than regular nurses. Also, nurses who work more than their assigned hours were significantly more likely to make errors.

Table 3. Descriptive statistics and relationships between the dimensions of factors affecting the incidence of medication errors and the number of medication errors in the past year.

Questionnaire dimensions	Mean ± SD	Correlation coefficient (r)	Significance level (p-value)
Managerial processes	20.32 ± 4.84	0.086	0.099
Nursing professionalism	16.00 ± 6.28	0.125	0.016*
Individual and psychological factors of nurses	21.94 ± 5.34	0.067	0.195
Medication- and physician-related factors	15.39 ± 3.73	0.131	0.011*
Patient and ward-related conditions	18.98 ± 5.04	0.126	0.016*
Total score	92.65 ± 17.33	0.155	0.003*

Other qualitative demographic variables including "gender, marital status, education level, history of taking medication and patient safety classes, type of

shift, and having another job" did not show a significant relationship with the history of medication errors (p > 0.05). (Table 4).

Table 3. Comparison of medication error history based on qualitative demographic variables.

Variables	Category	History of medication error: Yes (n = 100)	History of medication error: No (n = 270)	p-value
Gender	Male	31 (31%)	92 (34.1%)	0.577
	Female	69 (69%)	178 (65.9%)	
Marital status	Married	51 (51%)	138 (51.1%)	0.104
	Single	47 (47%)	130 (48.1%)	
	Divorced	2 (2%)	0 (0%)	

	Widowed	0 (0%)	2 (0.7%)	
Educational level	Bachelor's degree	90 (90%)	246 (91.1%)	0.595
	Master's degree	10 (10%)	22 (8.1%)	
	Doctoral degree	0 (0%)	2 (0.7%)	
Employment status	Internship (Trainee)	22 (22%)	32 (11.9%)	0.048*
	Contract-based	35 (35%)	87 (32.2%)	
	Permanent	43 (43%)	150 (55.6%)	
	Temporary	0 (0%)	1 (0.4%)	
History of attending medication administration classes	Yes	74 (74%)	202 (74.8%)	0.873
	No	26 (26%)	68 (25.2%)	
History of attending patient safety classes	Yes	87 (87%)	228 (84.4%)	0.539
	No	13 (13%)	42 (15.6%)	
Work shift type	Morning shift	8 (8%)	18 (6.7%)	0.352
	Evening shift	2 (2%)	15 (5.6%)	
	Night shift	2 (2%)	2 (0.7%)	
	Rotating shifts	88 (88%)	235 (87%)	
Working overtime (beyond required hours)	Yes	59 (59%)	67 (24.8%)	<0.001*
	No	41 (41%)	203 (75.2%)	
Having a second job (other than nursing)	Yes	11 (11%)	33 (12.2%)	0.747
	No	89 (89%)	237 (87.2%)	
History of taking specific medications	Yes	7 (7%)	8 (3%)	0.080
	No	93 (93%)	262 (97%)	
History of specific diseases	Yes	7 (7%)	9 (3.3%)	0.124
	No	93 (93%)	261 (96.7%)	

The results of the independent t-test showed that there was a significant relationship between the history of medication errors and age (p= 0.009) and job history (p= 0.024). More specifically, nurses who had a history of medication errors had a lower average age and job history than other nurses. These findings indicate that younger nurses with less work experience are more likely to make medication errors, which could be due to less experience and less mastery of medication processes (Table 5).

Table 5. Association between medication error history and quantitative demographic variables.

Variables	History of medication error	Frequency (N)	Mean ± SD	p-value
Age (years)	Yes	100	29.95 ± 5.23	0.009*
	No	270	31.72 ± 6.85	
Work experience (months)	Yes	100	73.41 ± 61.80	0.024*
	No	270	93.18 ± 78.43	

Discussion

The findings of this study showed that 27% of nurses had a history of medication errors during the past year, indicating that the average incidence was less than once per nurse (mean = 0.47). This rate was lower than that reported by Farajzadeh et al. (49.6% during the past six months) and Julai et al. (15.12 errors per nurse in the last three months), both of whom found higher rates of medication errors among nurses (12, 24). The results of these studies were inconsistent with the results of the present study. The different results of the studies could be due to the variation in sample size, differences in the departments of the place of employment, variation in the tools used, and the defined duration of medication error occurrence. Other factors affecting the results of the studies include the level of education of the samples, which in Julai et al.'s study was the minimum qualification for participation in the study was a postgraduate diploma in nursing and in Farajzadeh's study was a diploma in nursing, but in the current study the minimum qualification for participation in the study was a bachelor's degree in nursing.

The findings showed that more than a quarter of nurses (27%) had experienced a medication error in the past year. In a study by Shito et al. (2020), the prevalence of medication errors in the emergency department of a teaching hospital was estimated at 30.5% (28). In a study by Fathi Zadeh et al. (2024), it was found that 54% of Iranian nurses had experienced a medication error (29).

In terms of the causes of errors, the findings of the present study showed that the personal and psychological factors of nurses with the highest average score played the greatest role in the occurrence of medication errors, followed by management factors and ward conditions, while the role of doctors and medications was less prominent in the perception of nurses. Eschroes et al. (2021) also introduced fatigue, stress, and high workload as the most important factors in the occurrence of errors in

nurses (16). Also, a study by Farazi et al. (2017) in Iran reported similar findings and emphasized factors such as fatigue and high workload in the incidence of medication errors in nurses (30). However, some studies in developed countries have attributed a greater contribution to prescribing and prescribing errors by physicians. The difference in results can be attributed to the difference in the structure of the pharmaceutical system and the electronic nature of prescriptions in those countries (31). In the present study, among individual factors, nurses' economic problems and fatigue due to overwork played the greatest role in the incidence of errors. The distinguishing point of our findings is the prominence of "economic problems" as the most important factor. Economic pressures and "reward/benefit instability" cause reduced job satisfaction, increased burnout, and poor concentration, which in turn is associated with reduced patient safety and increased errors; in studies that have examined psychosocial components, the mismatch between effort and reward has been linked to increased nursing errors (32, 33). Furthermore, in areas with economic deprivation or limited resources, financial pressures may lead to multiple jobs, increased shifts, or overtime work, which directly lead to fatigue and errors, which is consistent with the findings of Fathi Zadeh et al. (2024), where high workload (43%) and fatigue (42.7%) were identified as the main causes of medication errors (29).

In addition, the results of this study showed that long working hours are significantly associated with increased medication errors. This result is also consistent with the findings of Bell et al. (2023), which shows that fatigue due to work characteristics such as night shifts and overtime is a contributing factor in medication errors (34). Also, the study by Alboshri et al. (2024) also emphasizes that fatigue due to long shifts and labor shortages are important challenges that nurses face and can lead to errors. These data send a clear message that workforce burnout is a serious risk to patient health (35). International evidence has also repeatedly

emphasized that working more than 40 or 60 hours per week significantly increases the risk of medication errors and occupational accidents (36).

The statistical results of this study showed that nurses with a history of errors had higher average scores in the dimensions of management, ward conditions, and factors related to physicians. In other words, people who have experienced errors considered systemic factors to be more effective in the occurrence of errors than others. This is in line with the theories of "systemic error" that state that the work environment and organizational structure play an important role in creating the context for errors. A notable point in this analysis is the lack of a significant correlation between the personal and psychological conditions of the nurse and the number of times errors occur. This finding indicates that although all nurses recognize the importance of individual factors in the occurrence of errors, the severity of these factors alone does not predict the recurrence of errors. This shows the complexity of the nature of medication errors, which depends not only on individual factors, but also on the complex interaction between individual, systemic, and environmental factors. This view is in line with the World Health Organization's "Harmless Medication" document, which emphasizes the importance of individual, environmental, and organizational factors in the occurrence of medication errors (5). A study conducted in Finland by Normaksela et al. (2021) examined the relationships between nursing managers' work activities, nurses' job satisfaction, patient satisfaction, and medication errors. The results of this study showed that medication errors are the result of a complex interaction between individual, systemic, and environmental factors (37). In another study conducted in the Czech Republic in 2021 on a large statistical population, the most common factors for medication errors were the similarity of names and packaging between different drugs, the replacement of brand drugs with cheaper generic drugs, frequent interruptions during the preparation and administration of drugs, and illegible medical records, which confirms the relationship between the "drug and physician factor" in the occurrence of medication errors (15). It can be concluded that to reduce medication errors, focusing solely on individual factors and causes is not enough. Rather, it is necessary for interventions to focus on improving environmental and organizational conditions (29, 38). This comprehensive approach can help create a safe and supportive work environment for nurses. By addressing the systemic roots of error, we can not only help improve patient safety, but also improve the quality of nurses' work life(8).

The results of this study show that some demographic variables of nurses are significantly associated with the occurrence of medication errors. Younger nurses with less work experience are more prone to medication errors. In a study conducted in Ethiopia, Wendemineh et al. cited insufficient work experience as an important reason for the occurrence of medication errors, which greatly increases the risk of committing errors(3). This finding is consistent with the study by Karari and Inab (2021). This study shows that there is strong evidence that the length of nurses' work experience is directly related to the occurrence of medication errors, and that younger nurses and those with less work experience are more exposed to medication errors(39). This finding is consistent with several studies that have identified novice nurses as a high-risk group for medication errors. Poor practical experience, insufficient mastery of processes, and stress from the new clinical environment could explain this finding (26, 32). In the current study, there is no evidence that gender, marital status, or shift type of nurses affect these errors. In another cross-sectional and descriptive-analytic study in Isfahan in 2019, there was no statistically significant relationship between the occurrence of medication errors and marital status, shift type, and age of the participating nurses, but there was a statistically significant relationship between the occurrence of medication errors and gender, employment status, and work experience of nurses. Some of the differences are due to the

characteristics of the study samples (such as cultural, educational, and experiential differences of nurses), differences in study design (use of self-report methods versus direct observation), and contextual and systemic variables of the workplace (such as patient safety culture and organizational supports) (40). Another finding of the study was a significant relationship between employment status and overtime with the occurrence of errors. Casual nurses were more prone to errors than formal nurses, and those who worked more than their assigned hours made more errors. Similar studies in different countries have also emphasized that less experience and a higher workload expose nurses to higher errors. Also, the results showed that younger and less experienced nurses were more likely to make errors (15, 24, 41, 42). Study limitations included the possibility of respondent dishonesty and incomplete questionnaires, which were managed by ensuring confidentiality and eliminating incomplete questionnaires.

Conclusion

Medication errors remain a major challenge for the health system. The findings showed that individual factors, especially fatigue due to overwork and economic difficulties, play a significant role in the occurrence of errors. Therefore, reducing the workload and properly managing the working hours of nurses, especially those on a temporary or contract basis who are more prone to errors, is crucial. Also, younger, less experienced nurses, and those with informal employment status were more prone to errors than others, which highlights the need for regular training workshops on patient safety and stress management. Given the role of systemic factors in the occurrence of errors, the use of new technologies such as electronic medication registration systems is also recommended as an effective solution to reduce medication errors. Medication errors are a multidimensional phenomenon that is formed in the interaction between individual, organizational, and cultural factors. Therefore, reducing them requires a comprehensive approach including education, individual support, improving working conditions, strengthening safety culture in hospital environments, reforming health structures and macro policies.

Conflict of interest

There is no conflict of interest between authors.

Authors' contributions

Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Resources, Software, Data Curation, Writing–Original Draft Preparation, Writing–Review & Editing, Visualization, Supervision, Project Administration: SS, RP, AV, FN.

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