

Medication Safety in Practice: Why Individual Knowledge and Supervisory Roles Show Limited Impact in Inpatient Wards

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ABSTRACT

Introduction: Medication errors are a major and common threat to patient safety in hospitals and may lead to adverse clinical outcomes and poor-quality care. Executive nurses, who are responsible for providing primary care such as medication administration, and head nurses, serving as a nursing practice leader, are core to reducing medication errors. The objective of this research is to examine the level of significance between practical nurses' knowledge and the head nurse's role toward medication errors in the inpatient ward at RSI Siti Aisyah Madiun.

Methods: The researchers employed a cross-sectional study and quantitatively collected the data. The entire population was counted through census sampling, which involved 100 managerial nurses and eight head nurses. The data were gathered by means of standardized and validated questionnaires. Statistical analyses such as Spearman's correlation and multiple linear regression were used to assess the separate and joint impacts of executive nurses' knowledge and head nurses' roles on medication error occurrence.

Results: The results indicated that the occurrence of medication errors was not significantly influenced by the practical nurses' knowledge ($p = 0.956$). Moreover, the roles of head nurses could not be traced as factors affecting the rates of medication errors ($p = 0.893$). The combined effect of both variables, as analysed simultaneously, also revealed no significant association with medication errors ($p = 0.989$) as indicated by a coefficient of determination of only 0.2%. From these results, it can be concluded that the roles of head nurses and adequate knowledge of practical nurses are, by themselves, not sufficient to significantly decrease the occurrence of medication errors.

Conclusion: The absence of significant findings agrees with system-oriented patient safety theories, which argue that supervisory functions and an individual's knowledge cannot sufficiently prevent medication errors if there are no strong organizational and process, level safeguards. The study results point out the importance of system, based interventions. Examples of such interventions are building a positive patient safety culture, implementing risk management plans, standardizing medication procedures, and having non-punitive incident reporting procedures. Hence, the work for improving medication safety should be aimed at wide-ranging organizational and structural changes instead of merely individual qualifications.

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INTRODUCTION

Patient safety continues to be one of the main concerns of hospital services and is an essential element of the provision of high-quality healthcare (1). The objective is to keep patients safe from unnecessary injuries due to medical acts that are at risk. The Hospital Patient Safety Committee and the Institute of Medicine (IOM) define patient safety as the prevention of any kind of harm that is not planned when medical care is given. Hospitals carry out patient safety through systematic approaches that involve risk assessment, reporting of events, investigation, and the use of measures to prevent and correct malfunctioning (3,4). One of the largest problem areas that the medication safety program consists of is the prevention of incidents relating to medication administration.

Medication errors, which may take place at any stage of the medicine use continuum, such as prescribing, dispensing, storage, and administration, are considered a major patient safety issue worldwide. Patient harm, prolonged hospital stays, and increased medical costs are the consequences of such errors (5,6). WHO estimates indicate that approximately half of all preventable patient safety incidents are due to medication errors, which thus represent a major source of adverse events in hospital environments (7). A survey among healthcare professionals in Indonesia showed that 64.7% of them reported medication errors. That means that they partially complied with the directive. However, various structural issues continue to present the failure of the report process, e.g. absence of standard reporting systems, and, most of all, the concern about punishment or blame which is voiced very often (8). Based on the RSI Siti Aisyah Madiun internal reports, medication errors made up 34.2% of all the patient safety incidents at the hospital level that were documented between October 2023 and September 2024. Almost all the cases were near misses (64.2%), only a few were non-injury incidents (34.3%), while unexpected adverse events (0.5%) and possible injury incidents (1%) ranked second and third, respectively. The main types of medication errors were giving the wrong dose, no identification of the patient, the time of giving was not right, the way of giving was not right, and not enough documentation. These findings pinpoint a strong necessity to implement strategies that prevent medication errors, at the same time they clearly emphasize the importance of medication safety as one of the top patient safety issues.

Advancement in the field of medication safety is basically a result of the cooperation between the head nurses, who are in charge of the clinical practice within the nursing units, and the practical nurses who, as the frontline healthcare providers, are responsible for medication administration. According to various studies, practical nurses' knowledge is the most important factor ensuring safe medication practices (9,10). Similarly, head nurses are expected to be the ones to ensure that patient safety standards are complied with by giving the right oversight, guidance, and leadership promptly (11). However, there are still contradictory pieces of evidence on the effects of these factors on the occurrence of medication errors. Research findings on how medication errors relate to nurses' supervisory functions and knowledge remain unclear. Some studies might have shown weak or context-dependent effects, while others have found strong correlations, particularly in controlled or intervention-based settings. These contradictions imply that at the individual level, factors are not direct determinants of medication safety but can rather be seen as enabling conditions that need to have a more comprehensive, system, based analytical framework. As depicted by some studies significantly correlating one to the other, factors such as workload, organizational culture, communication styles, and reporting systems have also been identified as influencing medication errors (12,13).

Medication errors have been researched widely; however, some core issues remain unclear. For example, most studies focus on either the knowledge of nurses or the role of head nurses separately, but hardly ever do they consider how these two aspects together contribute to medication errors. Moreover, the information we have is quite perplexing, especially when it comes to real situations in hospital wards. And if we consider Indonesia, hospital studies based on real incident reports are almost non-existent; the research mainly depends on people's opinions. We must address these problems if we want to gain a thorough understanding of medication errors and their causes.

What makes this research different is that it examines not only the knowledge of practical nurses but also the role of head nurses in managing medication errors in inpatient wards. Research results show that just having knowledge of the correct actions or being under a competent head nurse individually is not enough to determine the occurrence of medication errors. The paper extends the discussion of medication errors prevention by dissecting these elements along with hospital incident reports. The research is thus a valuable addition to the existing literature on the prevention of medication errors through the analysis of hospital incident reports and these factors combined. It is quite surprising that the analysis reveals no significant correlation between individual knowledge, the role of the head

nurse, and medication errors. In other words, hospitals should not only improve both the systems and overall organization but also concentrate their efforts on individual skills or leadership. Most of the studies in Indonesia and neighbouring countries have been focused on one aspect only, such as nurse knowledge, attitudes, or safety culture. Very few have examined nurse skills and the management role at the same time by using actual incident, reporting data. This study thus offers a more in, depth understanding of the medication errors situation in inpatient care by combining the two elements.

METHOD

Research Type

A quantitative cross-sectional methodology was adopted to assess the correlations between practical nurses' knowledge, the head nurses' role, and the frequency of medication errors in inpatient wards. Although such a cross-sectional design is suitable for discovering associations between variables, it does not allow for causality conclusions. Hence, the correlations observed should be taken cautiously, especially if we consider that medication error events are dynamic and context-dependent.

Population and Sample/Informants

The study population consisted of the practical nurses ($n = 100$) and head nurses ($n = 8$) working in the inpatient wards at RSI Siti Aisyah Madiun. The small number of head nurses was chosen in the study, as it was a result of the structure of the organization of the inpatient wards. Although including all eligible head nurses provided total coverage at the unit level, the small sample size could have led to a lower statistical power to detect modest associations involving managerial roles. A purposive sampling method was chosen to get all participants who were eligible and met the study criteria. The inclusion criteria were: (1) practical nurses and head nurses working in the inpatient wards of RSI Siti Aisyah Madiun, both permanent and contract staff; and (2) the willingness to participate in the study. The exclusion criteria were: (1) nurses who were on leave or not actively cooperating during the data collection period; and (2) nursing staff working in non-inpatient areas such as emergency departments, outpatient clinics, or operating rooms.

Research Location

The study was carried out in the inpatient wards at RSI Siti Aisyah Madiun, Indonesia, between April 7 and April 20, 2025.

Instrumentation or Tools

The practical nurse's knowledge and head nurse's role questionnaires were formulated by the authors. These questionnaires were developed based on literature and institutional patient safety guidelines. Furthermore, the item content was localized to clinical practice. Data collection was done through three instruments: The practical nurse knowledge questionnaire, consisting of 20 items, and the head nurse role questionnaire, comprising 18 items. In addition, the study also used secondary data on medication error incidents, which were obtained from the reports issued by the Hospital Quality and Patient Safety Committee. Furthermore, the content validity of the instruments was checked by hospital management and nursing experts. To determine the empirical validity of the instrument, Pearson product-moment correlation coefficients were used. The Practical Nurse Knowledge Quiz was checked for agreement with the results of fifteen nurses by item correlation coefficients between 0.534 and 0.955, all exceeding the critical R , value of 0.514 ($N = 15$). The Head Nurse Role Questionnaire was given to 10 head nurses, which produced correlation coefficients between 0.711 and 0.985, all above the critical R , value of 0.632 ($N = 10$). Cronbach's alpha was used to perform reliability analysis, the practical nurse knowledge questionnaire manifested very good internal consistency ($= 0.947$), whereas the head nurse role questionnaire was very consistent ($= 0.984$).

Data Collection Procedures

The primary data were collected through self-administered questionnaires that were handed out directly to the eligible respondents. The secondary data on medication error incidents were obtained from the hospital patient safety reports of RSI Siti Aisyah Madiun.

Data Analysis

The data analysis was performed using descriptive as well as inferential statistical methods. Univariate analysis was applied for the description of the respondents' characteristics. On the other hand, bivariate analysis through Spearman's rank correlation was used to investigate the relationships between the independent variables and the occurrence of medication error. The incidence of medication errors was initially recorded by the gathering of discrete count data. To enable unit-level comparison and multivariable analysis, the raw counts were converted into a standardized composite score representing relative medication error frequency. Assumption tests showed that the results met the criteria for approximate normality, linearity, independence of observations, and homoscedasticity. Based on these results, conducting a linear regression analysis is very well supported. Poisson and negative binomial regression models are often recommended for count outcomes; however, their use requires higher event counts and sample sizes to guarantee model stability. In this study, only a few inpatient units were available, and the nature of the research was exploratory; therefore, multiple linear regression was chosen as a method that is both practical and understandable. Future studies are advised to utilize count-based modelling approaches to further confirm these results. The findings were statistically significant with $p < 0.05$.

Ethical Approval

The Research Ethics Committee of RSI Siti Aisyah Madiun has granted the ethical approval for this study (Approval No. 02/RSISA, KEPK/III/2025). Before participating, all participants were fully informed about the study objectives and procedures, signed a written informed consent, and were guaranteed confidentiality, anonymity, and the right to discontinue participation at any time without any consequences.

RESULTS

Characteristics of Respondents

Table 1 shows a univariate distribution of the characteristics of respondents. These characteristics refer to practical nurses' knowledge of medication errors and the perceived roles of ward head nurses among inpatients. This analysis offers demographic and professional profiles of the respondents, as well as baseline information on the knowledge and other variables that constitute the focus of this study.

Table 1. Characteristics of Practical Nurses and Head Nurses in Inpatient Wards

Variable	Category	n	%
Practical Nurses' Characteristics (n = 100)			
Age (years)	20–25	1	1.0
	26–30	22	22.0
	31–35	22	22.0
	36–40	27	27.0
	41–45	16	16.0
	>45	12	12.0
Gender	Male	17	17.0
	Female	83	83.0
Education	Diploma III in Nursing	74	74.0
	Bachelor's Degree in Nursing	26	26.0
Length of Service (years)	2–5	13	13.0
	>5–10	30	30.0
	>10–15	30	30.0
	>15–20	15	15.0
	>20	12	12.0
Position	Practical Nurse	54	54.0
	Shift Supervisor	46	46.0
Knowledge of Medication Errors (n = 100)			
Knowledge Level	Good (>75%)	87	87.0
	Fair (56–74%)	12	12.0

Variable	Category	n	%
	Poor ($\leq 50\%$)		
Head Nurse Characteristics (n = 8)			
Gender	Female	8	100.0
Age (years)	31–40	1	12.5
	41–50	6	75.0
	>50	1	12.5
Position	Head Nurse	7	87.5
	Nurse Coordinator	1	12.5
Length of work	>10 years	8	100.0
Education	Diploma III in Nursing	2	25.0
	Bachelor's Degree in Nursing	6	75.0
Practical Nurses' Assessment of Head Nurse Role (n = 40)			
Role Level	Good ($>70\%$)	37	91.7
	Fair (55–70%)	3	8.3
	Poor ($\leq 55\%$)	0	0.0

*Assessment based on practical nurses' evaluation of head nurse role practices.

According to Table 1, the majority of practical nurses who participated in this investigation were 35 years old or more, and the 36–40 age group was the most populous (27% of total respondents). In addition, the majority of participants were females (83%), most of them had Diploma III in Nursing (74%), and had more than 10 years of practice in the clinical field (57%). In terms of profession, 54% of respondents identified themselves as practical nurses, and 46% worked as shift supervisors. These demographic characteristics refer to a nursing staff that has been largely experienced and well-practiced, deep in both inpatient care and drug administration.

With respect to medication errors, the great majority of practical nurses had a strong grasp of the concept. 87% were ranked as having good knowledge, 12% as having fair knowledge, and only 1% was considered to have poor knowledge. This means that, generally, nurses have a solid theoretical basis of patient safety and medication error prevention, although there might be some small areas for improvement.

All head nurses participating in the survey were female, most of them being between 41 and 50 years old (75%), and had a head nurse role experience of over 10 years. Most of them had a bachelor's degree in nursing (75%) and were ward heads (87.5%), thus representing a role profile of seniority and academic qualifications in inpatient wards. Furthermore, practical nurses' assessment of head nurses' roles showed that most of the perceptions were positive. The great majority of respondents (91.7%) considered head nurses' role abilities as good, while 8.3% thought that they were fair, and none considered them as poor. This assessment referred to the role functions of supervision, coordination, education, and enforcement of standard operating procedures for medication error prevention.

Table 2. Distribution of Medication Error Incidents Based on The Types of Patient Safety Incidents During Hospitalization at RSI Siti Aisyah Madiun

Type of Medication Error	Injury Incidents	Non-Injury Incidents	Near-Miss Events	Potential Injury	Total
Incorrect Identification Label	-	3	26	-	29
Incorrect Dose	-	15	8	-	23
Incorrect Medication	-	12	34	-	46
Incorrect Documentation	-	-	2	-	2
Incorrect Labeling	-	4	16	-	20
Delayed Medication Administration	-	20	15	-	35
Incorrect Prescription	-	-	1	-	1
Incorrect Medication Placement	-	-	2	-	2
Drug Allergy	-	10	-	-	10
Total	-	64	104	-	168

Table 2 presents the breakdown of medication error cases in inpatient wards that were reported during the year 2024, at a total of 168 incidents. All the events were either near-miss or non-injury events that accounted for 61.9% (n = 104) and 38.1% (n = 64) of the total number of cases, respectively. Importantly, no cases with patient injury or potential injury were recorded during the reporting period, which suggests that most of the medication errors were caught at an early stage before patient harm. With respect to error categories, giving the wrong medicine was the most common type of error (n=46, 27.4%), followed by failure to administer medicine on time (n=35, 20.8%), and wrong self-identification and labelling (n=29, 17.3%). Other error types that were frequently reported included giving the wrong drug dose (n=23, 13.7%) and mislabelling (n=20, 11.9%). Cases of drug allergies (n=10, 6.0%), incorrect documentation (n=2, 1.2%), wrong medication placement (n=2, 1.2%), and wrongful prescribing (n=1, 0.6%) were the least common.

The large share of near misses and no injury cases points to there being some reporting and early warning systems now in place. At the same time, the frequent occurrence of errors in picking the medication, giving it on time, and identifying the patient shows that there are quite a few loopholes in the medication use system. In view of the seriousness of the findings, safety in the workplace should be a priority, necessitating additional safety measures like more thorough checks, closer supervision, and nursing staff education on a continuous basis, to avoid further medication errors in hospitals.

It is also important to point out that the medication error data in this study were based on internal hospital incident, reporting systems, which depend on the organization's culture of reporting. The fact that most of the incidents reported were near misses or without injuries might reflect the effectiveness of early detection measures and a fairly supportive setting for reporting. Still, one should not be able to rule out the possibility that the minor, routine, or socially sensitive errors have not been reported. Therefore, the recorded frequency should be seen as a minimal estimate of real medication error events.

Table 3. Correlation Between Independent Variables and Medication Error Incidence

Independent Variable	Correlation Coefficient (r)	p-value
Practical Nurses' Knowledge	0.000	1.000
Head Nurse Role	-0.131	0.685
Practical Nurses' Knowledge × Head Nurse Role	-0.265	0.069

Table 3 shows the results of the correlational study at the bivariate level that the researcher has conducted between different independent variables and the occurrence of medication errors in the situation. The correlation between the knowledge of practical nurses and the incidence of medication errors was very low (r = 0.000), and the difference was not statistically significant (p = 1.000). This means that there was no association that could be detected between the practical nurses' knowledge and the occurrence of medication errors being reported in this sample. In the same way, the role of the head nurse was found to have a very weak negative relationship with the occurrence of medication errors (r = 0.131). Besides that, this association was considered statistically non-significant (p = 0.685). From these findings, it can be inferred that the activities of the head nurses' role, when considered separately, had no significant relation with the lowering of medication errors.

Nonetheless, the interaction between the knowledge of practical nurses and the role of the head nurse revealed a weak negative linear correlation (r = 0.265), and the p-value was close to being statistically significant (p = 0.069). This relationship between variables barely misses the conventional standards necessary for statistical significance and hence only hints at a possible joint effect: high nursing knowledge levels combined with a strong role of the head nurse may together lead to fewer medication errors. The indicated pattern highlights the value of harmonious cooperation between individual skills and managerial support as a factor in positive medication safety outcomes and therefore should be explored further with larger sample sizes or in a longitudinal study design framework.

Table 4. Multiple Linear Regression Analysis Examining the Effects of Practicing Nurse Knowledge and Head Nurse Role on Medication Error Incidence

Variable	B	SE	β	t	p-value	95% CI (Lower–Upper)
Constant	2.733	1.944	–	1.406	0.193	–1.665 to 7.132
Practical nurse knowledge	–0.033	0.575	–0.019	–0.057	0.956	–1.332 to 1.267
Head nurse role	–0.184	1.331	–0.046	–0.138	0.893	–3.192 to 2.826

Note: Dependent variable = incidence of medication errors.

Table 4 shows the results of a multiple linear regression analysis that examined the effects of practical nurses' knowledge and the role of head nurses on medication errors. The results of the study indicate that the knowledge of practical nurses and the role of the head nurse are not significant statistical predictors of the incidence of medication errors ($p > 0.05$ for all variables). The knowledge of practical nurses had a negative regression coefficient ($B = 0.033$, $\beta = 0.019$), which indicates the possibility of fewer medication errors as knowledge increases; however, this relation was not statistically significant ($p = 0.956$). The head nurse's role was also negatively related to medication errors, but the association was not significant ($B = 0.184$, $\beta = 0.046$; $p = 0.893$).

While the two independent variables both showed negative regression coefficients, which would signify a protective effect against medication errors, the large confidence intervals that include zero convey a great deal of variability and small explanatory power. The data mean that knowledge and head nurses are not enough to bring down medication errors. This points to the fact that other factors such as workload, staffing levels, organisational culture, and reporting systems have to be considered. As such, the prevention of medication errors should be executed via multifaceted, system-based approaches rather than being dependent only on personal knowledge or management roles.

DISCUSSION

This research was focused on how much the practical nurses know and how much the head nurses influence the medication errors for the inpatients at Siti Aisyah Hospital, Madiun. The results showed that neither the knowledge of the nurses nor the perception of the effectiveness of the head nurses' roles was significantly related to the medication error incidence. This study, thus, reveals the complexity of medication safety and that the mistakes are dependent on many different factors rather than just on a person's level of competence or position in management. The near-miss and non-injury incidents that were dominant in this study are evidence that there are some mechanisms within the medication use process for early detection. However, one can argue that such patterns may be reflective of the organizational culture and the incentives that exist for incident reporting. Hence, the results need to be viewed against the backdrop of institutional reporting systems that impact not only the exposure but also the apparent spread of medication error events.

Conceiving different theories from the analytical point of view, this study has effectively demonstrated no significant individual, level effects, hence it has provided direct evidence for the core concepts of Systems Theory (14) and the Swiss Cheese Model (15) through empirical analysis. Individual knowledge and leadership roles, even when strong, may not automatically lead to safer outcomes if systemic weaknesses continue to exist, thus making organisational, level interventions more necessary. Here, medication errors should be recognized as symptoms of interacting process, structure, and organisational condition weaknesses rather than as isolated failures attributable to individual practitioners.

This research significantly advances the patient safety literature by providing empirical evidence that medication error mechanisms are consistent with well, established system, oriented theoretical frameworks.

Interpretation of Key Findings

Although most nurses showed good knowledge of medication safety, this had no significant association with medication error occurrence. This finding pinpoints an extensive knowledge and practice gap, where knowing something at a cognitive level does not necessarily lead to safe clinical behaviour. Healthcare is very complicated, and there are huge workloads; nurses are always pressed for time, and there are so many distractions and things to do. All this makes it very difficult to apply knowledge in practice (18,19). So, a nurse might know the right way to handle medications but still not be able to do it every time in a busy and real hospital setting.

This result is in line with new studies showing that it is not really the competence of an individual that determines patient safety outcomes, but rather they go hand in hand with organisational and environmental factors. Abiding by the Lean safety framework (20), issues such as inefficient workflows, lack of standardisation, and fragmented processes lead to more variability and thus increase the likelihood of errors (21–23). On that account, besides augmenting knowledge, medication safety has to be improved through systems that are changed in ways that ensure the consistent performance of safe practices.

Likewise, the role of the head nurse was not significantly correlated with the incidence of medication errors, according to respondent ratings, which were generally positive towards the role. This gap between the two indicates that good perceptions of the head nurse's role do not necessarily lead to better safety outcomes. One reasonable assumption is that head nurses focus on their administrative work, which may limit their chances of direct clinical supervision, mentoring, and providing real-time feedback on medication administration (24,25). Neglecting to develop their clinical role, irregular safety rounds, and little participation in medication safety audits can also reduce their impact at the point of care (26–28). It is essential to understand that perceived leadership effectiveness and medication error incidence are two different things.

The results reveal a major mismatch between the theoretical frameworks of the head nurse role that focus on active clinical supervision and professional guidance, and the actual situation of ward management. The impact of the head nurse role in error reduction is greatest when it is deliberately used in the day, to, day clinical work through direct supervision, coaching, and continuous feedback, rather than being mainly limited to administrative tasks. The combined influence of nurses' knowledge and the head nurse's role was responsible for only a small share of the overall medication variance.

Comparison with Previous Studies

These results are in line with the earlier study, which shows that mere knowledge is not enough to significantly decrease medication errors. Rahmi et al. found that attitudes, motivation, and the culture of an organization have a greater impact on patient safety behaviours than knowledge alone (29). This study agrees with the earlier study, which shows that mere knowledge is not enough to significantly decrease medication errors. Rahmi et al. found that attitudes, motivation, and the culture of an organization have a greater impact on patient safety behaviours than knowledge alone. Moreover, the World Health Organisation points out that medication errors have multiple causes, such as communication breakdowns (30), workflow design, and organizational constraints (31), which are factors also identified by this study.

These results, however, go against nursing management theories as well as various empirical studies, which suggest that safety culture and compliance are directly improved through a well-executed head nurse role. The lack of a visible role in this study may indicate that there is a gap between theory and practice, which could be explained by the fact that, in the study setting, the head nurses' roles were mainly administrative. It has been stated in the literature that a head nurse's role is most effective if it is combined with direct oversight, continuous staff training, and a well-organized coaching program, aspects which may have been underdeveloped in this case.

As medication error incidence can be considered a count-based event, follow-up research could take advantage of different analytical methods such as Poisson or negative binomial regression models. These methods are considered most appropriate for low, frequency, and over-dispersed outcomes modelling. Employing these models might give a fresh insight into the factors affecting medication safety at the system and organizational levels, possibly with more accurate estimates.

Limitations and Cautions

Several limitations should be considered when reading these results. The use of a cross, sectional design makes it difficult to explain the cause of changes and simply using self, report questionnaires bring in the element of subjectivity and the risk of social desirability bias, especially in the evaluation of the nurses role by head nurses. Moreover, the independent variables only explained a small percentage of the variance in the occurrence of medication errors, thus it is quite clear that there are other very significant factors, like workload, safety culture,

staffing adequacy, and technological support, that have not been taken into consideration. Besides, a study carried out at a single site limits the generalizability.

Besides the cross, sectional nature of the investigation, the interpretation of the relationships that were observed must be done very carefully. Medication error incidents can be seen as very dynamic and local in nature as they are often dependent on the time variations of workload, staffing patterns, and organizational conditions. Therefore, the correlations established in this study should not be taken as having a causal relationship or as being stable over time. Thus, it is suggested that in order to reveal the changing face of medication safety practices, as well as to better identify the causal mechanisms, longitudinal or mixed, methods studies be conducted.

Though linear regression was applied, it should be noted that medication errors are by nature occurrences that can be counted. That is why the results should be taken with a grain of salt and maybe count regression models would be able to deliver more accurate estimates. Besides, the information on medication errors was mainly extracted from the incident reports of nurses, which means that nurses were in the position of reporters rather than being the absolute sources of causation.

Recommendations for Future Research

Further research needs to be mainly based on longitudinal or mixed-methods studies in order to understand more clearly and to specify causal relationships, as well as contextual influences on medication errors. Besides that, it is highly advised to include a broad range of systemic variables such as workload, staffing ratios, safety culture, interprofessional communication, and health information technology. Multi-centre studies have the advantage of increasing generalizability and, at the same time, making cross-organizational comparisons easier. Moreover, future investigations need to be focused on the assessment of system, level interventions and support of the head nurse's role practices that have a direct impact on medication safety processes.

CONCLUSION

This research showed that the levels of knowledge of practical nurses and the perceptions of the roles of head nurses did not significantly correlate with the occurrence of medication errors in inpatient wards at Siti Aisyah Hospital, Madiun. The nurses had a high level of knowledge, and the head nurses were still very much respected, but these factors by themselves were not enough to bring about a significant decrease in medication errors. The results point to the fact that medication safety is mostly a matter of systemic and organisational aspects rather than simply of individuals' knowledge and skills. The large number of near-miss cases is proof of frontline nurses' skill in early detection and at the same time a strong evidence of the weaknesses of the medication use system that still exist. These observations indicate that the medication safety programmes should be more focused on organisational changes than on staff abilities. Clinical supervision on nurse performance should be strengthened, workflow should be properly studied and redesigned, staff from different areas should collaborate more, and, in addition, strict systemic safeguards should be put in place in order to attain long, lasting improvements in medication safety.

AUTHOR CONTRIBUTION STATEMENT

Both authors made substantial contributions to this study, as detailed below: T.S. was responsible for the conceptualization, design of the methodology, data collection, data analysis, drafting of the manuscript, and revision of the final version. S.S. provided oversight, validated the methodology, edited the manuscript, and granted final approval for submission.

CONFLICT OF INTEREST

The authors affirm that they possess no financial or personal affiliations with individuals or organizations that may unduly influence the conduct, outcomes, or interpretation of this research. This declaration certifies that the study was executed with independence, objectivity, and transparency, free from any external pressures that could compromise its integrity.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors wish to declare that, during the preparation of this manuscript, generative artificial intelligence (AI) tools, including ChatGPT (OpenAI), were employed exclusively to enhance language clarity, readability, and overall writing quality. All research concepts, data analyses, interpretations of results, and conclusions are entirely the independent work of the authors, with no involvement of AI tools in scientific analysis or academic decision-making.

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