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## RESEARCH ARTICLE

### Workload as the most Important Influencing Factor of Medication Errors by Nurses

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#### Abstract:

##### Background:

This research is motivated by the fact that medication errors are serious threats to the safety of patients in hospitals. Nurses are one of the health workers who play a significant role in preventing these errors.

##### Objective:

The aim of this quantitative research is to determine the factors that influence the incidence of medication errors by nurses.

##### Methods:

The adopted method had a correlative descriptive design and used samples obtained from 164 nurses through a purposive sampling technique. The sample inclusion criteria were the nurses who worked in patient's rooms, those who were healthy and not sick, not currently in school, and were willing to be respondents. Furthermore, the research instruments were questionnaires, which were developed through the Cronbach's alpha validity and reliability test results of 0.681 and 0.873, respectively. Analysis was conducted using the independent t test,  $X^2$  (chi-square) and multiple logistic regressions.

##### Results:

The results showed that the factors which influenced the incidence of medication errors were work experience, motivation, workload, managerial and environmental elements. Moreover, the variable which contributed the most, with a *p*-value of 0.004 and OR of 5.387 was workload.

##### Conclusion:

Finally, the following factors, including nurse's workload, motivation, work experience, good managerial management and environmental elements, should be considered when preventing medication errors.

**Keywords:** Patient safety, Medication error, Workload, Nurse, STROBE, Magnetic resonance imaging.

#### Article History

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## 1. INTRODUCTION

Nurses administer medications in hospitals to ensure the safety of patients. Therefore, there exists a risk of making errors when administering drugs. This process is vital for patient's safety and is directly related to morbidity and mortality rates. Misconduct in administering medications can endanger hospitalized patients and increase health care costs [1 - 3].

The incidence of medication errors in the world is very high. The results from the research in England, Sweden and Brazil showed that the average incidence of medication errors was 1.4% - 16.9% [2 - 5]. Another study stated that 6% to 39% of this incidence occurred more than once, and out of 397 nurses, 57.4% reported cases of medication errors. Other research works reported that there were errors in drug administration from 8.5 to 16.9 per 100 operations. The most frequent errors made by nurses were 87.5% during documentation, 73.1% when administering a drug and 53.6% due to late administration [3, 5, 6].

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Medication errors may occur due to inappropriate use of a drug, and they may cause unexpected effects that threaten the safety of patients [4, 7]. Furthermore, they may occur due to nurses' inexperience, poor organizational system, communication, workload, shift change processes and a flaw in the ward managerial system [2, 8]. The aim of this research is to obtain an overview of the relationship between factors that cause medication errors by nurses in the inpatient room.

## 2. RESEARCH METHODS

The method used is in line with the protocol of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) of cross-sectional studies.

### 2.1. Design

This is cross-sectional research that aims to identify the factors influencing the incidence of medication errors by nurses. The participants were practicing nurses with the job of providing medication to patients in the inpatient room. Furthermore, this research was conducted at a hospital in East Kalimantan, Indonesia.

### 2.2. Participants and Setting

The inclusion criteria include nurses who have worked in the inpatient room, carried out a medication process, were not sick and not on leave, and were willing to be a respondent. Furthermore, the subjects were excluded whenever they could not complete the research. One hundred sixty-four nurses participated with a significance ( $\alpha$ ) level of 0.05 and a power of test 80%.

In general, 164 nurses were selected to be participants using the purposive sampling method. The nurses selected were from 15 inpatient rooms in the hospital consisting of the surgery room, emergency, intensive, adult, pediatric, and maternity care rooms. This research was carried out at a tertiary level hospital with various facilities, such as the Intensive care unit, Magnetic Resonance Imaging (MRI), radiotherapy unit, cardiac catheterization, cardiac surgery, and nuclear medicine installations. This teaching hospital comprising 851 beds and 1024 nurses is a regional and national reference located in East Kalimantan. It has a nurse-to-patient ratio of 1:8 and 1:10 on morning and evening shifts, respectively.

### 2.3. Instrument

The data collection instrument used was a questionnaire consisting of three parts. The first part contains general information about the respondents and consists of 10 items, namely gender, age, marital status, education level, length of work, employment status, a position at workplace, workplace (room), nurses' classification (PK), and have they ever been involved in medication processing.

The second part includes the factors causing medication errors by nurses. It was developed based on the literature review from Carayon & Smith (2000), AHRQ (2003), MOH (2008), Henriksen (2008), and Vincent (1998) (Apsay, 2018; Dumo, 2012). The instrument consists of 34 items, including

nurse's motivation (10 items), environment (8 items), managerial (10 items), and workload (8 items). Furthermore, the factors affecting medication errors by nurses were measured on a 4-point Likert scale which includes strongly disagree 1 point and strongly agree 4 points.

The questionnaire was evaluated by 2 experts from the Head of Basic and Fundamental Nursing Department, Faculty of Nursing, University of Indonesia and Head of Nursing Hospital in East Kalimantan. Further evaluation was performed by a team leader in the adult care room and 3 nurses in the emergency, intensive and adult care rooms with a content validity result of 0.873. In addition, the instruments' validity and reliability were carried out on 30 nurses with alpha Cronbach results of 0.806.

The third part was based on the information related to the incidence of medication errors by nurses. It consisted of 16 items that have the statements on the implementation of the six right principles in medication, including the correct patient (4 items), medication (3 items), dosage (3 items), way (3 items), timing (4 items) and documentation (3 items). The questionnaire was developed based on the results of Kee and Hayes, 2000, Kozier & Erb's, 2016 and Potter & Perry, 2017 and the reliability test was carried out on 30 nurses with a result of 0.681. Furthermore, the assessment of the medication errors incidence was measured using yes and no questions. The yes question got 1 point and no 0 point.

### 2.4. Data Collection

This research began by submitting an ethical clearance from the University, alongside a research permit to the hospital director to obtain permission in carrying out the research at the hospital. Furthermore, the purpose and methods of data collection were explained to the nursing manager and it was guaranteed that the data collected would be kept confidential. Nurses participated voluntarily and anonymously in this study, and data collection was carried out from 12 August to 22 October 2020.

The questionnaires were distributed in printed format and given to participants by the researcher. Participants were given the opportunity to fill out questionnaires in the staffroom during breaks or off duty to avoid interfering with the process of providing care to patients. A total of 167 questionnaires were distributed, 2 were not returned and 1 was unfilled, with a response rate of 98.2%. An explanation was given before the participants voluntarily filled out the questionnaire anonymously. The personal information provided by them was kept confidential, while the data was only used for research purposes. Furthermore, participants were compensated for their participation in the form of souvenirs.

Furthermore, the researcher also stated the procedure for filling out the questionnaire and gave sufficient time. When the participants felt tired, they were welcome to take a break and then continue after. The results were collected personally by researchers. The completed, signed, and returned questionnaire constituted a form of consent from the participants in this research. In addition, a total of 164 questionnaires were collected for later analysis.

## 2.5. Ethical Considerations

This research received approval from the ethics committee of the University of Indonesia (Approval Number: SK-247 / UN2.F12. D1.2.1 / ETIK 2020). Furthermore, nurses that met the inclusion criteria were able to participate voluntarily and anonymously.

The data collected was stored in the form of a file, in a laptop as well as on Google drive, and then encrypted with a password. Only researchers were able to access and use the data. Data in printed format were stored in a drawer locked and only accessible by the researcher. In addition, the printed data was to be destroyed one year after the research.

## 2.6. Data Analysis

Data were analyzed using SPSS version 21.0. Furthermore, the demographic data were analyzed using descriptive statistics and the categorical data were presented with proportions (percentages). Meanwhile, numerical data was presented in the form of a frequency distribution, namely mean, median, mode, minimum and maximum values, and 95% CI according to the scale of each data. Categorical variables were analyzed using the chi-square ( $X^2$ ) test with a confidence level of 95% or alpha = 0.005. In addition, multivariate analysis using multiple

logistic regression was also carried out.

## 3. RESULTS

The results showed that about 101 nurses were still in their productive age below 31.38 years and 68.9% of them were females. Furthermore, eighty-four of them had less than 6 years of working experience, and 73.78% had diploma education. The results also showed that 114 nurses had less work motivation, 127 had a high workload and 72 stated that the work environment was not good. Moreover, the analysis results of the managerial factors showed that a total of 113 of these factors were not good for nurses. Finally, 18 nurses made medication errors, while 146 made none. Therefore, the interpretation is that there are nurses who experience medication errors (Table 1).

The statistical test results showed that there was no relationship between age and the incidence of medication errors ( $p = 0.215$ ;  $a > 0.05$ ). Meanwhile, there was no relationship between the education level and the medication errors incidence ( $p = 0.658$ ;  $a > 0.05$ ). However, there was a relationship between the work experience and the medication errors incidence by nurses ( $p = 0.018$ ;  $a > 0.05$ ). It was concluded that there was a relationship between motivation and nurses who made medication errors ( $p = 0.014$ ;  $a < 0.05$ ).

**Table 1. Frequency distribution of nurse administrators based on age, gender, work experience, degree of education, motivation, workload, managerial, environment and incidents of medication errors, 2020 (n = 164).**

Variable	f	%
<b>Age</b>		
a. < 31,38	101	61,58
b. ≥ 31,38	63	38,42
<b>Gender</b>		
a. Male	51	31,1
b. Female	113	68,9
<b>Work Experience</b>		
a. < 6,74	84	51,22
b. ≥ 6,74	80	48,78
<b>Degree of Education</b>		
a. Bachelor	43	26,22
b. Diploma	121	73,78
<b>Motivation</b>		
a. Low	114	69,51
b. High	50	30,49
<b>Workload</b>		
a. High	127	77,44
b. Low	37	32,56
<b>Managerial</b>		
a. Bad	113	68,9
b. Good	51	31,1
<b>Environment</b>		
a. Bad	72	43,9
b. Good	92	56,1
<b>Medication Errors</b>		
a. Yes	18	10,97
b. No	146	89,13

The analysis concluded that there was a significant relationship between the workload and the incidence of medication errors by nurses ( $p = 0.001$ ;  $\alpha < 0.05$ ). Furthermore, there was a relationship between the environment and the medication errors incidence ( $p = 0.007$ ;  $\alpha < 0.05$ ). Subsequently, the analysis of the relationship between managerial factors and the medication errors incidence by nurses concluded that there was a relationship between managerial and medication errors ( $p = 0.001$ ;  $\alpha > 0.05$ ) (Table 2).

The six variables related to medication errors that were

used in the multivariate analysis and modeling stage included: age, work experience, motivation, workload, managerial and environmental (Table 3).

The research data analysis results concluded that workload is the variable that most influences the incidence of medication errors, followed by the managerial variable (Table 4). Based on the analysis, the adjusted odds ratio of the workload variable was 5.387. It suggests that the high workload has a 5.4 times greater odds for the incidence of medication errors compared to a low workload after being controlled by managerial variables, motivation, age, work experience and environment.

**Table 2. Relationship between causative factors and incidence of medication errors by nurses, 2020 (n = 164).**

Variable	Medication Error						OR (95% CI)	P
	Yes		No		Total			
	n	%	n	%	n	%		
<b>Age</b>								
a. < 31,38	14	13,9	87	86,1	101	100	2,374	0,215
b. ≥ 31,38	4	6,3	59	93,7	63	100	0,745-7,566	
<b>Gender</b>								
a. Male	6	11,8	45	88,2	51	100	1,122	0,828
b. Female	12	10,6	101	89,4	113	100	0,396-3,178	
<b>Work Experience</b>								
a. < 6,74	4	4,8	80	95,2	84	100	4,242	0,018
b. ≥ 6,74	14	17,5	66	82,5	80	100	1,333-13,506	
<b>Degree of Education</b>								
a. Bachelor	6	14	37	86	43	100	1,473	0,658
b. Diploma	12	9,9	109	90,1	121	100	0,516-4,203	
<b>Motivation</b>								
a. Low	5	4,4	109	95,6	114	100	7,659	0,014
b. High	13	26	37	74	50	100	2,558-22,936	
<b>Workload</b>								
a. High	16	14,2	109	85,8	127	100	0,858	0,001
b. Low	2	5,4	35	94,6	37	100	0,800-0,921	
<b>Managerial</b>								
a. Bad	5	4,4	108	95,6	113	100	0,738	0,001
b. Good	13	25,5	38	74,5	51	100	2,470-22,103	
<b>Environment</b>								
a. Bad	2	2,8	70	97,2	72	100	7,368	0,007
b. Good	16	17,4	76	82,6	92	100	1,635-33,20	

**Table 3. Modeling of factors that influencing the incidence of medication errors by nurses at the hospital, 2020 (n=164).**

No	Variable	P				
		Step 1	Step 2	Step 3	Step 4	Step 5
1	Age	0,215				
2	Gender					
3	Degree of education					
4	Work experience	0,012	0,012	0,087		
5	Motivation	0,014	0,054			
6	Workload	0,001	0,001	0,015	0,014	0,004
7	Managerial	0,001	0,001	0,009	0,009	0,005
8	Environment	0,007	0,007	0,052	0,058	

**Table 4. The factors that most influence the incidence of medication errors by nurses, 2020 (n=164).**

No	Variable	p	Odd Ratio
1.	Workload	0,004	5,387
2.	Managerial	0,005	5,154

#### 4. DISCUSSION

##### 4.1. Work Experience

This research revealed that there was a relationship between work experience and the incidence of medication errors. Furthermore, it was in accordance with the opinion that work experience had a positive relationship with nurses' productivity and performance. The experience could help in nurses' decision-making: The longer their working period, the more skilled they were in carrying out their work [2, 9]. Therefore, the skills in administering drugs by nurses should be improved. Nurses with more work experience should share their experience with the new ones. Sharing skills in administering drugs can be carried out through orientation and preceptorship programs. Such programs are effective in enhancing new nurses' performance [10, 11].

Work experience could also be improved by involving nurses in regular training related to safety and efficient drug administration process. Furthermore, nurses could also improve their experience by attending seminars on medication processes related to the use of the latest drugs, administration techniques, and the use of technology in the drug administration process.

##### 4.2. Motivation

These results are consistent with the research and they concluded that there was a significant relationship between work motivation and the prevention of medication errors [12]. According to the analysis, the motivation shown by nurses was based on a sense of responsibility to provide safe and quality health care. Nurses recognized their responsibility to carry out safe drug administration to patients. Motivation can improve nurses' performance in drug administration [13].

The motivation of nurses in the drug administration process should be maintained to ensure that the process is carried out safely. Nurses' motivation could be increased by paying attention to their needs and expectations. This is carried out by creating good working conditions and environments, making good policies, and giving awards for the best achievements. The high motivation of nurses will have good implications for the prevention of medication errors.

##### 4.3. Environment

The results indicated that the nurse's work environment was related to the incidence of medication errors. Furthermore, data showed that nurses that work in a good environment support the prevention of errors. These results are consistent with the research that showed that medication errors are influenced by the surrounding environment that can act as interruptions and distractions [2].

Poor environmental management could lead to medication errors. Nurses could not give medication properly in a noisy

environment. Poor lighting would increase the risk of medication errors. Too many visitors could also distract nurses from giving medication to patients. A messy treatment room, such as untidy bed arrangements, poor air circulation, overcrowding, and irregular drug storage areas, could also cause nurses to make mistakes in administering drugs [14, 15].

Therefore, it is necessary to arrange the room in order to create a safe and comfortable atmosphere for nurses to provide care to patients. Managing a safe, comfortable environment in the medication process involves the arrangement of adequate lighting, avoiding interruptions and distractions, regulating sound and minimizing noise levels, designing medication management rooms in an orderly, safe and efficient manner, as well as creating a medication safety zone in the treatment room [16].

Creating a physical environment that supports the medication process by nurses could be made possible by providing adequate lighting, good room temperature, arranging adequate space for them to prepare and administer drugs, and ensuring safety when administering drugs to patients.

##### 4.4. Managerial

In this research, the nurses' view about the management and leadership in the patient room was appropriate, and they further informed that the room head involves them when making several decisions. Furthermore, the room head reprimands them whenever they make an error, especially in administering medication. Therefore, they felt that they had received guidance from their superiors when facing problems at work. An effective nursing manager should have a leadership spirit [17]. The research suggested that emotional intelligence is a useful tool for leader of nurses and contributes decisively to the achievement of effective management in healthcare [18]. Furthermore, every leader should be able to carry out the role of accompanying, directing, motivating and strengthening their subordinates [9]. These results are consistent with a research that showed that the factor that mostly influences medication errors by nurses is managerial practices [19].

Nursing managers are responsible for safe drug administration carried out by nurses. Therefore, the process of controlling and supervising medication management practices would be very effective in preventing medication errors. Managers could also play a role in fostering the culture of patient safety, improving communication between team members, and building teamwork in the wards.

##### 4.5. Workload

The results showed that nurses' workload was a factor that most influenced the incidence of medication errors. This is in accordance with real conditions in the hospital where the ratio of nurses to patients is 1:10-12 on the afternoon and evening

shifts. Furthermore, they were in accordance with the statement that the drug administration errors are caused by excessive workload [7, 14, 20 - 22]. These results indicated that a high workload, insufficient nurses, a large number of patients receiving treatment and increasing work complexity are factors that cause nurses to make errors when administering drugs to patients.

Reducing the workload is very important in decreasing the risk of medication errors by nurses. This is carried out by calculating the balance between the number of nurses and the work they perform. Furthermore, the workload could also be reduced by simplifying their tasks. At the same time, the burden of administering drugs to patients could be reduced by using technology. Several studies recommend the use of technology in drug delivery, as it simplifies the activity, saves time and reduces the nurses' workload. Electronic drug administration reduces the number of tasks related to the drug administration process. Furthermore, the assignments decreased from 61.07 to 29.81. and the time for the medication-related task was reduced from 32 min to 26.57 minutes [23].

#### 4.6. Medication Error

The frequency distribution results of nurses that were categorized as making medication errors were 10.87%. Based on these findings, it is necessary to make efforts in order to prevent and reduce medication errors. Drug administration errors can be prevented by designing a safe health care system [7].

Hospital management should strive continuously to prevent nurses from making errors when administering drugs. They need to be given support in providing medication to patients by making their duties more efficient. Management of information technology-based medication safety systems is necessary to reduce nurses' workload. In addition, the use of technology in the drug administration process can also prevent medication errors by nurses [1, 2, 24 - 27].

Efforts to prevent medication errors could be carried out by increasing knowledge, skills and attitudes, teamwork, awareness of patient safety culture, providing support and guidance for nurses to improve their communication skills [2]. Communication is an important means of ensuring that drug delivery is better and more effective. Meanwhile, poor communication is a common cause of errors. One of the main problems which cause these errors is ineffective communication between patients and health workers [28]. Communication skills are an important tool in interacting with patients to identify drug use problems, medication effects and side effects. It helps to prevent errors in drug administration [29].

Improvement in communication skills can be made through the following maneuvers: each team member has to understand their respective roles, two-way communication between nurses and doctors, use of simple, precise and clear language, a combination of verbal and written communication, utilize familiar abbreviations, as well as visual aids.

The study recommended that information technology

should be formulated to stipulate in clinical facilities [30, 31]. The use of information technology is also effective in improving patient safety and could be used as a way of reducing the number of medication errors. The research recommended that the use of integrated health information technology, including a computerized drug administration system has an enormous potential of reducing medication errors. Furthermore, medication errors could be reduced by using electronic drug management. The research stated that using an electronic drug delivery system significantly improves patient safety by reducing drug administration errors. Another study involving 2835 and 2621 treatment processes before and after the intervention stated that electronic drug administration could reduce medication errors from 48% to 36.9% and the error timing of drug administration from 31.6% to 30.2% [1, 2, 24, 27].

#### CONCLUSION

Factors that affected the incidence of medication errors by nurses in the hospital room are work experience, motivation, workload and environment. These factors need the attention of the nursing manager for medication error management and control in the hospital. The variable that majorly influences the incidence of medication errors was the workload of nurses. These results can be used as a reference for managers to carry out more efficient nursing services.

The recommendation for this research is to continue the control and prevention of medication errors. Drug administration services to patients should be made more efficient to reduce the workload of nurses. Other efforts include creating orientation and preceptorship programs, increasing work motivation, considering and reassessing the workload of nurses, as well as conducting ongoing research on efforts to prevent technology-based medication errors. Information technology in the drug administration process can be used as a solution for preventing and reducing the incidence of these errors. Furthermore, the nursing service management should be committed to reducing the workload of nurses, by simplifying tasks and involving technology to make their work more efficient.

#### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study has been approved by the Faculty of Nursing, University of Indonesia, with approval number SK-247/UN2.F12. D1.2.1/ ETIK 2020.

#### HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

#### CONSENT FOR PUBLICATION

Informed consent was obtained from all study participants.

**STANDARDS OF REPORTING**

STROBE guidelines and methodologies were followed.

**AVAILABILITY OF DATA AND MATERIALS**

Not applicable.

**FUNDING**

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**CONFLICT OF INTEREST**

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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