

OVERVIEW OF MEDICATION ERROR INCIDENCE IN HOSPITALS IN VARIOUS COUNTRIES: LITERATURE REVIEW

Gambaran Kejadian Kesalahan Pengobatan pada Rumah Sakit di Berbagai Negara: Tinjauan Pustaka

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Abstract

Background: Medication error is one of the most common types of errors contributing to patient safety incidents in hospitals. In addition to their numerous cases and high costs, medication errors also contribute to deaths in various countries.

Aims: This study describes the incidence of medication errors in hospitals in various countries, determines the phase of errors that occurred the most, and describes preventive strategies for medication errors in hospitals.

Methods: This study was conducted between April 2021-July 2021 using the literature review method. Data were retrieved from ProQuest, ScienceDirect, PubMed, GoogleScholar and Garuda RistekBRIN. The data are generalized and extracted in a table based on the incidence of medication errors and preventive strategies.

Results: Of the eleven included studies, the incidence of medication errors in one study conducted in Nigeria was the highest (80%). Four of the eleven studies were conducted in India with varying incidence rates. Most errors occurred during the prescribing stage. The number of reports and the number of events actually have no relevance. It can be said that countries with a high number of reporting have good reporting indicators. Strategies for preventing medication errors include the implementation of an information system in the CPOE (Computerized Physician Order Entry) form and providing training for staff.

Conclusion: The difference in the incidence of medication errors in developing and developed economies can be attributed to factors in the healthcare system and the lower prescribing ratio and nurse ratio in developing countries.

Keywords: literature review, medication errors, patient safety

Abstrak

Latar Belakang: Kesalahan pengobatan merupakan salah satu jenis kesalahan yang paling sering terjadi yang merupakan faktor pemicu terjadinya insiden keselamatan pasien di rumah sakit. Selain jumlah kasus dan biaya yang tinggi, kesalahan pengobatan juga berkontribusi terhadap kematian di berbagai negara.

Tujuan: Penelitian ini menggambarkan kejadian kesalahan pengobatan pada rumah sakit di berbagai negara, menentukan fase kesalahan yang paling banyak terjadi dan mendeskripsikan strategi pencegahan untuk mencegah kesalahan pengobatan di rumah sakit.

Metode: Penelitian ini dilakukan pada bulan April 2021-Juli 2021 dengan menggunakan metode literature review dan menggunakan data dari ProQuest, ScienceDirect, PubMed, GoogleScholar dan Garuda RistekBRIN. Data digeneralisasi dan diekstraksi dalam tabel berdasarkan kejadian kesalahan pengobatan dan strategi pencegahan untuk mencegahnya.

Hasil: Berdasarkan sebelas studi terinklusi, kejadian kesalahan pengobatan dalam satu studi yang dilakukan di Nigeria adalah yang tertinggi (80%), empat dari sebelas studi adalah studi yang dilakukan di India dengan angka kejadian yang bervariasi. Kesalahan yang paling sering terjadi yaitu pada tahap peresepan. Pelaporan kesalahan pengobatan oleh suatu negara merupakan pelaporan sukarela. Sebagian besar kesalahan terjadi selama proses peresepan. Jumlah laporan dan jumlah kejadian sebenarnya tidak ada relevansinya. Strategi pencegahan yang dapat dilakukan untuk mencegah kesalahan pengobatan adalah dengan menerapkan sistem informasi berupa Computerized Physician Order Entry (CPOE) dan memberikan pelatihan kepada staf.

Kesimpulan: Perbedaan angka kejadian kesalahan pengobatan di negara dengan ekonomi berkembang dan ekonomi maju dapat disebabkan faktor sistem pelayanan kesehatan serta rasio peresepan dan rasio perawat yang lebih rendah di negara dengan ekonomi berkembang.

Kata kunci: kesalahan pengobatan, keselamatan pasien, tinjauan pustaka



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Introduction

Hospitals are among the health facilities with strategic roles in improving the health status of the community; therefore, hospitals are required to prioritize patient safety. Patient safety is one of the dimensions of quality in the hospital's minimum service standards. Patient safety is implemented in a system that makes patient care safer through risk assessment, identification, patient risk management, and implementation of solutions to minimize risk and injury to patients.

In the 10 facts regarding patient safety from the World Health Organization (WHO), it is stated that, in developing countries, one in ten patients treated in hospitals are at risk of medication errors and adverse events (WHO, 2019). Medication error is a universal problem that occurs in many countries, and is one of the most common types of medical errors (Alsulami, Conroy and Choonara, 2013). This is also the single most common preventable cause of adverse drug events (Fleming, 2009). The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) defines medication errors as any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer. Such events may be related to professional practice, healthcare products, procedures, and systems, including prescribing, order communication, product labelling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use (Gallagher and Melnyk, 2020). Medication error is divided into four categories: prescribing error, administration error, transcribing error and dispensing error.

About 0.1 million people die each year from medical errors that occur in hospitals and the mortality rate from medication errors is higher than injuries in the workplace (Gallagher and Melnyk, 2020). Studies in the United States estimate that medication errors can cause as many as 251,000 deaths each year,

making medication errors the third leading cause of death (Anderson and Abrahamson, 2017). Further research in England found that there were 237 million medication errors resulting in 1,708 deaths and an increase in length of stay (Elliott *et al.*, 2019). Johns Hopkins Medicine researchers estimated that, from 2013, based on a total of 35,416,020 hospitalizations, 251,454 deaths from medication errors occurred, which translates to 9.5% of all deaths each year in the United States (Johns Hopkins Medicine, 2016).

Globally, the costs associated with medication errors are estimated at USD 42 billion per year (Aitken and Gorokhovich, 2012). The financial costs associated with this error include length of stay, readmissions, patient death, post discharge disability, and patient emotional distress. A study conducted by (Elliott *et al.*, 2019) in England found that the incidence of medication errors costs 98.5 million euros annually.

Regulations by the Indonesian Ministry of Health regarding the standard of pharmaceutical services in hospitals state that medication errors are events that harm patients which can actually be prevented. Hard work is needed to prevent and reduce the occurrence of these medication errors.

Method

This study utilized a research design with a literature review method. The systematic process carried out in this study refers to (Snyder, 2019) and is divided into four stages. Data were collected from several online databases such as ProQuest, ScienceDirect, PubMed, Google Scholar, and Garuda RistekBRIN with publications between 2011 and 2021. This study was conducted based on the inclusion and exclusion criteria that were set, with the first identification based on the relevance of the title, abstract, and research objectives. In the analysis, the data were extracted in the form of a table that generalizes each study reviewed. The table includes the author's name, year of publication, country, research methods,

and study results. The last step was compiling, analyzing, and writing the results of the literature review.

Results and Discussion

Figure 1 shows 315,998 articles were collected and identified, but only 54 of them were full text. Finally, 11 relevant articles that met the criteria and research focus were included for review. All these included articles identified the prevalence of medication errors at hospitals and described preventive strategies for medication errors in hospitals.

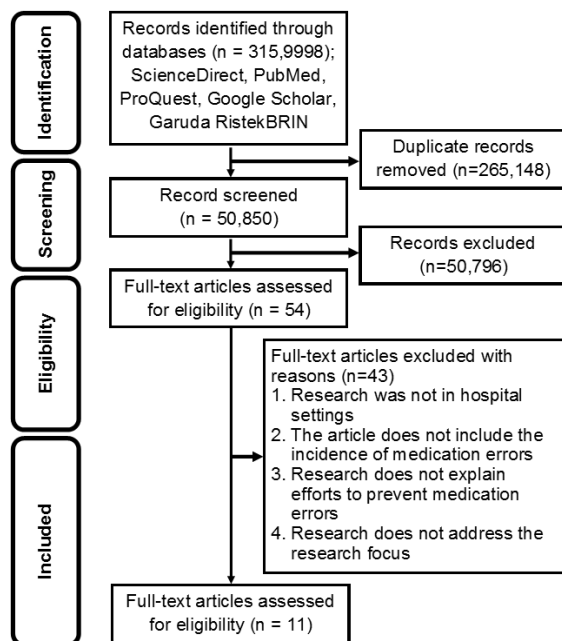


Figure 1. Study search and selection flow

Study search results were grouped into several characteristics. Based on regional characteristics, it was found that the most studies were conducted in Asia with nine studies, and four studies were conducted in hospitals in India. Grouping was also carried out by dividing studies into those in developed and developing countries based on the Guidelines for The World Economic Situation and Prospect As Of Mid-2020 (United Nations, 2020), with most studies conducted in developing economies (n=10). Based on the year of publication, it was found that most studies were in the last five years (2016 to 2021), with a total of eight studies. Meanwhile,

based on the characteristics of the type of study, it was found that qualitative type studies were the most common (n=7).

The percentage medication errors incidence in hospitals for eleven countries included studies was identified (Table 1). Each incident rate is a percentage of the number of different admissions or prescription in each hospital. The largest percentage was code A4, which represents hospitals in Nigeria (87.3%) with 89 medication errors of 102 prescriptions. The next largest percentage of medication error was found in A11 or Iran (74%) from 688 prescriptions. This was followed by A2, Uganda (71%) with 78 medication errors of 110 examined prescriptions. The next percentages came from A3 (65.6%), A9 (56%), and A5 (47.3%) in India with different total number of medication errors. Article A10 in Indonesia followed the result, and 1,563 out of 7,662 medication errors (20.4%) were found in A6 or Japan (514 out of 3,459 medication errors) (14.9%), and finally A1 or India (6.1%).

From several studies conducted in developing and developed economies, developing countries were found to have the most studies. India made up the largest portion of these with four of the eleven studies on the incidence of medication errors in hospitals. A total of four studies had backgrounds in different types of hospitals, including private hospitals and government hospitals. There were differences in incidence rates due to the characteristics of different types of hospitals and their workloads. This finding is in line with that published by Mailman School of Public Health (2021) that the healthcare system in India is universal. There is huge variety in the quality and coverage of medical care in India. Health services between states and rural areas can be very different.

In a smaller area, compared to rural residents, urban residents are more likely to experience medication errors in developing countries. A study based on the results of research conducted by Dorothy (2021) in Uganda found that this was because city residents preferred to take outpatient treatment, thereby reducing patient monitoring compared to inpatients. The

education factor of the population in developing countries is also said to have an effect on the incidence of medication errors. In the same study, it was explained that patients with secondary education were more likely to experience medication errors due to the inability to understand treatment instructions and health education.

Prescribing Errors

The prescribing error phase is a common cause of morbidity and mortality both in community practice and in hospitals. A total of 11 included studies found that the incidence of medication errors in several countries showed that all studies found errors in the prescribing phase. Although the incidence varied, in the treatment process, patients were always found to have errors before prescribing. The percentages of events in the prescribing error phase were found to be 6.5% (Ernawati, Lee and Hughes, 2014), 13%

(Dake and Ramana, 2020), 16% (Salmasi *et al.*, 2015), 26.5% (Umoh and Opue, 2021), 32.6% (Kandasamy *et al.*, 2021), 42.3% (Dorothy, 2021), 52.8% (Moudgil *et al.*, 2021), 56.8% (Eslami *et al.*, 2019), 61.8% (Alsulami, Conroy and Choonara, 2013), 64.1% (Noguchi *et al.*, 2016), and 82.8% (Yadhukrishnan *et al.*, 2020).

The types of errors that most often occurred in the prescribing process were errors related to dose/ strength (wrong dose), wrong drug, and omission error. Two of the eleven studies found that drugs belonging to the look alike sound alike (LASA) category were most prone to medication errors (Moudgil *et al.*, 2021; Kandasamy *et al.*, 2021). Drugs that fall into the LASA category include drugs that are visually similar in physical appearance or packaging and drug names that have similar spelling and/ or phonetics (Bryan *et al.*, 2021).

Table 1. Percentage of Medication Errors Occurrence

	Prescribing Error (%)	Transcribing Error (%)	Dispensing Error (%)	Administration Error (%)	Others (%)
A1: India (Dake and Ramana, 2020)	13	54	-	33	-
A2: Uganda (Dorothy, 2021)	42.3	11.5	9	37.2	-
A3: India (Kandasamy <i>et al.</i> , 2021)	32.6	-	37.8	-	-
A4: Nigeria (Umoh and Opue, 2021)	26.5	-	32.5	37.8	3.2
A5: India (Yadhukrishnan <i>et al.</i> , 2020)	82.8	-	17.2	-	-
A6: Japan (Noguchi <i>et al.</i> , 2016)	64.1	0.7	2.4	14.1	18.7
A7: Southeast Asia (Salmasi <i>et al.</i> , 2015)	16	11	11	43	19
A8: Middle East Countries (Alsulami, Conroy and Choonara, 2013)	61.8	5.8	-	32.4	-
A9: India (Moudgil <i>et al.</i> , 2021)	52.8	7.7	-	20.75	20.75
A10: Indonesia (Ernawati, Lee and Hughes, 2014)	6.5	14.7	14.4	59.3	5.1
A11: Iran (Eslami <i>et al.</i> , 2019)	56.8	-	-	43.2	-

Errors in the prescribing process can be related to the competence of officers in writing prescriptions. This competency is related to the process of writing a drug name or dose and whether it can be read by the officer who will then copy the prescription. Poor handwriting or illegible handwriting is also the cause of prescribing errors. Five out of eleven articles found that handwritten prescriptions were at risk of being illegible and/or incomplete in prescribing causing medication errors in the prescribing phase (Eslami *et al.*, 2019; Yadhukrishnan *et al.*, 2020; Moudgil *et al.*, 2021; Dorothy, 2021; Kandasamy *et al.*, 2021).

Administration Errors

Administration error is defined as any discrepancy between the drug given to the patient and the drug order from the doctor's prescription. Nine of the eleven articles found that medication errors occurred in the administration phase with varying percentages. The most common types of errors are omission of dose, wrong drug, and wrong dose. One of the studies that discusses the types of events in the administration phase found that administration errors occurred mostly during the night shift (Alsulami, Conroy and Choonara, 2013). This finding is in line with the results of two other studies regarding errors at the administrative stage caused by high workloads due to the limited number of staff (Ernawati, Lee and Hughes, 2014; Salmasi *et al.*, 2015). In general, the incidence of medication errors at the administrative stage tended to be higher during the night shift when compared to the incidence of medication errors during the day.

Transcribing Errors

Seven of the eleven articles found transcription errors in the treatment of patients in various hospitals with varying percentages of incidence. A transcription error is defined as any deviation in the process of copying a drug order from the previous step. A transcribing error is a specific type of medication error caused by data entry errors commonly performed by

human operators (Salmasi *et al.*, 2015). Errors in the transcription process were caused by staff negligence (omission) such as entering drugs that were not actually necessary and not entering the required drugs. Such incidents may result from staff multitasking and/or due to the inexperience of new staff (Ernawati, Lee and Hughes, 2014; Noguchi *et al.*, 2016; Dake and Ramana, 2020; Moudgil *et al.*, 2021; Dorothy, 2021).

Dispensing Errors

Dispensing error or drug dispensing error occurs when the drug issued by the pharmacy does not match the order written in the doctor's prescription. Dispensing error was the rarest type of error found in this literature review. This finding is in line with the results of Dorothy (2021) study which also found that drug dispensing errors had the smallest prevalence. The lack of errors in the drug dispensing process is due to the fact that most of the medicines were distributed by trained pharmacists who often double checked before giving the medicine in order to reduce the risk of errors.

Types of errors related to drug strength or dose errors were the most common types of errors. Two of the seven studies that found this error were of the opinion that dispensing errors were caused by a large number of prescriptions, storage problems, limited number of pharmacists, and insufficient staff (Yadhukrishnan *et al.*, 2020; Kandasamy *et al.*, 2021). Pharmacists have an important role in the patient's treatment process, especially in the process of dispensing drugs. Several studies have found that the involvement of clinical pharmacists is proven to be able to improve prescribing practices, improve patient medication monitoring, and be able to reduce medication errors risking adverse drug events by up to 78% (Ernawati, Lee and Hughes, 2014; Salmasi *et al.*, 2015; Yadhukrishnan *et al.*, 2020; Moudgil *et al.*, 2021).

Preventive Strategies Implementing Information Systems

Based on the findings in the eleven included articles, efforts or strategies to prevent medication errors in hospitals were grouped into six categories (n=35). Implementing information systems in the patient's treatment process was the most recommended strategy. One of the commonly used information systems is electronic prescribing known as CPOE (Computerized Physician Order Entry). CPOE is defined as a computerized system that provides various common features to automatically record the process of entering instructions regarding patient-handling by doctors electronically, and ensures orders are standardized, legible, and complete (Khanna and Yen, 2014).

Six of the eleven included studies argue that CPOE or electronic prescribing can substantially reduce the frequency of medication errors in healthcare settings and has the potential to prevent other technical errors (Alsulami, Conroy and Choonara, 2013; Ernawati, Lee and Hughes, 2014; Noguchi *et al.*, 2016; Eslami *et al.*, 2019; Dorothy, 2021; Kandasamy *et al.*, 2021). Research conducted in hospitals in India found a reduction in hospital medication errors by up to 48% through the use of CPOE (Kandasamy *et al.*, 2021). Another study conducted at a hospital in Japan resulted in a reduction in the number of medication errors by 81% using CPOE (Noguchi *et al.*, 2016).

The implementation of CPOE in developing countries with poor healthcare systems still seems to be undervalued (Dorothy, 2021). This is further explained by Ernawati, Lee and Hughes (2014) who stated that CPOE requires expensive information, technology maintenance, and healthcare providers with adequate computer-operating skills to be able to utilize the system effectively. The need for maintenance with a large nominal can be an obstacle for hospitals in adopting this system in their health services.

In the *ABC of Patient Safety*, Sandars and Cook (2007) state that latent failures that can lead to errors include inadequate training, existing procedures not working properly, low standard quality, poor or inadequate technology, unrealistic time

pressure, and staff shortages. The application of CPOE as an information and technology system may be able to prevent latent errors that can be caused by inadequate technology. CPOE is the prevention of active failure on sharp edges. Active failures caused by human negligence factors such as illegal handwriting and drug errors categorized as LASA may be prevented by the presence of CPOE in the barrier layer. It is an advantage that the computer will not feel bored or tired of repetitive tasks, which is the ideal condition for humans to make mistakes.

Staff Training

Seven of the eleven articles included were of the opinion that medication errors could occur due to staff's lack of knowledge regarding medication safety. This knowledge is not only limited to knowledge related to the patient's treatment process, but also knowledge about how to communicate as well as skills and experiences. In terms of training, clinical pharmacists can play a role in leading the training program because they have been shown to have a significant effect on reducing the occurrence of medication errors (Ernawati, Lee and Hughes, 2014; Salmasi *et al.*, 2015). Clinical pharmacists are considered to have extensive knowledge about patient treatment and are specially trained in the therapeutic process and are in the best position to detect and make improvements related to medication errors.

In the Swiss Cheese Model approach, training efforts on staff is a strategy against latent conditions of 'inadequate training'. Providing quality training and refresher knowledge for staff will prevent the emergence of latent failure holes. This effort is certainly in order to prevent the occurrence of active failure at the sharp end and improve patient safety. Staff training can be provided by the hospital management for staff to enhance their knowledge and skills, which are key determinants for effective and efficient professional practice.

The resource that plays the biggest role in the patient's treatment process is

human resources. Efforts to prevent the occurrence of medication errors that are considered efficient can be implemented in hospitals in Indonesia, one of which is by training staff. Training is considered capable of improving skills, attitudes, and knowledge about safe prescribing practices. These three things can also shape the staff to be competent. Adequate numbers of competent staff will be able to reduce the possibility of medication errors related to correcting each other's work and verifying before the medication is given to the patient.

Conclusion

The literature review was carried out through search of studies sourced from five databases with publication years ranging from 2011 to 2021. A total of 11 included articles were collected from India, Uganda, Nigeria, Japan, Southeast Asia, the Middle East, Indonesia, and Iran.

Medication errors with the largest percentage occurred in hospitals in Nigeria (87.25%), Iran (73.98%), Uganda (70.90%), India (65.60%; 56.03%; 47.32%), Indonesia (20.40%), Japan (14.90%), and India (6.10%). The difference in the incidence of medication errors in developing and developed economies could be due to factors in the healthcare system and the lower prescribing and nurse ratio in developing countries. Indicators reporting of medication errors by a country is voluntarily reported. The number of reports and the number of events actually have no relevance. It can be said that countries with a high number of reporting have good reporting indicators. The phases with the highest number of errors occurred in the order of prescribing, administration, transcribing, and dispensing. The preventive strategy most widely recommended was implementing an information system in the form of CPOE and staff training.

Abbreviations

CPOE: Computerized Physician Order Entry; LASA: Look Alike Sound Alike;

NCC MERP: National Coordinating Council for Medication Error Reporting and Prevention; WHO: World Health Organization

Declarations

Ethics Approval and Consent Participant
Not applicable.

Conflict of Interest

The authors declare that there was no significant competing financial, professional, or personal interests that might have affected the study.

Availability of Data and Materials

Data and material research can be accessed at open data repositories (ProQuest, ScienceDirect, PubMed, GoogleScholar, and Garuda RistekBRIN) or upon request.

Authors' Contribution

Developed study's concept and methodology (AEA, MB); review and evaluate (MB); wrote and created original manuscript draft (AEA).

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