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NARRATIVE REVIEW: INCIDENCE, CAUSES AND INTERVENTION STRATEGIES OF MEDICATION ERRORS TO IMPROVE CHEMOTHERAPY SERVICES IN HOSPITALS

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ABSTRACT

Medication errors (MEs) are medication errors that have the potential to harm patients during treatment or care. Cancer care is a complex and interconnected system and many errors can be catastrophic. ME in antineoplastic drugs have the potential to cause permanent injury and even death. Evaluation measures of ME incidence in Indonesia are still not optimally carried out, thus leading to the need for a good understanding of the potential ME incidence, especially in cancer patient care. A good understanding of the incidence of *medication errors* will encourage preventive efforts against the potential occurrence of ME. This *narrative review* aims to provide information related to the incidence of ME in the Chemotherapy department at the hospital, the causative factors, and the handling and prevention efforts. Scientific information searches were conducted on the PubMed and Google Scholar databases for the period 2012-2022. The results showed that theincidence of ME mostly occurred in the prescription phase, namely in the form of dosage errors (45–59.3%), incomplete prescriptions (43–45.5%), drug frequency errors (30.4%), and errors in patient name, age, and diagnosis data (22.5%). Several aspects contributing to the occurrence of ME were identified, including work procedures, staff, organizational systems, and staff understanding of medication regimens. This study concluded that there is a need to regulate and evaluate several aspects, including work procedures, availability of auxiliary systems, and increasing the capacity of human resources involved. This may prevent the occurrence of ME.

Keywords: Medication Error, Incidence of Medication Error, Causes of Medication Error, Chemotherapy

INTRODUCTION

A 1999 report from the IOM (Institute of Medicine) stated that in 1 year as many as 44,000–98,000 patients in hospitals die due to medical and medication errors (Ministry of Health of the Republic of Indonesia, 2008). In the2007 PERSI Congress National Map of Patient Safety Incidents Report, medication errorsranked first (24.8%) among the top 10 reported incidents (Ministry of Health of the Republic of Indonesia, 2008). Whereas in Permenkes Number 129 of 2008 concerning at Minimum Service Standards, the hospital requires that the standard for the absence of drug administration errors must be 100% or 0% error (zero defect). To reduce the occurrence of medication errors, the World Accreditation Body or Joint Commission on Accreditation of Healthcare Organizations (JCAHO) requires patient safety activities in the form of identification and evaluation to reduce the risk of

injury and loss to patients, employees, visitors, and organizations (Ministry of Health of the Republic of Indonesia, 2008).

Antineoplastic drugs are potentially dangerous and their misuse can lead to permanent injury and even death (Mattsson et al., 2015). Cancer care is a complex and interconnected system; therefore, errors can be catastrophic (Weingart et al. 2018). Medication errors (MEs) in oncology have been in the public eye since the sentinel event that led to Lehman's (1994) death at Boston's Dana-Farber Cancer Institute (Weingart et al., 2018). Cancer patients are at a high risk of harm when medication errors occur for many reasons, including (1) the physiological reserve of cancer patients may be compromised by the nature of the disease and its effects on vital organs, immune function, and functional status. (2) many antineoplastic therapies are toxic and have a narrow therapeutic index. (3) therapies require dose adjustments and precise monitoring of laboratory parameters (4) treatments carried out over the long term by interprofessional care teams, possibly working in different clinical settings, which increases the risk of miscommunication (Weingart et al., 2018).

Although the incidence of ME has been widely reported, the evaluation of medication errors has still not been optimized in Indonesia. This leads to the need for a good understanding of the potential for medication errors, especially in the care of patients with cancer. A good understanding of the incidence of medication errors will encourage efforts to mitigate their potential for medication errors. On this basis, this study aimed to provide information related to the incidence, causative factors, and strategies for handling and preventing ME in hospital services. This review article is expected to provide scientific information supporting the improvement of services in the chemotherapy departments of hospitals.

RESEARCH METHOD

This narrative literature review was conducted by collecting various research articles from electronic databases through PubMed and Google Scholar for the period 2012-2022. Articles were selected using keywords in PubMed, namely "Factor/Factors." "Medication errors," and "Chemotherapy," as well as keywords on Google Scholar namely "causal factors," "medication errors," "medication errors," and "chemotherapy." Articles selected as data sources were articles that analyzed causal factors or factors that influence the occurrence of medication errors in chemotherapy services, with publication years 2017-2022. Articles obtained in accordance with the criteria were described in a narrative form.

RESULTS AND DISCUSSION

Definition And Categories Of *Medication Error* (Me)

MEs are adverse patient events that result from the use of medicines while in the care of a health professional that could have been prevented (Indonesian Minister of Health, 2014; National Coordination Council for Medication Error Reporting and Prevention, 2016). Such events can be related to professional practices, healthcare products, procedures, and systems, including prescribing, order communication, product labeling, packaging and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and monitoring (National Coordination Council for Medication Error Reporting and Prevention, 2016). Medication errors are grouped into 4 levels, with several categories at each level (National Coordination Council for Medication Error Reporting and Prevention, 2016). ME level categories can be seen in Table I.

Table I. Medication error categories (National Coordination Council for Medication Error Reporting and Prevention, 2016)

Category	Description	Error Level
A	State or events that potentially cause errors	**No Error**
B	Error occurred, but did not reach the patient	**Error – No Harm**
C	The error occurred and reached the patient, but did not causeany harm to the patient. - The medicine has reached the patient and has been administered. - The medicine has reached the patient and has not been administered.	
D	Errors occur and patient monitoring is required, but noharm is done to t h e patient.	
E	The error occurred and contributed to or resulted in temporaryharm to the patient and required intervention	**Error - Harm**
F	The error occurred and contributed to or resulted in temporary harm to the patient and required treatment or extended care in the hospital	
G	The error occurred and contributed to or resulted in permanent harm to the patient	
H	Error occurred and almost caused the death of the patient	
I	Errors occur and contribute to or causedeath in patients	**Error – Death**

Types Of Events And Causes Of ME

Based on the phase of its occurrence, ME is divided into several phases, including prescribing, transcribing, dispensing, and administration (Cohen, 1999; World Health Organization, 2016).

ME in hospitals generally occur during these phases. ME in the prescribing phase or errors during prescription writing involve prescription writers, namely doctors, forms of occurrence such as illegible prescriptions, incomplete instructions, incorrect dose calculations, and contraindications (Cohen, 1999). ME in the Transcribing phase or errors when reading a prescription or translation in the form of incorrect reading, there are instructions that are missed or not done, or misinterpreting instructions, while the dispensing phase includes mislabeling, miswriting instructions or unclear instructions, and poor drug preparation (Cohen, 1999). Both phases involved pharmacists and pharmacist assistants. The administration phase usually involves pharmacists and pharmacist assistants to nurses with forms of ME in the form of giving the wrong drug, the wrong patient, the wrong dose of administration, and missed drugs given (Cohen, 1999).

MEs in chemotherapy are often caused by incomplete prescription (Gloria et al., 2017). Several studies have identified the incidence of ME in hospital chemotherapy departments and possible contributing factors (Table II).

Table II. Research studies on Medication errors in chemotherapy services in hospitals

No.	Researcher	Location	Method	ME Incidences	ME causes
1.	(Fyhr & Akselsson, 2012)	Sweden	Qualitative Retrospective. Total sampling: all national error reporting cases from 1996 - 2008.	There were 60 cases reported and analyzed. 42% of errors occurred during prescribing by doctors, 42% during drug preparation by pharmacists, and 16% during preparation and administration by nurses. The most common types of errors were wrong dose (45%) and wrong drug (30%).	Not analyzed.
2.	(Ranchon et al., 2012)	University Hospitals in France	Cross-sectional study. Total sampling: all antineoplastic prescriptions from June 2006 to May 2008.	There were 17,150 chemotherapy prescriptions for 2423 patients. 540 prescriptions contained errors (3.15%): (59.3%) dose-related, (43%) incomplete prescription, and (3.7%) regimen selection.	Potential risk factors: 1) Patient (LPT), 2) Regimen (protocol contains >3 injectable antineoplastics, carboplatin, modifications present), and 3) Organization (resident prescription, medical oncology ward, inpatient unit).
3.	(Mathaiyyan et al., 2015)	Regional Cancer Center - Tertiary Hospital, South India	Cross-sectional study. Total sampling: outpatient chemotherapy prescriptions from June-September 2013.	There were 4253 prescribing errors out of 1500 prescriptions (283.5%). Errors in name, age, diagnosis (47.1%), brand name errors (22.5%),	High patient load, and lack of attention from the prescriber.

				premedication and anticancer abbreviations (29.5%). Potentially dangerous errors resulting in serious consequences for patients were 11.7%.	
4.	(Mathaiyyan et al., 2016)	Regional Cancer Center - Tertiary Hospital, South India	Cross-sectional study using direct observation and chart review. Total sampling was 500 patients during June-August 2013.	A total of 500 patients were observed to have (41.5%) medication errors, among the total errors observed (54.8%) were prescription writing errors, (24.5%) transcribing errors and (20.7%) administration or dispensing errors. Prescribing errors were dominated by missing information on the prescription (45.5%).	High patient load and lack of attention to ensure completeness in prescription writing by doctors. The large workload of nurses. Lack of attention from health workers on duty, and lack of socialization in handling potentially dangerous patients.
5.	(Dorothy et al., 2021)	Mbarara Regional Referral Hospital, Southwest Uganda	110 participants: adults and children undergoing chemotherapy. Conducted for 5 months: January - May 2020. Checklists were used to collect patient, medication, and disease information to identify prescription,	Of the 110 participants, 52 (47.3%) experienced a total of 78 medication errors. Of these, 33 (42.31%) were prescribing errors, 29 (37.18%) were administration errors, 9 (11.54%) were transcription errors, and 7 (8.97%) were	Prescribing errors can result from a lack of oncologists to oversee the prescribing process, lack of up-to-date cancer-specific treatment protocols, lack of ongoing training for prescribers.

			transcription, dispensing, and administration errors.	dispensing errors. Prescribing errors were dominated by dosage errors (54.5%) and frequency errors (30.4%).	
6.	(Gloria et al., 2017)	Mohammad Hoesin Hospital Palembang, Indonesia	Cross-sectional study. With the population: chemotherapy prescriptions, doctors and pharmaceutical technicians for the period May-June 2017. Sampling by purposive sampling with a total sample size of 792 prescriptions, and 58 doctors and 55 pharmaceutical technicians. Data were analyzed using chi square test and binary logistic regression analysis.	Prescriptions with ME were 107 (13.5%) out of a total of 792 prescriptions, consisting of 9.1% Prescribing Error and 4.4% Dispensing Error. 52 people (46%) out of 113 samples of staff studied influenced the occurrence of ME, consisting of 35 doctors in Prescribing Error and 17 Pharmaceutical Technicians Dispensing Error.	The results of the analysis showed that the influential variables were workload (p-value = 0.027), officer education (p-value = 0.006) and officer gender (p-value = 0.003). Work experience (p-value 0.0001) and work schedule (p-value 0.0001), and communication (p-value 0.002) became confounding factors in this study.

The results of the study showed uniform values; namely, the incidence of ME in chemotherapy mostly occurred in the prescribing error phase or errors when writing prescriptions. Most errors in the prescription phase were in the form of dosage errors, incomplete prescriptions, drug frequency errors, and errors in patient name, age, and diagnosis. Of the total sample, 60.3% were involved in prescription errors. The second most common occurrence of ME was transcribing errors or errors in reading or translating prescriptions and dispensing errors or errors in the preparation of prescriptions by pharmacy staff. Of.9 of pharmacy technicians, 30.9% were involved in dispensing errors. In addition to these three types of errors, there were administration errors or errors during the delivery/use of drugs by patients involving nurses. Based on these 6 studies, it can be seen that there is still a high incidence of ME that occurs in Hospital Chemotherapy Services, where based on the Minimum Service Standards of the Hospital, there should be 100% or 0% error in drug administration (zero defect) (Manias et al., 2020).

Factors Causing ME

Various types of ME events in chemotherapy services can cause small to large risks, or even life-threatening dangers, if they are too late to overcome. To understand how to handle it so that it can be prevented in the future, it is necessary to know the causes of

various ME events that have occurred in hospitals. The study summary in Table II shows the various types of ME events in chemotherapy services and the causes found in various studies conducted in hospitals in several countries. The data are summarized and categorized according to the related factors in Figure 1.

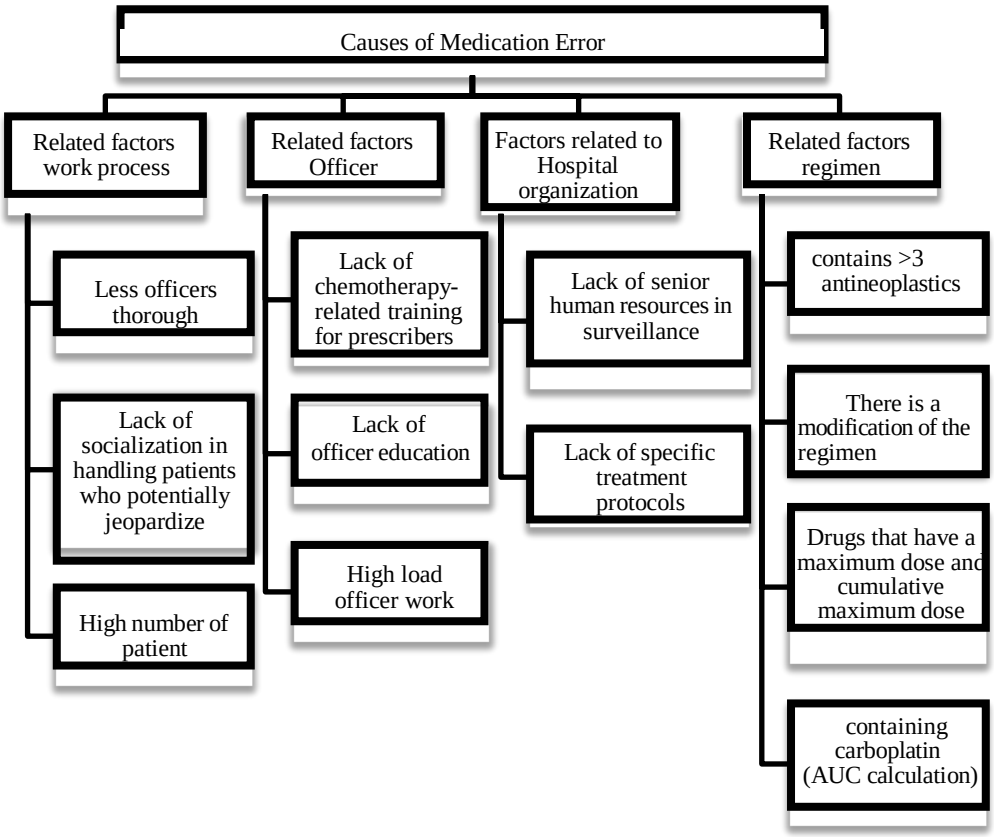

Figure 1. Causes of Medication errors

The work process is closely related to all activities carried out in chemotherapy patient services. The high number of patients that are not balanced with a sufficient number of officers will potentially cause *overload* activities to fatigue officers, and continue to decrease accuracy in the process of work so that there is a high potential for errors. ME is very likely to occur in officers who lack understanding related to chemotherapy, both in terms of formal and non-formal education, but face the reality of a fairly high workload. The role of hospital organizational arrangements is also an important aspect that contributes; if the hospital does not have complete protocols or procedures as a guide for officers at work, along with the lack of senior professionals who carry out supervisory functions, the opportunity for ME to occur is very large. Factors related to diverse regimens are conditions that have a great chance of presenting ME, but at the same time, it is also something that may be difficult to condition because the variety of patient conditions will result in a variety of regimen variations to maximize treatment. Therefore, regulating the previous three factors is the driving force that can prevent this regimen-related cause of ME.

Intervention Strategy

ME prevention efforts are important to understand and implement to maintain service quality for patient safety (World Health Organization, 2016).

Table III. Medication Error Intervention Strategy

Causes of ME	Intervention Strategy
Officers are less thorough Less socialization in handling potentially dange rous patients High number of patients Lack of training related to chemotherapyfor prescription writers Lack of officer education	Organize chemotherapy training for doctors and training for officers in accordance with their work fields. Organize training or joint meetings to improve communication and cohesiveness across multidisciplines. Highlighting areas of frequent errors and increasing vigilance.
High workload of officers Lack of senior human resources in supervision Lack of specific treatment protocols	HR and task management improved. Standard protocols and procedures are completed, socialized and evaluated regularly to maintain quality process and performance of all officers.
contains >3 antineoplastics There is a modification of the regimen Drugs that have a maximum dose and cumulative maximum dose containing carboplatin (AUC calculation)	Design prescription forms according to needs and convenience. Use a computerized system with standardizedtreatment protocols.

Regular training for health workers in charge of chemotherapy services, improved implementation of SPO or Standard Operating Procedures in each activity, and organization of routine evaluation and monitoring are actions that are considered to reduce the incidence of ME in chemotherapy services (Mulatisih et al., 2015). Other efforts, such as the use of electronic prescriptions and implementation of special standards for ordering drugs through computer data input, have shown effective results in reducing ME (Handayani, 2017).

CONCLUSION

The number of MEs in chemotherapy services in the hospital that occurred most frequently was in the prescribing error phase or prescription writing errors, followed by transcribing errors or errors in reading or translating prescriptions, and dispensing errors or errors in preparing prescriptions. MEs may occur because of factors such as work processes, staff, hospital organization, and medication regimens. Organizing and evaluating the work process, providing media or auxiliary systems, and developing the quality of human resources (staff).

ME during chemotherapy is a dangerous condition that should be prevented. Identifying the problem of chemotherapy ME is expected to provide an overview of efforts to prevent its occurrence. The slightest ME can affect a patient's recovery and safety if it occurs, as well as being a loss for officers and hospitals. Management of ME from staff to infrastructure is an important component that needs to be considered because it affects the success rate of treatment in patients. Monitoring of each stage of the chemotherapy service process is important. All staff in each process should double-check and be thorough in doing so. Good and adequate event reporting and documentation are essential for evaluation and improvement.

It is difficult to find national reporting data on the incidence of ME in Indonesia. It is hoped that policies related to national ME reporting can be one of the concerns that are considered so that it can be an evaluation for many parties and efforts to improve the quality of treatment and prevent the danger of treatment accidents.

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