Asian Journal of Environmental Research
E-ISSN: 3047-4930
DOI: https://doi.org/10.69930/ajer.v3i3.903
Research Article

ScienceTech. Group

Vol. 3 (3), 2026
Page: 246-258

Management of LASA and HIGH ALERT Medications at Clinic X Lembang

Lutfiyah Shifa Rahayu *, Rida Emelia

Departement of Pharmacy, Faculty of Health, Politeknik Piksi Ganesha, Indonesia
*Email (corresponding author): lutfiyahshifa199@gmail.com

Abstract. *The management of LASA (Look-Alike Sound-Alike) and HIGH ALERT medications is an essential component of pharmaceutical services because it is directly related to patient safety. LASA medications share similarities in name, appearance, or packaging that may lead to medication errors, whereas HIGH ALERT medications carry a high risk of causing serious harm if errors occur during their use. This study aimed to describe the management system of LASA and HIGH ALERT medications at Clinic X Lembang, including aspects of medication storage, labeling, and distribution. The research employed a descriptive method with a qualitative approach, using direct observation and document review. The study was conducted from February to March 2026 with medical and pharmaceutical personnel responsible for medication management as subjects. The results showed that the management of LASA and HIGH ALERT medications at Clinic X Lembang has been implemented adequately. LASA medications were stored using a location-separation system, grouped by dosage form and strength, and managed according to the FIFO (First In, First Out) and FEFO (First Expired, First Out) principles. Labeling practices included special warning stickers and the Tall Man Lettering method to enhance awareness and reduce the risk of medication errors. HIGH ALERT medications, meanwhile, were stored separately in designated areas with warning labels and strict security measures, and the distribution process incorporated a double-check verification system to minimize the risk of medication errors. In conclusion, the management system for LASA and HIGH ALERT medications at Clinic X Lembang supports patient safety efforts; however, improvements in supervision, healthcare personnel training, and continuous evaluation remain necessary to further minimize the potential for medication errors.*

Keywords: *LASA; HIGH ALERT; Medication Management; Patient Safety; Medication Errors*

1. Introduction

Medication storage is an essential component that cannot be separated from all pharmaceutical activities, whether within hospitals or in the community (6). An effective and appropriate storage system is one of the primary factors determining the quality of distributed medications (3). Medication storage serves several purposes, including maintaining drug quality, preventing inappropriate use, ensuring stock availability, and facilitating retrieval and monitoring (1). A standardized, well-functioning storage system is therefore required to achieve these objectives.

LASA (Look-Alike Sound-Alike) and HIGH ALERT medications constitute a group of drugs with a high risk of causing medication errors (12). LASA medications share similarities in name, packaging, or pronunciation that may lead to confusion, whereas HIGH ALERT medications carry a high risk of causing serious injury or even death if used incorrectly (8). Consequently, the management of LASA and HIGH ALERT medications must be a primary

Received: 6 August 2026 / Accepted: 30 August 2026 / Available online: 3 September 2026

concern in the delivery of pharmaceutical services to ensure patient security and safety. Pharmaceutical service is a direct, accountable service to patients concerning the medications provided, aimed at achieving definite outcomes that improve patients' quality of life (6). A patient safety system enables safer patient care and helps prevent injury resulting from errors occurring during the healthcare delivery process (7). Medication administration errors are, in fact, preventable incidents that can nonetheless result in inappropriate drug use or pose risks to patients (9). Such errors may occur at various stages of medication management, from prescribing and preparation through storage and administration (9). LASA (Look-Alike Sound-Alike) medications are drugs that share visual or phonetic similarities — whether in name, packaging, color, or dosage form — resulting in a high risk of mix-ups during the pharmaceutical service process (10).

LASA (Look-Alike Sound-Alike) medications are characterized by similarities in drug names, physical appearance, packaging, or pronunciation, which may increase the risk of medication errors during prescribing, dispensing, storage, and administration. These medications may also be available in multiple dosage forms, further increasing the possibility of confusion if they are not managed appropriately. Several factors may contribute to LASA-related medication errors, including similarities in drug names, illegible prescription writing, adjacent storage of medications with similar names or appearances, insufficient vigilance among healthcare personnel, and the absence of a specific labeling or identification system. Therefore, proper separation, clear labeling, and careful verification are essential strategies for reducing the risk of LASA-related errors. HIGH ALERT medications are drugs that carry a greater risk of causing serious patient harm when an error occurs, particularly errors related to dosage, route, preparation, or administration. These medications commonly have a narrow therapeutic range, require accurate dose calculations, may cause severe adverse effects when used incorrectly, and often require close clinical monitoring.

Medication errors involving HIGH ALERT medications may be influenced by several factors. Human-related factors include fatigue, excessive workload, inadequate knowledge or competence, reduced vigilance, and poor communication among healthcare personnel. Prescribing and documentation factors may include illegible handwriting, inappropriate use of abbreviations or symbols, decimal-point errors, and failure to clearly indicate clinical indications. Packaging and appearance may also contribute to errors when products have similar packaging, confusing labels, or similar dosage forms. In addition, environmental and work-system factors, such as poor lighting, interruptions, distractions, unclear standard operating procedures, and the absence of double-checking practices, may further increase the risk of error. Calculation-related problems, including incorrect unit conversion, errors in dose calculation based on body weight, and inappropriate dilution techniques, are also important contributing factors. Consequently, the safe management of HIGH ALERT medications requires standardized procedures, clear identification, appropriate storage, accurate calculation, effective communication, and consistent double-checking practices. Risk assessment, risk identification and management, incident reporting and analysis, and the implementation of solutions to minimize risk are all components of the patient safety system (4). One important factor that ensures patient safety in healthcare facilities is the monitoring of LASA and HIGH ALERT medications (12). Safer management of LASA and HIGH ALERT medications also contributes to the achievement of Sustainable Development Goal 3 (SDG 3: Good Health and Well-Being), particularly by strengthening patient safety and reducing preventable harm associated with medication errors. Appropriate storage, clear labeling,

separation of high-risk medications, standardized distribution procedures, and consistent double-checking practices can minimize the risk of drug selection, dispensing, and administration errors. These measures support the delivery of safer and higher-quality healthcare services by preventing avoidable adverse drug events and protecting patients from medication-related injury. Therefore, improving the management of LASA and HIGH ALERT medications represents an important component of medication-safety initiatives and contributes to broader efforts to ensure safe, effective, and quality healthcare in line with SDG 3.

2. Methods

2.1. Type and Design of the Study

This study employed a descriptive qualitative approach to systematically describe the management of Look-Alike Sound-Alike (LASA) and HIGH ALERT medications at Clinic X Lembang. The study focused on medication storage, labeling, distribution, and medication-error prevention practices. A qualitative descriptive design was selected because it allowed the researchers to directly examine routine medication-management practices and compare their implementation with the applicable medication-management procedures at the clinic.

2.2. Research Location and Time

The study was conducted at Clinic X Lembang from February to March 2026. Data collection was carried out in the pharmacy service area and other relevant medication-management areas where LASA and HIGH ALERT medications were stored, prepared, distributed, or administered.

2.3. Research Subjects and Objects

The research participants consisted of six healthcare personnel, including one pharmacist, two pharmacy technicians, two nurses, and one physician who were directly involved in the management, dispensing, distribution, or use of LASA and HIGH ALERT medications at Clinic X Lembang.

Participants were selected purposively based on the following inclusion criteria: (1) healthcare personnel who were actively working at Clinic X Lembang during the study period; (2) directly involved in the storage, preparation, labeling, dispensing, distribution, or administration of LASA and HIGH ALERT medications; (3) had worked at the clinic for at least six months and were familiar with the medication-management procedures; and (4) were willing to participate in the study. Personnel who were not directly involved in medication management or were absent during the data-collection period were excluded.

The research object was the system and actual implementation of LASA and HIGH ALERT medication management at Clinic X Lembang, particularly regarding storage, labeling, distribution, double-checking practices, and medication-error prevention.

2.4. Research Variables and Assessment Aspects

The main aspects examined in this study included:

1. Management of LASA and HIGH ALERT medications;
2. Storage procedures for LASA and HIGH ALERT medications;
3. Labeling and identification of LASA and HIGH ALERT medications;
4. Distribution and use of LASA and HIGH ALERT medications; and
5. Medication-safety practices, including double-checking procedures and other measures intended to prevent medication errors.

2.5. Data Collection Techniques

Data were collected through direct observation and document review.

2.5.1. Observation

Direct observations were conducted in the pharmacy and medication-service areas to examine actual practices related to the storage, labeling, preparation, distribution, and handling of LASA and HIGH ALERT medications. Observations were conducted six times over a four-week period, with each observation session lasting approximately 60–90 minutes. The observations were performed on different working days and during different service periods to obtain a more representative description of routine medication-management practices. The observation process focused on several aspects, including the physical separation of LASA medications, placement of HIGH ALERT medications in designated storage areas, use of warning labels or special identification, arrangement of medication shelves, medication preparation and distribution procedures, and implementation of double-checking before medications were dispensed or administered. Observations were recorded using a structured observation checklist and field notes. The checklist was developed based on the clinic's standard operating procedures and commonly applied medication-safety principles for LASA and HIGH ALERT medications. Field notes were used to document additional findings, discrepancies, and contextual information that were not fully captured by the checklist. To minimize the possibility that the results reflected only a single episode of practice, observations were repeated at different times and involved different personnel who were responsible for medication management during the observation periods.

2.5.2. Document Review

Document review was conducted to verify and complement the findings obtained through direct observation. The documents examined included the clinic's standard operating procedures related to medication management and patient safety, the official list of LASA and HIGH ALERT medications, medication-storage procedures, labeling guidelines, medication-distribution records, and available patient-safety or medication-error incident reports. A total of seven relevant documents were reviewed during the study period. Documents were selected based on their direct relevance to LASA and HIGH ALERT medication management and their availability at Clinic X Lembang during February–March 2026. Each document was reviewed using a structured document-review checklist. The review focused on whether written procedures included requirements regarding identification of LASA and HIGH ALERT medications, separation and storage, special warning labels, medication distribution, double-checking procedures, and documentation or reporting of medication errors.

The document-review findings were compared with the results of direct observation to identify consistency or discrepancies between written procedures and actual practice. Triangulation was performed by comparing information obtained from repeated observations, different professional personnel, and relevant clinic documents. Findings that were consistently identified across these data sources were considered to provide stronger evidence of routine medication-management practices at Clinic X Lembang.

The assessment of LASA and HIGH ALERT medication management was conducted using a structured checklist developed from the clinic's standard operating procedures (SOPs), medication-safety principles, and relevant pharmaceutical-service standards. The assessment covered four main domains: storage, labeling, distribution, and double-checking practices. For the storage domain, the indicators included separation of LASA and HIGH ALERT medications from regular medications, appropriate shelf or cabinet placement, availability of designated storage areas, proper arrangement according to medication type and dosage form, and prevention of adjacent placement of medications with similar names or appearances. For the labeling domain, the indicators included the presence of clear and easily identifiable warning labels, consistent use of LASA or HIGH ALERT identification, legibility of labels, and placement of warning signs in locations visible to pharmaceutical personnel. For the distribution domain, the indicators included verification of medication name, strength, dosage form, quantity, prescription details, and patient identity before medications were dispensed or administered. For the double-checking domain, the indicators included independent verification by another healthcare professional for HIGH ALERT medications, confirmation of the correct drug, dose, route, patient, and administration time, and documentation of the checking process when applicable.

Each indicator was categorized as compliant, partially compliant, or non-compliant. A practice was considered compliant when it was consistently implemented in accordance with the written SOP or assessment standard; partially compliant when it was implemented inconsistently or only fulfilled some of the required criteria; and non-compliant when the required procedure was not implemented. The overall term "adequately implemented" was used when most of the assessed indicators were consistently fulfilled and no major patient-safety deficiencies were identified. However, areas that were only partially compliant or non-compliant were reported separately as findings requiring improvement. Data analysis was conducted descriptively through data reduction, categorization, comparison, and interpretation. Observation findings were first organized according to the four assessment domains and then compared with the corresponding written procedures identified through document review. Triangulation was performed by comparing findings from repeated observations, different professional personnel involved in medication management, and relevant clinic documents, including SOPs, medication lists, and available incident reports. Findings were considered more credible when similar patterns were identified across multiple observations and supported by documentary evidence. Any discrepancies between actual practice and written procedures were recorded and interpreted as gaps in implementation rather than being automatically classified as adequate practice.

3. Results and Discussion

3.1. Medication Management Process for LASA and HIGH ALERT Medications

The overall medication management process implemented at Clinic X Lembang is illustrated in Figure 1.

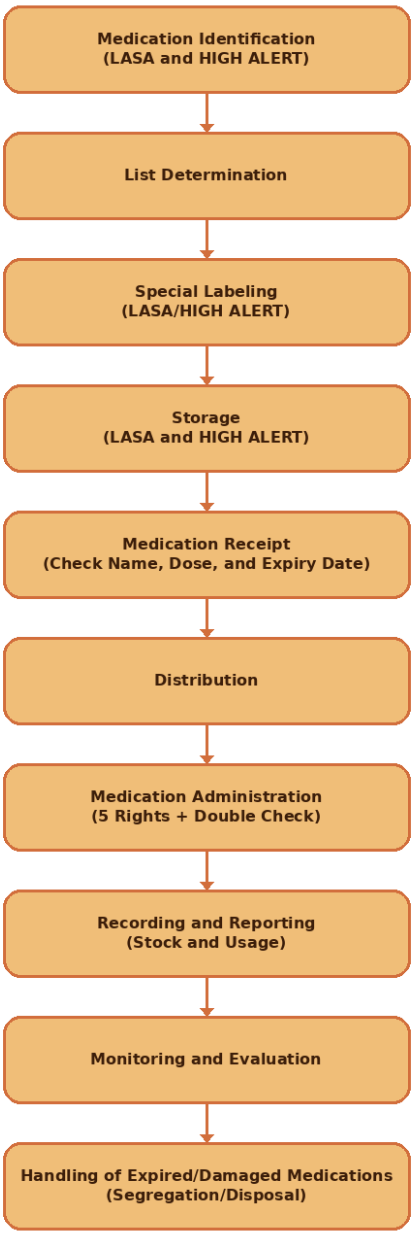

Figure 1. Medication management flow at Clinic X Lembang

3.2. Storage System for LASA and HIGH ALERT Medications at Clinic X Lembang

Based on observations conducted at Clinic X Lembang, the following findings were obtained regarding the storage of LASA and HIGH ALERT medications:

Storage of LASA Medications

- LASA medications were arranged alphabetically and grouped according to dosage form (tablets, capsules, syrups, injections). The principle of location separation was applied, whereby medications with similar names or appearances were not stored adjacently but were separated by, or interspersed with, at least one to two other types of medication to avoid confusion. Shelving arrangement also differentiated medications by dosage strength

to prevent mix-ups, for example, between 100 mg and 200 mg formulations of the same drug.

Figure 2. Location separation of LASA medications on the storage shelf.

- Labeling System: most LASA medications had been marked with distinct yellow stickers clearly labeled "LASA" on both the packaging and storage shelves to enhance visual differentiation. A list of LASA medication pairs was also posted near the storage area as a quick reference guide for staff.
- Storage Principles: the FIFO (First In, First Out) and FEFO (First Expired, First Out) systems had been implemented to ensure that medications were used according to their receipt order and expiration date.

Storage of HIGH ALERT Medications

- Location and Grouping: HIGH ALERT medications (such as anticoagulants, concentrated electrolytes, and anesthetics) were stored on separate shelves or in dedicated cabinets, completely apart from other routine medications. The storage area was clearly marked with red boundary lines and large labels reading "HIGH ALERT" for easy identification from a distance. Medications classified as HIGH ALERT were also given an additional "DOUBLE CHECK" label.

Figure 3. Storage cabinet for HIGH ALERT medications.

- Security and Access: HIGH ALERT medications belonging to the narcotic or psychotropic classes were stored in double-locked cabinets, with access restricted to authorized personnel only. Every instance of medication retrieval was recorded in a dedicated register to monitor usage and stock levels.

3.3. Labeling of LASA and HIGH ALERT Medications

Labeling of LASA Medications

- Identification of drug pairs: identifying medications with similarities in name, spelling, pronunciation, form, or packaging (e.g., Mefenamic Acid vs. Tranexamic Acid).
- Selection of labeling method: (a) Tall Man Lettering — writing the differing portion of a drug name in capital letters (e.g., asamMEFENamat vs. asamTRANEXamat); (b) special stickers — stickers with distinctive colors and wording, such as a yellow sticker labeled "LASA MEDICATION."
- Implementation: stickers or labels are affixed to drug packaging, storage shelves, and medication lists, ensuring that they remain clearly visible and are not obscured by other information.

Labeling of HIGH ALERT Medications

- Identification: identifying drugs with a high risk of causing serious injury or death if used incorrectly (e.g., anticoagulants, high-concentration electrolyte solutions).
- Selection of labeling method: (a) special stickers in bright colors, such as a red sticker labeled "HIGH ALERT"; (b) warning labels containing information on risk, method of use, or special precautions, such as "DOUBLE CHECK."
- Implementation: stickers or labels are affixed to drug packaging, storage shelves, and related documents such as prescriptions or medication administration records, ensuring that they are clearly visible and legible to all personnel involved.

3.4. Distribution Process for LASA and HIGH ALERT Medications

The distribution of LASA and HIGH ALERT medications was conducted with a high degree of caution, applying a double-check verification system to ensure the accuracy of dispensed medications. The distribution process comprised the following stages.

Stage 1: Prescription Receipt and Verification

- Staff receive the prescription from the physician or service unit.
- An initial check is performed to determine whether the prescription contains any medication included on the LASA or HIGH ALERT list.
- If so, the system or staff member issues a warning (either manually or through the pharmacy management information system) to increase vigilance.

Stage 2: Retrieval of Medication from the Shelf

- Staff retrieve the medication according to the name, dose, and dosage form specified in the prescription.
- For LASA medications: special attention is paid to labels and Tall Man Lettering to avoid confusion with similarly named drugs, and staff confirm that the medication is retrieved from the correct location — since LASA medications are stored separately — and that it fully corresponds to the prescription, thereby preventing medication errors.
- For HIGH ALERT medications: dose calculations must be performed with extreme care, particularly for concentrated liquid medications that require dilution prior to administration; where possible, calculations are reconfirmed by another staff member.

Stage 3: Packaging, Labeling, and Re-verification

- The medication is placed into an appropriate container or secondary packaging.
- A warning label, including clear and easily understood instructions for use, is affixed to the packaging of medications to be distributed.

- Prior to dispensing, a re-check (*double check*) is performed by the pharmacist or a designated staff member, covering: (a) correctness of drug name, dose, quantity, and expiration date; (b) correspondence with the patient's identity; and (c) completeness of the warning label.

3.5. Measures to Prevent Errors in the Use of LASA and HIGH ALERT Medications

- Separate storage: LASA medications with similar names are not stored adjacently and are separated or relocated to a different shelf; HIGH ALERT medications are stored in a dedicated cabinet or clearly marked area, locked when necessary.
- Special labels and markings: use of brightly colored stickers (red/yellow) labeled "LASA" or "HIGH ALERT", application of Tall Man Lettering (capital letters) to distinguish parts of drug names, and color-coding to differentiate different doses of the same medication.
- Double-check verification: a mandatory re-check performed by two staff members prior to dispensing, with careful matching of drug name, dose, and patient identity.
- Clarity of information: prescriptions must be written completely and clearly, avoiding abbreviations.

Case Example: An Information Error Involving a LASA Medication

- Background: a 2.5-year-old child presented with high fever; the physician prescribed Paracetamol Forte Syrup 160 mg, 5 mL.
- Error: pharmacy staff dispensed the wrong medication — Paracetamol Syrup 250 mL was given to the patient instead of the prescribed formulation.
- Impact: although both medications contain the same active ingredient, the differing dosage strength raised concern that the patient may have received an excessive dose.
- Cause: insufficient double-checking and the adjacent storage of the two medications.

3.6. List of LASA and HIGH ALERT Medications

Table 1. LASA medications identified at Clinic X Lembang.

No.	Drug Name	Dosage From	Remarks
1.	Acyclovir 200 mg – Acyclovir 400 mg	Tablet	Same name, different dose
2.	Allopurinol 100 mg – Allopurinol 300 mg	Tablet	Same name, different dose
3.	Amlodipine 5 mg – Amlodipine 10 mg	Tablet	Same name, different dose
4.	asamMEFENamat – asamTRANEXamat (Mefenamic Acid – Tranexamic Acid)	Tablet	Similar name, different function
5.	Cotrimoxazole Tab – Cotrimoxazole FORTE	Tablet	Same name, different dose
6.	Clindamycin 150 mg – Clindamycin 300 mg	Tablet	Same name, different dose
7.	Captopril 12.5 mg – Captopril 25 mg	Tablet	Same name, different dose
8.	CIPROfloxacin – LEVOfloxacin	Tablet	Very similar spelling and pronunciation
9.	Cefixime 100 mg – Cefixime 200 mg	Tablet	Same name, different dose
10.	LANSOprazole – OMEprazole	Tablet	Very similar spelling and pronunciation
11.	Meloxicam 7.5 mg – Meloxicam 15 mg	Tablet	Same name, different dose
12.	Simvastatin 10 mg – Simvastatin 20 mg	Tablet	Same name, different dose
13.	Amoxicillin Syr 125 mg – Amoxicillin Syr 250 mg	Syrup	Same name, different dose

14.	Cefadroxil Syr 125 mg – Cefadroxil Syr 250 mg	Syrup	Same name, different dose
15.	Cofarcetin Syr – Cofarcetin Plus Syr	Syrup	Similar name, different function
16.	Ibuprofen Syr 60 mg – Ibuprofen Syr 100 mg	Syrup	Same name, different dose
17.	Paracetamol Syr 120 mg – Paracetamol Syr 250 mg	Syrup	Same name, different dose

Table 2. HIGH ALERT medications identified at Clinic X Lembang.

No.	Drug Name	Dosage Form	Drug Class	Risk Basis	Remarks
1.	MgSO4 40% (Magnesium Sulfate)	Injection	Concentrated Electrolyte/ Anticonvulsant	Contains electrolyte at very high concentration	Treats magnesium deficiency
2.	OTSU D-40 (Dextrose 40%)	Injection/ Infusion	Energy Source/ Infusion Fluid	Glucose solution at very high concentration	Provides high glucose intake
3.	PEHACAIN inj	Injection	Combined Local Anesthetic	Has a narrow therapeutic window	Prolongs anesthetic effect and reduces local bleeding
4.	EPINEPHRINE inj (Adrenaline)	Injection	Sympathomimetic /Emergency Drug	Extremely potent drug acting on the cardiovascular and respiratory systems	Treats cardiac arrest
5.	LIDOCAINE inj	Injection	Local Anesthetic/ Antiarrhythmic	Has a narrow therapeutic window	Provides local tissue anesthesia
6.	Aspilet tab (Aspirin)	Tablet	Antiplatelet/ NSAID	Carries a high risk of severe bleeding	Prevents blood-clot formation
7.	Digoxin tab	Tablet	Cardiac Glycoside	Has a very narrow therapeutic window	Increases the strength of cardiac contraction
8.	ISDN tab	Tablet	Nitrate/ Vasodilator	Potent vasodilator acting on blood vessels	Assists treatment of heart failure and relieves chest pain

3.7. Discussion

Based on the study results, the management of LASA (Look-Alike Sound-Alike) and HIGH ALERT medications at Clinic X Lembang has generally been implemented adequately

and is aligned with patient safety standards. With respect to the storage of LASA medications, the clinic has implemented an alphabetical arrangement system organized by dosage form. In addition, the application of location separation between medications with similar names or appearances represents an important step in minimizing the risk of mix-ups. The addition of spacing between LASA medications, together with grouping by dosage, demonstrates a systematic effort to enhance safety.

Regarding labeling, the use of distinctly colored stickers (yellow for LASA and red for HIGH ALERT), together with the application of Tall Man Lettering, is consistent with patient safety principles. This labeling helps healthcare personnel identify high-risk medications quickly and accurately. For HIGH ALERT medications, management is conducted more strictly. These medications are stored in dedicated, separate locations, marked with warning labels, and equipped with security measures such as locked cabinets for certain drugs. This demonstrates that the clinic recognizes the high level of risk associated with this category of medication. In the distribution process, the double-check verification principle has been applied to both LASA and HIGH ALERT medications. This process encompasses prescription review, medication retrieval, and verification prior to dispensing to the patient. The implementation of this system is critical to preventing medication errors.

The medication-error case involving paracetamol was identified through the review of the clinic's patient-safety incident documentation rather than through direct observation during the study period. The incident indicated that an error occurred during the medication-management process and was subsequently recorded in the clinic's internal documentation. This finding was therefore treated as supporting contextual evidence and was not interpreted as representing the overall frequency or pattern of medication errors at Clinic X Lembang. When considered together with the observational findings, particularly the inconsistent implementation of double-checking procedures for selected high-risk medication processes, the documented case suggests the importance of strengthening verification practices before medication dispensing or administration. However, because this study used a descriptive qualitative design and did not measure the incidence or causal determinants of medication errors, the paracetamol case should be interpreted only as an example illustrating the potential consequences of insufficient verification rather than as evidence of a direct causal relationship between inadequate double-checking and medication errors.

Conclusions

The management of LASA and HIGH ALERT medications at Clinic X Lembang was generally implemented through structured storage, labeling, distribution, and verification practices. The study documented several medication-safety measures, including physical separation of selected medications, the use of warning labels, designated storage for HIGH ALERT medications, restricted access, and double-checking practices during medication handling. These findings indicate that the clinic has established important safety practices for managing medications with a higher potential for error. However, because this study did not measure medication-error rates or clinical outcomes, the observed practices cannot be interpreted as direct evidence that medication errors were reduced. Rather, they should be considered preventive measures intended to support safer medication management. Several implementation gaps remain, particularly in the consistency of double-checking procedures, staff vigilance, adherence to standardized labeling and storage practices, and continuous monitoring of medication-management procedures. Therefore, regular supervision, periodic

staff training, reinforcement of standard operating procedures, and continuous evaluation are recommended to improve the consistency and reliability of LASA and HIGH ALERT medication management at Clinic X Lembang.

Funding

This research received no external funding.

Acknowledgments

The authors would like to thank the management and staff of Clinic X Lembang for granting permission and providing support during the data collection process.

Conflicts of Interest

"The authors declare no conflict of interest.

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