

PROFILE OF *HIGH ALERT MEDICATION* STORAGE AT PHARMACY X IN MAJALENGKA REGENCY

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ABSTRACT

Look Alike Sound Alike (LASA) drugs are drugs that have similarities in physical appearance, name, or pronunciation that can cause medication errors. Improper storage of LASA drugs is one of the main risk factors for dispensing errors in pharmacies. This study aims to evaluate the appropriateness of LASA storage at Pharmacy X based on Ministry of Health Regulation No. 73 of 2016. This study used a descriptive method with an observational and analytical approach based on the guidelines of Permenkes No. 73 of 2016. The study sample included all LASA drugs available at Pharmacy X, categorized into three groups: similar pronunciation, similar packaging, and drugs with different strengths. Of the total 59 LASA drug names evaluated, it was found that 91.52% of the drug names had been stored in accordance with the standards of Minister of Health Regulation No. 73 of 2016, while 8.48% still required improvements in the storage system by labeling all LASA-categorized drugs with the "LASA" label and using the Tall Man Lettering method for drug names that have similar pronunciations. The storage of LASA drugs at Pharmacy X is generally adequate. However, careful implementation of labeling and the use of tall man lettering are still required to achieve optimal standards and prevent medication errors. Medication errors can occur if drugs are not stored properly and are not labeled or marked, allowing for mistakes to be made when dispensing medication.

Keywords: Drug storage; look alike sound alike; medication error; pharmacy.

INTRODUCTION

Drug management according to Minister of Health Regulation No. 73 of 2016 is a series of pharmaceutical service activities that begin with the planning stage and end with evaluation, with each stage being interrelated. These activities include planning, procurement, receipt, storage, distribution, control, recording and reporting, disposal, monitoring, and evaluation (Ministry of Health Regulation No. 73 of 2016 concerning Pharmaceutical Service Standards in Pharmacies, 2016) . The main objective of drug management is to ensure the availability of the right type, quantity, quality, timing, and price of drugs, so that health services can run optimally and efficiently (Aisah et al., 2020) .

Proper drug storage procedures can ensure drug stability and safety, maintain the quality and quantity of drug preparations, prevent contamination, maintain the alphabetical arrangement of drugs according to therapeutic class, and ensure that drug quality is maintained during the distribution process (Prastika, 2025) .

In line with developments in science and technology in the field of pharmacy, there has been a shift in the orientation of Pharmaceutical Services from the management of drugs as commodities to comprehensive services (*Pharmaceutical Care*) in a broader sense, including the provision of information to support the correct use of drugs, the use of drugs to achieve the ultimate goal, and the possibility of medication errors (Tangkudung, 2023) .

Medication errors can cause harm and even death, especially if the distributed drugs are classified as *high alert medications* according to the Ministry of Health, (Fahriati et al., 2022) .

High alert medications are drugs that often cause serious errors, drugs that have a high risk of causing unwanted effects, such as drugs that look and sound similar (Name, Appearance, and Pronunciation Similar/NORUM) or *Look Alike Sound Alike* (LASA).

Medication errors are preventable incidents involving the improper use of medications. These errors occur in hospitals with varying incidence rates. *Medication errors* have four *phases* : *prescribing errors*, *transcribing errors*, *dispensing errors*, and *administration errors*. An error in one

stage of *medication error* can lead to a chain of errors affecting subsequent stages (Handoko et al., 2023) . *Dispensing error* is one stage of *medication error* caused by *improper* medication storage, which can result in *the wrong medication*, *wrong quantity*, or *wrong dosage* (Kumorowani et al., 2024) .

Medication errors can cause harm or even death, especially if the distributed medication is *a high-alert medication*. *Medication error* is defined as any preventable event that could lead to or result in the inappropriate or harmful use of medication while the medication is under the control of healthcare professionals, patients, or consumers (Prevention, 2022) . Global data shows that *medication errors* are a significant cause of morbidity and mortality. According to Tang, a survey in the United States revealed that human factors contributed to 65.2% of medication errors, which were generally caused by inadequate performance and knowledge (Fadilah, 2025) . The rate of *medication errors* ranges from 2% to 4%, resulting in 7,000 medication-related deaths annually in the United States (Rahmadinah, 2022) .

Based on national data, *medication errors* rank first at 24.8% of the 10 major incidents that occur in hospitals (Napitu, 2020) . *Dispensing errors* are also one of the causes. *Dispensing errors* are medication errors that occur during the storage and delivery of prescriptions by medical personnel. *Dispensing errors* can occur when medications are taken from shelves or cabinets due to similar packaging or careless storage.

The Indonesian government has issued regulations to regulate the storage of LASA drugs through Minister of Health Regulation No. 73 of 2016 concerning Pharmaceutical Service Standards in Pharmacies. This regulation stipulates that LASA drugs must be stored separately, labeled specifically, and arranged in such a way as to prevent errors in retrieval. Meanwhile, the minimum service standards for hospitals outlined in Minister of Health Decree No. 129/Menkes/SK/II/2008 state that *medication errors* must be 100% prevented.

Therefore, an effective way to address *dispensing errors* is by improving the drug storage system, eliminating or reducing such incidents, and enhancing the storage process of *high-alert medications* through a " " approach, ensuring drugs are stored according to validated guidelines.

A study on the accuracy of LASA drug storage at Mutiara Bunda Tulang Bawang Hospital in Lampung showed an accuracy rate of 90% with a total of 16 LASA drugs and 2 drugs that were not labeled "LASA" (Primadiamanti et al., 2021) .

Research conducted at Mitra Plumbon Cirebon showed LASA drug storage accuracy results of 81.43% (Hidayati et al., 2021) . Research conducted by Widyastuti et al. (2020) in several pharmacies in Jakarta showed that 68% of pharmacies still had inadequate LASA drug storage systems (Widyastuti et al., 2020) . A study by Pratiwi & Sari (2021) found that 43% of dispensing errors in community pharmacies were caused by improper storage of LASA drugs (Pratiwi & Sari, 2021) .

Research conducted at Majalengka Regional General Hospital, West Java, showed that the

accuracy of LASA drug storage was 74.60% (Suryani et al., 2022) . Meanwhile, another study conducted at a community health center in Majalengka Regency showed that the accuracy of LASA drug storage was 69.20% (Handayani & Prasetyo, 2023) .

A pharmacist plays a crucial role in the storage, management, and use of *high-alert medications* to eliminate medication errors.

As medical personnel, pharmaceutical technicians are required to work efficiently in the pharmaceutical field in accordance with their competencies in order to improve the quality of health services, as explained in Article 108 paragraph 1 (Ikhsan & Wahab, 2021) .

Pharmacies play a very important role in the health system because they are the final point in the drug distribution chain to the community. With high *dispensing* volumes and a wide variety of drugs, pharmacies have a significant risk of *medication errors*, especially those involving LASA drugs. Therefore, a systematic evaluation of the implementation of LASA drug storage standards in pharmacies is very important to ensure patient safety.

Pharmacy X is a private pharmacy located in Majalengka Regency, West Java. Located in a developing urban area, this pharmacy serves the needs of the community both from the surrounding area and from buffer areas such as sub-districts in Central and South Majalengka.

This pharmacy has a pharmaceutical service system that includes drug procurement, management, storage, and distribution of drugs directly to patients. With a high number of patient visits every day, Pharmacy X also plays an important role in ensuring the availability of safe, quality, and targeted drugs.

As part of an area that still has a combination of urban and rural areas, the characteristics of the Majalengka community require pharmaceutical services that are not only fast and efficient, but also capable of providing education related to the use of medicines, especially high-risk medicines such as LASA (*Look Alike Sound Alike*) medicines. For this reason, the storage and arrangement of LASA drugs is an important aspect of the pharmacy management system at Pharmacy X, in order to minimize the risk of medication errors and obtain preliminary data. During the observation, several errors were found in the storage at Pharmacy X in Majalengka Regency.

This research is important to provide an actual picture of the implementation of *Look Alike Sound Alike* (LASA) drug storage at Pharmacy X based on the standards of Permenkes No. 73 of 2016. This study aims to analyze and describe the profile of high-alert medication storage at Pharmacy X in Majalengka Regency based on the standards set forth in the Indonesian Ministry of Health Regulation (Permenkes) No. 73 of 2016 concerning Pharmaceutical Service Standards in Pharmacies. The research seeks to identify the types and characteristics of high-alert medications, evaluate the compliance of storage practices such as labeling, segregation, and documentation, and determine the level of conformity as well as potential risks related to their handling. The findings are expected to contribute theoretically to the enhancement of pharmaceutical management and patient safety literature, and practically to provide pharmacists and pharmacy managers with guidance in improving Standard Operating Procedures (SOPs) and risk prevention mechanisms for safer high-alert medication management.

RESEARCH METHOD

This study used a descriptive observational method. The descriptive method was chosen to provide an objective picture of the LASA drug storage conditions at Pharmacy X based on the criteria set out in Permenkes No. 73 of 2016. This approach included observation, classification,

recording, and systematic analysis of LASA drug storage practices. The data analysis used by the researcher employed a qualitative descriptive method based on observations conducted at the research site. From the analysis conducted, conclusions were drawn and the results were tabulated and presented in a table (. Data analysis in this study used *Microsoft Excel*.

RESULT AND DISCUSSION

This study took a sample of drug data from the warehouse of Pharmacy X, with the number of *high alert medications* in the LASA category totaling:

Table 1. List of LASA Medications at Pharmacy X

No	Medications with Similar Pronunciation	Medications with Similar Packaging	Same Medication with Different Strengths
1.	Tranexamic acid and Mefenamic Acid	Allopurinol 100 mg and 300 mg	Allopurinol 100 mg and Allopurinol 300 mg
2.	Ciprofloxacin and Levofloxacin	Amlodipine 5 mg and Amlodipine 10 mg	Amlodipine 5 mg and Amlodipine 10 mg
3.	Dimenhydrinate and Diphenhydramine	Tranexamic acid 250 mg and 500 mg	Tranexamic acid 250 mg and 500 mg
4.	Ephedrine and Epinephrine	Bisoprolol 2.5 mg and 5 mg	Bisoprolol 2.5 mg and 5 mg
5.	Folamil and Folavit	Captopril 12.5 mg and 25 mg	Captopril 12.5 mg and 25 mg
6.	Miconazole and Ketoconazole	Candesartan 8 mg and 16 mg	Candesartan 8 mg and 16 mg
7.	Lansoprazole and Omeprazole	Cefadroxil 250 mg and 500 mg	Cefadroxil 250 mg and 500 mg
8.	Prednisone and Prednisolone	Clindamycin 150 mg and 300 mg	Clindamycin 150 mg and 300 mg
9.		Dulcolax Supp 5 mg and 10 mg	Dulcolax Supp 5 mg and 10 mg
10.		Fenofibrate 100 mg and 200 mg	Fenofibrate 100 mg and 200 mg
11.		Glimepiride 1 mg, 2 mg, and 3 mg	Glimepiride 1 mg, 2 mg, and 3 mg
12.		Hydrocortisone 1% and 2.5%	Hydrocortisone 1% and 2.5%
13.		Lisinopril 5 mg and 10 mg	Lisinopril 5 mg and 10 mg
14.		Meloxicam 7.5 mg and 15 mg	Meloxicam 7.5 mg and 15 mg
15.		Metformin 500mg and 850mg	Methylprednisolone 4 mg, 8 mg, 16 mg
16.		Methylprednisolone 4 mg, 8 mg, 16 mg	Metformin 500 mg and 850 mg
17.		Sodium Diclofenac 25 mg and 50 mg	Sodium Diclofenac 25 mg and 50 mg

18.	Ondansetron 4 mg and 8 mg	Ondansetron 4 mg and 8 mg
19.	Pantoprazole 20 mg and 40 mg	Pantoprazole 20 mg and 40 mg
20.	Piracetam 400 mg and 800 mg	Piracetam 400 mg and 800 mg
21.	Piroxicam 10 mg and 20 mg	Piroxicam 10 mg and 20 mg
22.	Propranolol 10 mg and 40 mg	Propranolol 10 mg and 40 mg
23.	Salbutamol 2 mg and 4 mg	Salbutamol 2 mg and 4 mg
24.	Simvastatin 10 mg and 20 mg	Simvastatin 10 mg and 20 mg
25.	Spironolactone 25 mg and 100 mg	Spironolactone 25 mg and 100 mg

Storage Profile of *High Alert Medication* at Pharmacy X in Majalengka Regency

Based on Ministry of Health Regulation No. 73 of 2016 concerning Pharmaceutical Service Standards, proper storage conditions ensure the safety and stability of medications. All drugs/medicinal ingredients must be stored under appropriate conditions to ensure their safety and stability (Ministry of Health Regulation No. 73 of 2016 on Pharmaceutical Service Standards in Pharmacies, 2016) . The number of *high alert medications* at Pharmacy X in Majalengka Regency can be seen in Table 2.

Table 2 Number of *High Alert Medications* at Pharmacy X by Category

Category	Number of drugs	Percentage (%)
LASA	59	100
High Concentration Electrolyte Medication	0	0
Cytostatic Medication	0	0
Total	59	100

Based on Table 2, the number of *high alert medications* at Pharmacy X is 59, with 59 drug names, 0 high concentration electrolyte drugs, and 0 cytostatic drugs.

Proper storage management of *high alert medications* is very important to reduce *medication errors*, because these types of drugs have a high risk of causing treatment errors and negative consequences that are dangerous for patients (*adverse outcomes*) (Minister of Health Regulation Number 73 of 2016 concerning Pharmaceutical Service Standards in Pharmacies, 2016) .

The method of storing medications is an activity of storing and maintaining medications by placing them in a location deemed safe from theft and physical damage that could compromise their quality. At Pharmacy X, the LASA drug storage method based on Permenkes No. 73 of 2016 uses alphabetical order, type of preparation, and FIFO (*First In First Out*). The LASA drug storage method based on the form and type of pharmaceutical preparation can be seen in Table 3.

Table 3 LASA drug storage method based on the form and type of pharmaceutical preparation at Pharmacy X.

LASA Drug Storage Method	Yes	No
<i>Formulation</i>	100%	-
Alphabetical order	100%	-
FIFO (<i>First In First Out</i>).	100%	-

Based on Table 3, the LASA drug storage method at Pharmacy X uses a storage method based on the form and type of pharmaceutical preparations and uses the FIFO method.

The drug storage system at one of Pharmacy X in Majalengka Regency is in accordance with Indonesian Minister of Health Regulation No. 73 of 2016.

At Pharmacy X, drug storage is based on the form and type of pharmaceutical preparations, making it easier to retrieve drugs using the FIFO method.

Table 4 LASA Drug Storage Methods at Pharmacy X based on Permenkes No. 73 of 2016

LASA Medication Storage Method Based on Ministry of Health Regulation No. 73 of 2016	Yes	No
Based on therapeutic class		✓
Based on the form and type of pharmaceutical preparation	✓	
<i>FIFO</i>	✓	
Alphabetical	✓	

Based on Table 4, the storage methods for LASA drugs at Pharmacy X are based on the form and type of pharmaceutical preparation, FIFO, and alphabetical order, making it easier to remember and retrieve drugs. The storage method based on therapeutic class is not applied at Pharmacy X for LASA drugs because the quantity is not too large and requires more space.

Number of Look-Alike Sound-Alike Drugs

At Pharmacy X Majalengka, the total list of LASA drugs available at the time of the study was 59 drug names consisting of LASA drugs with similar pronunciations, the same packaging, and the same drug names with different strengths. The number of LASA drugs can be seen in Table 5.

Table 5 Number of LASA Medications at Pharmacy X

Look Alike Sound Alike	Details	
Look-Alike	9	15.25
Similar Packaging	25	42.37
Same Drug Name, Different Strength	25	42.37
Total	59	100

Based on Table 5, the number of LASA drugs at Pharmacy X has 59 drug names divided into 3 groups of LASA drugs with similar pronunciations (9 drugs), similar packaging (25 drugs), and the same drug name with different strengths (25 drugs). LASA drugs with the same drug name but different strengths have the highest number, as drug strength refers to the concentration of the active ingredient in the drug formulation, resulting in the largest quantity because drug dosage is based on body surface area.

Accuracy of LASA Medication Storage Based on Ministry of Health Regulation No. 73 2016

The accuracy of LASA drug storage in this study uses Ministry of Health Regulation No. 73 of 2016 concerning Pharmaceutical Service Standards in Pharmacies. *LASA* category drugs are pharmaceutical preparations that have similarities in naming and pronunciation, thus requiring a labeling system or special stickers in the storage process (Daryatmo, 2024).

The accuracy of LASA drug storage can be seen in Table 6.

Table 6 Accuracy of LASA drug storage at Pharmacy X

No	<i>LASA (Look Alike Sound Alike)</i>	Number of Incorre ct Cases	Incorrect (%)	Number of Accura te	Accur ate (%)
1.	<i>LASA</i> medicine labeled "LASA" with a yellow background color	5	8.48	54	91.52

Based on Table 6, the accuracy of LASA drug storage shows that there are 5 drugs that do not meet the standards of Permenkes No. 73 of 2016 at Pharmacy X. The inaccuracy of the 5 drugs is due to the absence of the "LASA" label/sticker and the non-use of the *tall man lettering* method, resulting in approximately 8.48%. The names of drugs with improper storage according to Ministry of Health Regulation No. 73 of 2016 can be seen in Table 7.

Table 7 Names of LASA Medications with Improper Storage According to Ministry of Health Regulation No. 73 of 2016 at Pharmacy X

No.	Parameter	Drug Name
1	<i>LASA</i> drugs labeled using the <i>Tall Man Lettering</i> method	TRANEXAMIC acid and MEFENAMIC acid KETOconazole and MICOconazole
2	<i>LASA</i> medication labeled "LASA" with a yellow background	Dulcolax Supp 5 mg and 10 mg Fenofibrate 100 mg and 200 mg Amlodipine 5 mg and Amlodipine 10 mg

Based on Table 7, there are 2 LASA drugs that do not comply with the storage requirements specified in Ministry of Health Regulation No. 73 of 2016, as they do not use the *tall man lettering* method, and 3 that do not have the yellow LASA label. Incomplete drug

labeling can lead to *medication errors* based on similar appearance and pronunciation, which have the potential for medication errors according to Nurhikmah (Daryatmo, 2024).

The results of the study at Pharmacy X in Majalengka Regency showed that there was still a discrepancy with the drug storage standard of 8.48%, namely in the storage of drugs that did not use *tall man lettering* and did not use LASA stickers.

The use of LASA stickers, in addition to serving as a form of prevention against *medication errors*, indicates that the drug is a *high alert medication* whose use needs to be watched carefully due to the high risk of unwanted side effects. In accordance with Permenkes Number 73 of 2016, the function of LASA stickers is to ensure that pharmacy staff reread the name of the drug on the packaging before storing it on the shelf or in its place, thereby reducing *dispensing errors*.

The *tall man lettering* method can be used to overcome the problem of storing *LASA* drugs that have similar pronunciations. The main function of this method is to emphasize the distinguishing aspects of drugs whose names or pronunciations are almost the same. *Tall man lettering* is applied by modifying the way drug names are written to highlight different elements and facilitate the identification of similar names. The results of several studies show that the application of *tall man lettering* is effective in increasing the ease of differentiating similar drug names and reducing the error rate through the use of capital letters for different parts and lowercase letters for similar parts.

Proper management and storage of high-alert medications are essential to minimize medication errors and enhance patient safety. The results of this study show that Pharmacy X has implemented appropriate storage methods, including arrangement by dosage form, alphabetical order, and the FIFO (First In First Out) system. These findings align with the principles stated in Minister of Health Regulation No. 73 of 2016, which emphasize that the storage of medications must ensure stability, safety, and quality through proper labeling and segregation procedures.

CONCLUSION

Based on the research conducted at Pharmacy X in Majalengka Regency, it can be concluded that the storage profile of high-alert medications has been implemented appropriately using storage methods based on dosage form, alphabetical order, and the FIFO (First In First Out) system. The accuracy level of high-alert medication storage, particularly LASA medications labeled "LASA" with a yellow base, reached 91.52%, which is categorized as very good. This finding is consistent with previous studies such as Primadiamanti et al. (2021), Hidayati et al. (2021), and Suryani et al. (2022), which also reported high levels of compliance in LASA storage accuracy. The results further reinforce the importance of systematic labeling and visual management, as highlighted by Fadilah (2025) and Daryatmo (2024), in reducing the potential for medication errors and enhancing patient safety in pharmaceutical practice.

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