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Overview of look-alike sound-alike (LASA) drug storage in several pharmacies in Magelang City

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Abstract

Look-Alike Sound-Alike (LASA) medications pose a significant risk for medication errors, particularly in community pharmacy settings where storage and labeling practices greatly influence patient safety. This study aims to evaluate LASA drug storage practices in several pharmacies in Magelang City, focusing on adherence to safety guidelines, labeling consistency, and storage organization. A total of eleven pharmacies were assessed through observations, interviews, and surveys to analyze storage conditions and identify common issues. The findings show that most pharmacies fall within the "adequate" category, with only one pharmacy meeting the "good" criteria, while four others were categorized as "poor." The percentage of LASA drugs based on sound-alike names, similar packaging, and identical names with different strengths varied widely across pharmacies, indicating inconsistent storage and risk prevention strategies. Common issues identified include inconsistent labeling, inadequate temperature control, and limited staff training on LASA risk management. These findings align with previous studies reporting similar challenges in both hospital and community settings. The study highlights the urgent need for improved storage protocols, routine audits, implementation of technological tools such as barcode scanning, and continuous staff training to minimize LASA-related medication errors. Strengthening interprofessional collaboration and standardizing LASA management guidelines are essential to enhance patient safety. Further research across broader regions is recommended to develop comprehensive, evidence-based policies for LASA drug handling in community pharmacies.

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Keywords

Drug storage, LASA, Medicine, Pharmaceutical care, Pharmacy

Introduction

Look-Alike Sound-Alike (LASA) medications constitute a persistent and well-documented source of medication errors worldwide, posing substantial risks to patient safety across healthcare settings. These errors commonly arise from similarities in drug

names, spelling, pronunciation, packaging, and labelling, which may lead to incorrect medication selection, inappropriate dosing, or administration to the wrong patient. LASA-related medication errors have been associated with serious adverse events, including prolonged hospitalization, increased healthcare costs, and, in severe cases, patient mortality. As a result, international patient safety organizations and regulatory agencies have identified LASA medications as a priority area for medication safety improvement [1], [2], [3].

Multiple strategies have been proposed and implemented to mitigate LASA-related risks. These include the use of tall-man lettering, enhanced labeling systems, differentiation of drug storage locations, and the incorporation of technological safeguards such as computerized physician order entry and barcode verification systems [4]. However, evidence suggests that many of these interventions remain heavily dependent on human vigilance and local implementation practices, which may limit their effectiveness, particularly in resource-constrained settings. Consequently, contextual factors within healthcare organizations, including workflow design, staff training, and infrastructure, play a critical role in determining the success of LASA risk management strategies [5].

Pharmacists are uniquely positioned to lead medication safety initiatives due to their expertise in pharmacotherapy, medication management systems, and patient counseling. Their responsibilities extend beyond dispensing to include medication verification, monitoring storage conditions, identifying high-risk medications, and collaborating with other healthcare professionals to ensure safe medication use. Studies have demonstrated that continuous professional development, adherence to ethical standards, and effective interprofessional collaboration significantly enhance pharmacists' capacity to prevent medication errors and optimize patient outcomes [6], [7]. In both hospital and community pharmacy settings, pharmacists serve as a critical safeguard against LASA-related errors by ensuring appropriate storage, labeling, and communication practices.

Proper medication storage and labeling are fundamental components of LASA risk reduction. Inadequate storage conditions, unclear labeling, and poor inventory organization can increase the likelihood of medication mix-ups, compromise drug stability, and hinder timely identification of expired or recalled products. Previous research has emphasized that standardized storage protocols, clear labeling that includes both brand and generic names, and routine inventory audits are effective measures to reduce medication errors and enhance traceability [4]. Additionally, integrating medication indication information and applying visual differentiation strategies have been shown to support safer dispensing practices, although their impact remains variable across settings [8].

LASA medications are particularly prevalent among solid oral dosage forms, such as tablets and capsules, which constitute a large proportion of medication inventories in community pharmacies. Mixed-methods studies have highlighted that LASA-related

errors involving these dosage forms continue to occur despite existing preventive strategies, underscoring the need for ongoing evaluation and system refinement [9]. While substantial attention has been directed toward LASA medication safety in hospital environments, evidence from community pharmacy settings—where high prescription volumes and limited staffing may further elevate risk—remains comparatively limited [10].

In Indonesia, and specifically in smaller urban areas such as Magelang City, empirical data on LASA medication storage and labeling practices in community pharmacies are scarce. The absence of locally generated evidence hampers the development of context-specific interventions and policy recommendations. Understanding how LASA medications are currently stored, labeled, and managed in community pharmacies is therefore essential to identify gaps in compliance, knowledge, and resource availability. Accordingly, this study aims to evaluate LASA medication storage and labeling practices in community pharmacies in Magelang City. By systematically assessing current practices against established medication safety principles, this study seeks to identify potential vulnerabilities and inform targeted strategies to strengthen medication safety systems. The findings are expected to contribute to the growing body of evidence on LASA risk management in community pharmacy settings and support efforts to improve the quality and safety of pharmaceutical services.

Method

This study employed a descriptive observational approach involving 11 pharmacies randomly selected across various neighborhoods in Magelang City, utilizing a registered list from the local health department to ensure representative sampling. Data collection was executed through a robust triangulation of structured surveys, semi-structured interviews, and direct clinical observations. The primary research instrument was a standardized evaluation checklist based on predefined safety criteria, which assessed inventory management, the use of original packaging, and the consistency of labeling—specifically the implementation of Tall-Man lettering and visual differentiation. Environmental storage conditions, including temperature control, light exposure, and humidity, were monitored to evaluate their impact on drug stability and quality. Observations focused on the accuracy of the dispensing workflow, identifying potential vulnerabilities such as communication barriers, resource constraints, and the absence of standardized operating procedures (SOPs).

For data analysis, compliance was quantified and categorized into three performance tiers: "good" (>80% adherence), "enough" (60–80% adherence), and "less" (<60% adherence) based on the total safety criteria met. Additionally, a categorical frequency analysis was performed to determine the percentage distribution of LASA medications across three risk profiles: phonetic similarity (sound-alike), visual packaging similarity (look-alike), and identical generic or brand names with differing dosage strengths. This comprehensive methodological framework allowed for the identification of specific

systemic gaps, providing an evidence-based foundation for targeted interventions to enhance pharmaceutical care and patient safety in Magelang City.

Results

This section reports the findings of an observational evaluation of Look-Alike Sound-Alike (LASA) drug management conducted in 11 community pharmacies. The results are presented in tabular form and describe the categories of LASA storage practices as well as the distribution of LASA drugs according to similarities in pronunciation, packaging, and drug names with different strengths. Table 1 presents the distribution of LASA drug storage practices across 11 community pharmacies based on observational assessment, categorized into good, enough, and less compliance.

Table 1. LASA drug storage practices across 11 community pharmacies

No	Pharmacies	Category		
		Good	Enough	Less
1.	A	√		
2.	B		√	
3.	C		√	
4.	D		√	
5.	E			√
6.	F		√	
7.	G			√
8.	H		√	
9.	I			√
10.	J			√
11.	K		√	
	Total	**1**	**6**	**4**

Table 2 summarizes the number and percentage of LASA drugs classified as having similar pronunciation identified in each pharmacy during the observation period.

Table 2. LASA drugs in similar classes per pharmacy

No	Pharmacies	Pronunciation	
		Observation results	Percentage
1.	A	11	6.08%
2.	B	6	3.31%
3.	C	10	5.52%
4.	D	5	2.76%
5.	E	9	4.97%
6.	F	20	11.05%
7.	G	50	27.62%
8.	H	42	23.20%
9.	I	3	1.66%
10.	J	12	6.63%
11.	K	13	7.18%

Table 3 shows the distribution and proportion of LASA drugs with similar packaging characteristics across the observed pharmacies. Then, Table 4 illustrates the frequency and percentage of LASA drugs sharing the same generic or brand name but differing in strength among the surveyed pharmacies.

Table 3. LASA drugs in similar packaging classes per pharmacy

No	Pharmacies	Similar packaging	
		Observation results	Percentage
1.	A	10	7.94%
2.	B	10	7.94%
3.	C	3	2.38%
4.	D	1	0.79%
5.	E	5	3.97%
6.	F	15	11.90%
7.	G	42	33.33%
8.	H	52	41.27%
9.	I	1	0.79%
10.	J	13	10.32%
11.	K	17	13.49%

Table 4. LASA drugs with the same name class but different strengths per pharmacy

No	Pharmacies	Similar packaging	
		Observation results	Percentage
1.	A	7	2.86%
2.	B	31	12.65%
3.	C	9	3.67%
4.	D	16	6.53%
5.	E	17	6.94%
6.	F	45	18.37%
7.	G	45	18.37%
8.	H	25	10.20%
9.	I	11	4.49%
10.	J	27	11.02%
11.	K	12	4.90%

Discussion

Implications of substandard LASA drug storage for patient safety

Patient safety may be seriously impacted by improper LASA medication storage. Inadequate storage of pharmaceuticals increases the risk of contamination, deterioration, or mislabeling, which can result in unfavorable drug reactions or ineffective treatment. When used properly, automated dispensing cabinets (ADCs) can lower the likelihood of look-alike, sound-alike (LASA) medication errors, but they can also raise them if several LASA medications are kept in the same storage compartment. Attention should be paid to the identification and safe storage of LASA medicines to promote safe use of ADCs in hospitals [11]. Strict storage policies and procedures must be followed by pharmacies in order to protect patients and preserve their good name. This entails putting in place safe access controls, carrying out regular security audits, maintaining up-to-date software, and complying with regulations like HIPAA [12].

Failure to do so could have detrimental effects on both the pharmacy and the patients it serves. To avoid any deterioration, microbial growth, and other negative effects on the drugs, pharmacies must routinely check and maintain the storage conditions of their medications, including temperature, humidity, and light exposure. effects of the medications [13]. Medication errors and mix-ups can be decreased by putting in place

appropriate labeling and organization systems. By prioritizing safe and secure drug storage, accurate labeling practices, and effective management of expiration dates, healthcare professionals can mitigate medication errors and maintain medication integrity in neonatal care [14] [15].

Additionally, cybersecurity measures like encryption and secure access controls are essential to protect patient data and maintain trust with patients. Disaster preparedness plans are critical for pharmacies to continue providing essential services during emergencies [12].

Recommendations for improving storage practices in pharmacies

Include putting in place a first-in, first-out system to guarantee appropriate stock rotation, labeling all medications clearly and consistently, and routinely auditing inventory to find and eliminate damaged or expired medications. In order to guarantee appropriate storage conditions and avoid temperature fluctuations, pharmacies should also invest in secure storage solutions, such as locked cabinets or refrigerators for temperature-sensitive medications. To guarantee that medications are stored and dispensed correctly, pharmacies should provide their employees with training on safe medication handling and storage practices. Pharmacies can improve patient safety and care quality by continuing their education and training. However, there are issues with staff and faculty members' incomplete attendance at safety training sessions and the implementation of thorough patient safety content. Advances in patient safety are also hampered by reporting obstacles and fear of legal action. Adopting full disclosure policies can lower liability for health care systems. Integrating patient safety content into clinical clerkships and residency programs can help reinforce skills and improve patient safety practices [16]. By April 2018, there is also a commitment to develop medication reviews and establish a minor ailments scheme in England, which might necessitate access to complete medical records. A national contract might include smoking cessation services, and current Vanguard programs could be utilized to develop community pharmacist roles within new care models [17].

Potential interventions to prevent medication errors related to LASA drugs

Reducing medication errors and enhancing patient safety requires implementing double checks for high-risk medications, using barcode scanning technology to confirm medication accuracy, and guaranteeing clear communication. Studies have shown that introducing a final barcode scan-based check at the bedside can significantly reduce error rates. The use of preset regimens and barcode scanning technology ensures accurate medication preparation and administration, reducing the risk of errors [18]. While technology plays a vital role in enhancing medication safety, challenges such as overridden bar-coded doses still exist, highlighting the need for continuous improvement in clinical processes and workflow [19]. Technology for drug safety provides valuable information on utilizing technology to prevent and manage drug safety issues, emphasizing the importance of incorporating technology in medication safety practices [20].

To reduce the possibility of misunderstandings or confusion, pharmacies can also set up procedures for the correct labeling and storage of LASA medications. By consistently reviewing and updating policies and procedures, pharmacies can proactively address potential issues and improve patient outcomes. In order to reduce medication errors in healthcare settings, effective interprofessional communication is essential. The study emphasizes the necessity of focused communication training, particularly for professionals with less experience and those working in unconventional environments. Improving patient safety and lowering medication errors requires improving channels of communication and creating an atmosphere that encourages candid, multidisciplinary discussion. Collaboration between regulatory bodies and patient safety organizations can also enhance learning from medication errors [21] [22]. In order to ensure safe medication practices and lower the possibility of errors related to LASA drugs, cooperation with prescribers and other healthcare professionals is also essential. Implementing regular staff training and education programs on LASA drugs in pharmacies can help increase awareness and knowledge among employees, potentially reducing medication errors [23].

To improve employee awareness and knowledge, pharmacies can also regularly conduct staff education and training programs on LASA medications. Errors can be avoided, and patient safety can be enhanced in general. By employing crucial tactics like identifying and classifying high-risk drugs, educating and training medical personnel, employing standardized procedures, patient education, monitoring, and pharmacist involvement, pharmacies can establish a more secure setting for the dispensing of high-risk drugs. High-risk medications should be clearly labeled and stored separately from non-high-risk medications to minimize errors. Additionally, utilizing technology such as automated dispensing systems can indeed enhance medication safety and accuracy in the pharmacy setting, as demonstrated by various studies. These systems are intended to increase operational effectiveness, decrease medication errors, and improve patient safety in hospitals.

Conclusion

This study underscores the importance of effective management of Look-Alike Sound-Alike (LASA) medications to enhance patient safety and reduce dispensing errors in pharmacy practice. Continuous staff training, regular monitoring, and standardized procedures are essential to minimizing LASA-related risks and strengthening a culture of safety. Further multicenter research is needed to inform the development of evidence-based guidelines for safer LASA drug storage and management across pharmacy settings.

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