

Evaluation of HAM and LASA Medication Management: Alignment Between Standards, Procedures, and Practice

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Tarsisius Jemading¹, Abraham Christian MacArthur Lameng²,
Fransiskus Xaverius Lameng³, Nelly Kurniawati⁴

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Medication errors are an important patient safety concern that can occur at various stages of the medication-use process and result in preventable harm. This study aimed to evaluate High-Alert Medication (HAM) and Look-Alike Sound-Alike (LASA) medication management at RSUD dr. T.C. Hillers Maumere by assessing medication-list concordance, compliance with applicable STARKES 2024 and hospital SOP requirements, and item-level and process-level gaps. A descriptive observational study with an evaluative approach was conducted through document review and direct observation at the Pharmacy Department, emergency trolley, Operating Room, and Intensive Care Unit (ICU) in July 2026. Of the 10 medication-safety indicators assessed according to STARKES 2024, 7 (70.0%) were compliant. The main gaps included the absence of periodic HAM list updating, inconsistent HAM and LASA management across hospital service area, particularly in the emergency trolley, and non-compliance with concentrated electrolyte storage requirements in the Operating Room and ICU. Among 39 observed HAM items, labeling on outer packaging and medication containers achieved 100% compliance, while storage compliance was 32/39 (82.1%). Among 104 LASA items, LASA labeling and physical separation achieved 100% compliance, whereas Tall Man Lettering was applied to 29/94 sound-alike items (30.9%). Neostigmine was included in the hospital HAM list but not in the ISMP reference list. Overall, HAM and LASA management practices assessed at the study sites were generally well implemented, but periodic, risk based evaluation and updating of the HAM and LASA lists are needed to ensure that medication safety practices remain aligned with actual risks.



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Medication error is an important patient safety concern because it can occur at various stages of the medication use process and may result in preventable harm [1], [2]. The World Health Organization (WHO) launched the Global Patient Safety Challenge: Medication Without Harm in 2017, with a global target of reducing severe avoidable medication related harm by 50% over five years [3]. Preventing medication errors does not depend solely on

individual vigilance but requires risk control through systems and medication use processes designed to identify and reduce vulnerabilities throughout the medication use process [4]. Such a systems approach is particularly important for medications that may cause serious clinical consequences when errors occur [4].

^{1,2,3,4}Program Studi Diploma III Farmasi, Akademi Farmasi Santo Fransiskus Xaverius, Jl.Hogor Hini, Kel.Kota Uneng, Maumere, Nusa Tenggara Timur 86113, Indonesia
Email: tarsisiusjemading@gmail.com

One group of medications requiring specific safety measures is High-Alert Medications (HAM), which are drugs that carry a heightened risk of causing significant patient harm when they are used in error [5]. Although errors involving HAM may not necessarily occur more frequently than errors involving other medications, their consequences can be more devastating to patients [4]. Therefore, Institute for Safe Medication Practices (ISMP) recommends special safeguards for HAM, including standardizing medication ordering, storage, preparation, and administration; improving access to medication information; limiting access to high-alert medications; using auxiliary labels; employing clinical decision support and automated alerts; and using redundancies such as automated or independent double checking when necessary [4]. In addition, ISMP recommends layering multiple risk-reduction strategies throughout the medication-use process, with strategies addressing system vulnerabilities across prescribing, dispensing, administration, and monitoring [4].

Medication safety risks may also increase because of similarities in medication names or appearances, commonly referred to as Look-Alike Sound-Alike (LASA) medications, which may increase the likelihood of errors during medication selection or retrieval [6]. LASA management requires strategies that help healthcare professionals distinguish medications with similar names or appearances, including special labeling, physical separation, and the use of Tall Man Lettering [6], [7]. Karet (2023) demonstrated that medication-name pairs recommended for Tall Man Lettering had relatively high linguistic similarity, with a mean POCA score of 69.5 ± 9.7 . Evidence on Tall Man Lettering also indicates that this strategy may help reduce medication-selection errors, although its effectiveness in preventing name related errors should be considered together with other safety strategies [8]. Therefore, LASA management should be viewed as part of a broader risk-control system that combines multiple strategies to reduce the likelihood of medication-selection errors [8].

In hospital practice, HAM and LASA management involves various safety strategies, including the establishment of medication lists, storage, labeling, physical separation, double checking, and incident reporting and follow up [4], [9]. Hospital Accreditation Standards (STARKES) 2024 assesses several aspects of HAM management through indicators covering HAM policies and lists, storage, labeling, double checking, incident reporting, and incident follow-up. STARKES 2024 also stipulates that the HAM list should be evaluated and updated at least annually based on incident reports [9]. This requirement emphasizes that medication-safety management should incorporate systematic review of local risk information rather than relying solely on established procedures.

Previous studies have demonstrated variability in HAM and LASA management across healthcare facilities, with differences reported in LASA labeling, placement, storage, and the use of Tall Man Lettering [6], [10], [11]. These findings indicate that the implementation of LASA management strategies remains inconsistent across healthcare facilities, particularly in medication labeling, placement, and differentiation strategies. ISMP further recommends that healthcare organizations use information on medication-safety risks and errors from internal and external sources, assess their vulnerability to similar events, and implement appropriate risk-reduction strategies [4], [12]. Thus, medication lists and safety practices should be responsive to the risks identified within individual healthcare facilities rather than treated as entirely static components.

Although previous studies have evaluated specific aspects of HAM and LASA management, such as storage, labeling, placement, and Tall Man Lettering, further evaluation is needed to connect external standards, local medication lists, hospital standard operating procedures (SOP), medications actually available, and the implementation of STARKES indicators [6], [10], [13]. Recent Indonesian studies have primarily evaluated specific components of HAM or LASA management, whereas integrated

evaluations combining STARKES 2024 indicators, ISMP references, hospital SOP, and direct observation remain limited in Indonesian hospital settings [6], [10]. In this study, alignment refers to the consistency between external medication safety references, hospital defined procedures and medication lists, medications physically available in the Pharmacy Department, and the implementation of applicable STARKES 2024 requirements. Accordingly, the study compared the ISMP HAM reference list with the hospital HAM list, compared hospital listed medications with observed stock, and evaluated the implementation of HAM and LASA management practices against applicable STARKES 2024 indicators and hospital SOP requirements.

An integrated approach is important because HAM lists and medication safety practices need to be aligned with the risks and medication-use characteristics identified within individual healthcare facilities [4]. ISMP recommends that each medication included on a facility's HAM list be supported by a robust set of risk-management processes covering as many stages of the medication use process as feasible [4]. STARKES 2024 also incorporates incident reporting and follow up as components of HAM management, allowing evaluation to extend beyond procedural compliance to include learning from risks occurring in clinical practice [9].

These reference frameworks served distinct roles in the evaluation. STARKES 2024, established through Kepmenkes No. HK.01.07/MENKES/1596/2024, was used as the national hospital accreditation standard, including SKP 3 requirements for HAM and LASA management. Hospital SOPs were used to assess conformity with locally established medication management procedures, while ISMP references were used primarily for HAM identification and medication safety practices. Tall Man Lettering was considered a supplementary strategy for differentiating sound-alike medication names rather than an ISMP benchmark for LASA management.

The evidence regarding Tall Man Lettering is not entirely consistent, its role in distinguishing

medication names with high similarity makes it a relevant strategy for LASA medication management. Karet (2023) demonstrated substantial linguistic similarity among medication name pairs recommended for Tall Man Lettering, supporting the relevance of this strategy for distinguishing similar medication names [7]. Lohmeyer et al. (2022) reported that the use of mixed case lettering reduced medication selection errors from 5.3% to 0.7% among critical care nurses, while emphasizing that preventing medication name errors requires a multimodal approach [14]. Therefore, evaluating Tall Man Lettering together with LASA labeling and physical separation is relevant for assessing the comprehensiveness of medication differentiation strategies in hospital practice.

Accordingly, this study aimed to evaluate HAM and LASA medication management at the study sites of RSUD dr.T.C. Hillers Maumere by assessing (1) concordance of HAM lists between the ISMP reference, hospital SOP, and observed medication stock, (2) compliance of observed HAM and LASA management practices with applicable STARKES 2024 and hospital SOP requirements, and (3) item level and process level gaps requiring further improvement.

Results and Discussion

This study evaluated the management of High-Alert Medications (HAM) and Look-Alike Sound-Alike (LASA) medications at the Pharmacy Department of RSUD dr. T.C. Hillers Maumere by comparing the Institute for Safe Medication Practices (ISMP) reference list, hospital standard operating procedures (SOP), medications actually available in the pharmacy, and the 2024 Hospital Accreditation Standards (STARKES). A total of 131 HAM and LASA medication items were observed during data collection, compared with 139 items listed in the hospital SOP and 42 items in the ISMP reference list. The difference between listed and observed items reflects medications included in the reference lists that were not physically present in the pharmacy during data collection. The results are presented in stages, including the distribution and characteristics of HAM and LASA medications according to their

reference sources, the observed compliance with HAM and LASA management requirements, and the

fulfillment of HAM and LASA management indicators based on STARKES 2024.

Table 1. Distribution of Medication Items According to HAM and LASA Categories and Reference Sources

Medication category	Distribution n (%)			
	Number of items	ISMP	Hospital SOP	Observed
HAM only	29 (20.7)	28 (66.7)	28 (20.1)	27 (20.6)
LASA only	96 (68.6)	n/a	96 (69.1)	92 (70.2)
HAM and LASA	15 (10.7)	14 (33.3)	15 (10.8)	12 (9.2)
Total	140 (100.0)	42 (100.0)	139 (100.0)	131 (100.0)

Items in the Observed column are fewer than Hospital SOP items because some listed medications were not physically available in the pharmacy during data collection (July 2026). HAM = High-Alert Medication; LASA = Look-Alike Sound-Alike; ISMP = Institute for Safe Medication Practices; SOP = Standard Operating Procedure; n/a = not applicable.

Table 1 shows the distribution of medication items according to the HAM and LASA categories and the reference sources used in the study. Most of the identified items were classified as LASA only, while others were classified as HAM only or had characteristics of both HAM and LASA. The ISMP list and the hospital SOP were used as reference sources for the identification and classification of medication items, whereas the “observed” column indicates the items actually found in the Pharmacy Department during the study and subsequently included as objects of medication-management observation. Therefore, the number of observed items was not necessarily the same as the number of items listed in each reference source.

The items recorded in the “observed” column subsequently served as the basis for the analyses presented in Tables 2 and 3. Accordingly, Table 2 assessed the management of 39 observed HAM items, whereas Table 3 assessed the characteristics and management of 104 observed LASA items.

The difference in coverage between the ISMP list and the hospital SOP indicates that the HAM list established at the hospital level was not completely identical to the external reference list. ISMP provides a list of potential high-alert medications developed from medication error reports, evidence from the literature, studies of medications frequently involved in harmful errors, and input from practitioners and medication safety experts [5]. The hospital HAM list,

meanwhile, reflects the medications designated as high-alert within the local institutional context. Therefore, differences between the two lists may reflect differences in medication availability, medication use patterns, local management needs, and medication related incidents within the hospital. The establishment and evaluation of the HAM list should also consider medication error reports and patient safety incidents as sources of information for identifying medications requiring special safeguards and for periodically evaluating the relevance of the HAM list [15], [16], [17].

In this study, differences were identified between the ISMP HAM list and the hospital SOP. Neostigmine was the only medication listed in the hospital SOP but not included in the ISMP HAM list. Conversely, medications listed in the ISMP list but not included in the hospital SOP were medications that were not available at the hospital. Therefore, these differences did not indicate differences in risk assessment but rather reflected differences in medication availability across institutions.

This finding indicates that the hospital HAM list may include items established based on local considerations and needs [18], [19]. Therefore, the HAM list should be evaluated periodically by considering external references, the characteristics of medication use within the hospital, and data on medication-related events or incidents [17], [20].

Neostigmine was included in the hospital HAM list but not in the 2024 ISMP HAM list used for comparison. Although neostigmine is used to reverse neuromuscular blockade during the perioperative period and may cause adverse effects such as bradycardia, hypotension, and bronchospasm [21], [22], [23]. These clinical considerations alone do not establish whether it should be classified as a HAM in this hospital. The present study did not conduct a formal medication-risk assessment or specifically analyze medication errors involving neostigmine. Therefore, its inclusion should be regarded as a hospital specific designation that warrants further evaluation based on local medication-use patterns, available incident data, and relevant external references.

Table 2 shows that HAM management in the Pharmacy Department was implemented consistently in terms of labeling. All observed HAM items were labeled both on the smallest unit (vials, ampoules, infusion bags, bottles, and similar forms) and on the medication packaging/carton. Specific labeling is one of the strategies for HAM management to increase medication visibility and healthcare professionals' awareness of potential medication use

errors. Visual markers on packaging and storage locations can help distinguish HAM from other medications and attract staff attention when medications are selected or prepared [16], [18]. The 100% labeling compliance observed in this study was higher than the 57.24% reported at At-Tin Husada Ngawi Islamic Hospital [24], indicating better implementation of HAM labeling in the present study. The clarity and accuracy of information on labels are also important because labeling errors or incomplete labeling may contribute to medication administration errors and potentially affect patient safety [25].

Regarding storage, 32 of 39 observed HAM items (82.1%) met the storage requirements, while 7 items (17.9%) were non-compliant. Of the seven non-compliant items, five were insulin preparations, one was an oxytocin preparation, and one was a large-volume 3% NaCl preparation. The insulin and oxytocin preparations were stored in a medication refrigerator together with regular medications and were therefore considered non-compliant because they were not physically segregated as HAM. Large-volume 3% NaCl was not placed in the designated HAM cabinet because of the bulky nature of its formulation.

Table 2. Compliance of HAM Management

HAM Management Parameter	Compliance n (%)		
	Compliant	Non-compliant	Total
HAM labeling on individual units	39 (100)	0 (0)	39 (100)
HAM labeling on boxes	39 (100)	0 (0)	39 (100)
HAM storage	32 (82.1)	7 (17.9)	39 (100)

In contrast, opioids were stored in a designated narcotics cabinet and were not classified as non-compliant because their storage in a restricted access narcotics cabinet was considered appropriate for their specific storage requirements. These findings indicate that the remaining gaps in HAM storage were primarily related to the physical segregation of refrigerated medications and the storage of large-volume electrolyte solutions.

In this study, the large volume formulation of 3% sodium chloride was not stored in the designated

HAM cabinet because of its bulky size. Although this finding does not constitute evidence that a medication error occurred, storage outside the designated HAM area may reduce the visual differentiation of hypertonic sodium chloride from other medications and potentially increase the risk of medication-selection errors [26]. Errors involving hypertonic sodium chloride may lead to serious complications, including electrolyte disturbances, metabolic acidosis, or pulmonary edema [27], [28]. Therefore, appropriate storage and clear

differentiation of 3% sodium chloride remain important components of risk reduction and patient-safety strategies [19].

Previous studies have shown that compliance with HAM storage requirements varies across hospitals in Indonesia. At At-Tin Husada Ngawi Islamic Hospital, storage compliance reached 90.34%, whereas labeling compliance was only 57.24% [24]. In contrast, several hospitals reported very high levels of compliance, including 99% at Hospital X Banjarmasin and 100% at Juanda Kuningan Hospital and Dr. Murjani Sampit Regional Hospital [29], [30], [31]. However, variation was also observed across medication groups. At Solo Oncology Hospital, storage compliance for concentrated electrolytes reached 100%, whereas compliance for cytotoxic medications was only 66.67% [32]. Wahyuni et al. (2021) reported an overall HAM storage compliance rate of 77.14% and identified several HAM items whose storage was not consistent with the hospital

SOP. The study also indicated that storage non-compliance may be associated with facility conditions and limited storage space [33]. Furthermore, at Hospital X Cibinong, compliance increased from 49.99% to 76.54% following increased supervision [34]. These findings indicate that HAM management compliance is not always consistent and may be influenced by the consistency of implementation and supervision in practice.

Table 3 shows that the management of the 104 observed LASA items met the requirements for labeling and adequate storage separation. All items in the sound-alike, look-alike, and combined categories were provided with LASA labels and stored with appropriate separation. The implementation of these two strategies is important for increasing awareness of medications with similar names or appearances and reducing the risk of medication selection errors [16].

Table 3. Characteristics and Compliance of LASA Medication Management

	Compliance n (%)			
	Sound-alike	Look-alike	Both look-alike and sound-alike	Total
Number of items	94 (90.4)	6 (5.8)	4 (3.8)	104 (100.0)
Appropriate LASA labeling	94/94 (100.0)	6/6 (100.0)	4/4 (100.0)	104 (100.0)
Appropriate storage with adequate separation	94/94 (100.0)	6/6 (100.0)	4/4 (100.0)	104 (100.0)
Appropriate Tall Man Lettering	29/94 (30.9)	n/a	0/4 (0.0)	29 (27.9)

LASA = Look-alike Sound-alike; n/a = not applicable. Tall Man Lettering was applied only to sound-alike medications because it highlights distinctive letter patterns in similar drug names and is not applicable to look-alike medications differentiated by physical appearance alone. The denominator for Tall Man Lettering was 94 observed sound-alike medication items.

Previous studies have shown that labeling and physical separation are important components of LASA medication management. At Hermina Tangerang Hospital, storage compliance reached 99.91%, whereas compliance with labeling and placement was only 71.42% and 71.29%, respectively [6]. Inappropriate placement of LASA medications that were still stored in close proximity was also found at pharmacies in Cimahi, with an overall storage system compliance rate of 86.36% [35]. In contrast, several facilities demonstrated high storage compliance, including 100% for the storage process at Ngampilan Community Health Center and 94.44% for the storage system at Pharmacy X Bandung [30],

[36]. These variations indicate that overall storage compliance does not always ensure consistent labeling and separation of LASA medications, although both aspects play a role in preventing medication selection errors [33].

Tall Man Lettering was applied to 29 of 94 sound-alike items (30.9%), representing 27.9% of all observed LASA items. The 29 items were sound-alike medications for which Tall Man Lettering had been implemented according to hospital practice. The remaining 65 sound-alike items did not have Tall Man Lettering applied. Based on the study criteria, Tall Man Lettering was focused on sound-alike items because it highlights the distinctive portions of

medication names with similar names or pronunciations [16]. The indicator was not applicable to look-alike items, while no Tall Man Lettering implementation was identified among items categorized as both look-alike and sound-alike. Tall Man Lettering is recommended as one strategy to differentiate similar medication names and reduce the risk of LASA related errors [7], [8], [11]. In a hospital study in Thailand, Supapaan et al. reported that confusion involving similar medication names accounted for 64.62% of LASA medication errors, highlighting the relevance of medication-name similarity as a patient-safety concern in the Southeast Asian hospital context [37].

Overall, LASA management in this study was more consistently implemented through labeling and physical separation, both of which achieved 100% compliance, whereas Tall Man Lettering was applied to 30.9% of sound-alike items. This pattern is consistent with the variability reported across healthcare facilities, where LASA labeling, placement, storage, and Tall Man Lettering have shown different levels of implementation [6], [10], [11]. Karet (2023) reported substantial linguistic similarity among medication name pairs recommended for Tall Man Lettering, with a mean POCA score of 69.5 ± 9.7 . However, evidence regarding its effectiveness in preventing medication errors remains inconsistent. Lohmeyer et al. (2022) reported a significantly lower medication selection error rate with Tall man Lettering than with non-Tall man Lettering labels in a randomized in situ simulation involving 30 critical care nurses, with error rates of 0.7% and 5.3%, respectively [14]. However, Lambert et al. (2022) emphasized that label based interventions alone are unlikely to prevent all wrong drug errors and advocated a multimodal approach to medication safety [8]. Therefore, the limited application of Tall Man Lettering in this study should not be interpreted in isolation as evidence of suboptimal LASA management, because labeling and physical separation were consistently implemented as additional safeguards.

Based on Table 4, Of the 10 medication-safety indicators assessed according to STARKES 2024, 7 (70.0%) were classified as compliant. This percentage represents a descriptive proportion of the assessed indicators, with each indicator counted equally, and should not be interpreted as a weighted performance score or a formal STARKES 2024 accreditation score. The hospital had a documented HAM list and had implemented key medication safety practices, including HAM storage, routine pharmacist supervision, double checking, incident reporting, and incident follow-up. However, three indicators were not fully compliant, namely the absence of periodic HAM list updating, inconsistent HAM and LASA management across hospital service area, particularly in the emergency trolley, and non-compliance with concentrated electrolyte storage requirements in the Operating Room and ICU.

The absence of periodic HAM list updating is an important finding. STARKES 2024 requires hospitals to evaluate and update the High-Alert and LASA medication lists at least annually by considering local, national, and international incident reports [9]. Therefore, updating the HAM list should be regarded not merely as an administrative activity but as part of risk assessment to ensure that the list remains relevant to changes in medication use and medication safety risks. Kurniawati et al. (2026) demonstrated that HAM lists may require refinement or the addition of specific medications based on recent medication error reports. Similarly, Harper et al. (2021) showed that medication safety event analysis can identify medications associated with serious risks that are not included in the ISMP acute care HAM list. To address this gap, the Pharmacy and Therapeutics Committee (KFT), in collaboration with the Pharmacy Department and relevant clinical units, should establish a structured periodic review of the HAM and LASA lists. The review should be conducted at least annually, or more frequently when significant medication related incidents or safety alerts occur, using data from the hospital medication incident reporting system and relevant national and international medication-safety alerts.

Incident reporting can provide information on the medications, processes, and risks involved in medication errors and can support prioritization of risk-reduction measures [38]. Such reports may also contribute to changes in service processes, management practices, and awareness of patient-

safety risks [39]. Thus, incident reporting and follow-up should be linked to risk assessment and periodic HAM list evaluation, including consideration of adding or refining specific medications based on local medication safety events [16].

Table 4. Compliance of HAM Management Based on STARKES

STARKES 2024	Assessment Indicator	Operational Indicator	Evaluation Result
SKP 3 EP 1	Documented HAM list	An officially established HAM list is available	Compliant
SKP 3 EP 3	HAM list updating	The HAM list is evaluated and updated at least once a year based on incident reports	Not compliant
SKP 3 EP 2	HAM management	HAM and LASA management is implemented uniformly throughout all hospital service area.	Not compliant in emergency trolley
PKPO 3 (a)	HAM storage	HAM are stored in designated cabinets/shelves labeled "High-alert"	Compliant
SKP 3.1 EP 1	Concentrated electrolyte storage	Concentrated electrolytes are stored only in the Pharmacy Department, except in designated units	Compliant (except in the operating room and ICU)
SKP 3.1 EP 2	Concentrated electrolyte storage in clinical units	Concentrated electrolytes outside the Pharmacy Department are stored according to applicable requirements	Compliant
PKPO 3 (c)	Routine supervision	Routine supervision of HAM storage is conducted by pharmacists	Compliant
PKPO 6 (c)	<i>Double checking</i>	<i>Double checking</i> is performed before HAM administration	Compliant
PKPO 7.1 (b)	Incident reporting	A medication-error reporting system for HAM/LASA is available	Compliant
PKPO 7.1 (c)	Incident follow-up	Documentation of incident follow-up is available	Compliant

The lack of consistent HAM management across all service area also indicates that hospital level policies do not necessarily ensure consistent operational implementation. In this study, 3 of 10 HAM related STARKES indicators were not fulfilled, including inconsistent HAM management across service area, particularly in the emergency trolley. STARKES 2024 emphasizes consistent management of high risk medications to reduce the risk of harm from medication use errors [9]. Overall, these findings indicate that the hospital has established the main components of HAM management, but greater integration of incident reporting, risk assessment,

and periodic HAM list updating is needed to ensure that the list remains dynamic and reflects the actual medication safety risks faced by the hospital [4], [16], [26].

Based on Table 5, most of the LASA management indicators assessed according to STARKES 2024 were fulfilled. The hospital had documented LASA management regulations and a LASA list, implemented LASA management consistently, and had arrangements for storage and procedures for handling prescriptions containing LASA/NORUM medications. However, 1 of 6 LASA

related STARKES indicators was not fulfilled, namely the periodic updating of the LASA list. The absence of periodic LASA list updating is an important finding because STARKES 2024 requires hospitals to evaluate and update the High-Alert and LASA medication lists at least once a year based on local, national, and

international incident reports [9]. Therefore, the existence of a documented LASA list should be accompanied by a periodic evaluation mechanism to ensure that the list reflects changes in medications used and medication-error risks identified in clinical practice [16].

Table 5. Compliance of LASA Management Based on STARKES 2024

STARKES 2024	Assessment Indicator	Operational Indicator	Evaluation Result
SKP 3 EP 2	LASA management policy	Written regulations for LASA management are available	Compliant
SKP 3 EP 1	Documented LASA list	An officially established LASA list is available	Compliant
SKP 3 EP 3	Updating the LASA list	The LASA list is evaluated and updated at least once a year based on incident reports	Not compliant
SKP 3 EP 2	LASA management	LASA management is implemented consistently throughout all hospital service area	Compliant
PKPO 3 (a)	LASA storage	LASA medications are stored according to hospital regulations	Compliant
PKPO 4.1	LASA management in prescribing	A prescription-management procedure is available for medications containing LASA/NORUM	Compliant

This finding becomes particularly relevant when considered alongside the results in Table 3. Although all observed LASA items had been labeled and stored with appropriate separation, Tall Man Lettering had not been applied to all sound-alike items. This condition indicates that the existence of hospital level LASA policies and lists does not automatically ensure that all LASA management strategies are optimally implemented at the operational level. Therefore, periodic evaluation of the LASA list should be accompanied by a review of the effectiveness of the management strategies implemented in practice.

Overall, the findings in Table 5 indicate that the hospital's LASA management system has a relatively comprehensive policy and procedural foundation but requires strengthening in the area of list updating. Such updates should be conducted periodically and based on incident reports and risk assessment so that LASA management can adapt to patterns of medication use and medication-safety issues identified within the hospital.

Conclusion

This study demonstrated that HAM and LASA medication management at RSUD dr. T.C. Hillers Maumere was generally well implemented at the item level, but gaps remained in storage practices and process-level implementation. Although labeling compliance was 100% for both HAM and LASA medications and physical separation compliance was 100% for LASA medications, HAM storage compliance and Tall Man Lettering application remained incomplete. The findings also identified discrepancies between the hospital HAM list and the ISMP reference, as well as gaps in periodic list review and consistent implementation across service areas. These findings highlight the need for a structured, risk-based review of HAM and LASA lists and consistent implementation of medication-safety procedures across clinical areas. The Pharmacy and Therapeutics Committee, Pharmacy Department, and relevant clinical units should collaborate to support periodic review using available incident data and relevant safety alerts. Given the single-center, cross-sectional design, these findings should be interpreted within the context of

the study setting. Strengthening this integrated process may support continued improvement in HAM and LASA medication management.

Materials and Methods

Study Design

This study used an observational evaluative design to assess the management of High-Alert Medications (HAM) and Look-Alike Sound-Alike (LASA) medications at RSUD dr. T. C. Hillers Maumere, Indonesia. The evaluation was based on the 2024 Hospital Accreditation Standards (STARKES), Institute for Safe Medication Practices (ISMP) recommendations, and the hospital's internal Standard Operating Procedures (SOP). The study assessed the conformity of HAM and LASA management practices with these standards and identified gaps between established requirements and their implementation in practice. No inferential statistical tests were applied, as the study uses a descriptive evaluative approach to assess compliance against established standards.

Study Setting and Period

The study was conducted at RSUD dr. T.C. Hillers Maumere, Indonesia. Direct observation was conducted once during July 2026 in the Pharmacy Department, emergency trolley, Operating Room, and Intensive Care Unit (ICU). Data collection was conducted in July 2026. The study focused on medication management practices and supporting documents available at RSUD dr. T. C. Hillers Maumere during the study period.

Data Sources and Study Materials

Data were obtained from RSUD dr. T. C. Hillers Maumere, including hospital policies and SOP related to HAM and LASA management, the hospital's HAM and LASA lists, medications available in the Pharmacy Department, medication-storage facilities, medication labels and storage area, and records related to medication incidents. External references used for the evaluation included the applicable ISMP recommendations and STARKES 2024 indicators.

Study Sample

The study sample consisted of medication items identified through comparison of the ISMP reference list, the HAM and LASA lists established by RSUD dr.T.C.Hillers Maumere, and medications physically available in the Pharmacy Department during the study period. The hospital SOP listed 139 medication items, while the ISMP reference list contained 42 medications classified as HAM. The ISMP reference was used as a reference for HAM identification and did not provide a LASA list. Medication items listed in the hospital SOP but not physically available in the Pharmacy Department during data collection were excluded from the observed sample but remained included in the medication list comparison. A total of 131 medication items were therefore available for direct observation. Duplicate entries referring to the same medication item were consolidated before analysis. Medication items were defined based on the medication name, with strength, dosage form, and formulation considered when necessary to distinguish products. The identified medication items were classified according to their HAM and/or LASA status.

Data Collection Procedure

Data collection was conducted once during July 2026 through document review and direct observation. Direct observation covered the Pharmacy Department, emergency trolley, Operating Room, and Intensive Care Unit (ICU). Documentary assessment, including review of the hospital HAM/LASA lists, relevant SOPs, and applicable STARKES 2024 requirements, was conducted directly by the principal researcher. Document review also covered medication-storage facilities and labels, medications available during the observation, and relevant medication-safety documentation. The hospital SOP used as the local procedural reference was SOP No. 05/IFRS/PKPO/X/2022, "Prosedur Penyimpanan Obat dan Bahan Medis Habis Pakai," Revision 4. External references included the applicable STARKES 2024 indicators and the ISMP reference used for HAM identification.

Medication incident records, where available, were reviewed by the principal researcher only as supporting documentary evidence for applicable medication-safety requirements concerning incident reporting and follow-up. These records were not independently analyzed as a study dataset and therefore did not contribute quantitative findings to the Results.

Physical observation of medication items, particularly medication labeling and storage practices, was assisted by a pharmacy student serving as a research assistant. Before data collection, the research assistant received training from the principal researcher on the assessment checklist, observation procedures, operational definitions of HAM and LASA management, applicable hospital SOP requirements, and criteria for recording compliance. The completed observation forms were subsequently reviewed by the principal researcher for completeness and consistency. Because physical item-level observations were conducted by a single research assistant, formal inter-rater reliability or observer-agreement testing was not performed. For potentially ambiguous conditions, compliance was determined according to the applicable STARKES 2024 indicator and hospital SOP. For example, refrigerated HAM were considered compliant only when they were appropriately stored and physically segregated from non-HAM medications.

Tall Man Lettering was assessed at the medication item level using the sound-alike medication list specified in the hospital SOP as the reference list. Of the sound-alike medications listed in the SOP, 94 medication items were physically available and therefore eligible for direct observation during data collection. Tall Man Lettering was recorded for each eligible medication item based on its actual labeling in practice. The denominator for Tall Man Lettering was therefore 94 medication items, rather than the number of medication-name pairs, because sound-alike relationships in the hospital list may involve two or more medication names within a single similarity group.

Assessment Checklist and Measurement

HAM and LASA management at RSUD dr. T. C. Hillers Maumere were assessed using checklists developed based on the relevant STARKES 2024 indicators, ISMP recommendations, and hospital SOP. Each applicable indicator was assessed and categorized according to its compliance with the established requirements. For potentially ambiguous conditions, compliance was determined according to the specific requirements stated in the applicable STARKES indicators and hospital SOP. For example, HAM requiring refrigeration were considered compliant only when they were appropriately stored and physically segregated from non-HAM medications. The assessment also included the availability and implementation of policies and medication lists, list updating, storage, labeling, supervision, incident reporting, and incident follow up.

Assessment and Recording of Findings

Each assessment item was recorded using a binary Yes/No format. A check mark (✓) was used when the observed practice or documentary evidence was in accordance with the applicable STARKES 2024 requirement or hospital SOP, whereas a cross mark (X) was used when the requirement was not met. Items that were not applicable to the assessed medication or setting were recorded as “not applicable” (n/a). The Yes/No and ✓/X classifications were used as a study specific operational method to facilitate descriptive evaluation and should not be interpreted as the formal accreditation scoring or level of fulfillment system of STARKES 2024.

For item level assessments, such as HAM storage, each observed medication item was assessed individually against the applicable storage requirements. In contrast, STARKES 2024 indicators were assessed at the indicator level based on the available documentary and observational evidence. Therefore, fulfillment of an indicator does not necessarily indicate that all individual medication items met the corresponding requirement.

Data Analysis

Data obtained from RSUD dr. T.C. Hillers Maumere were analyzed descriptively. Findings recorded as Yes/✓ and No/X were summarized as frequencies and percentages for each applicable assessment item. The analysis included the distribution of medication items according to HAM and LASA categories, comparison between the ISMP reference and the hospital HAM list, comparison between hospital listed medications and observed medication stock, and assessment of HAM and LASA management practices against the applicable STARKES 2024 and hospital SOP requirements. The

findings were used to identify item level and process level gaps between established requirements and observed practice. No inferential statistical tests were applied, as the study used a descriptive evaluative approach.

The conceptual crosswalk used in this study is presented in Figure 1. It illustrates how the ISMP reference, hospital SOP and medication lists, observed medication practices, and applicable STARKES 2024 requirements were considered together to evaluate medication-list concordance, management compliance, and gaps in HAM and LASA medication management.

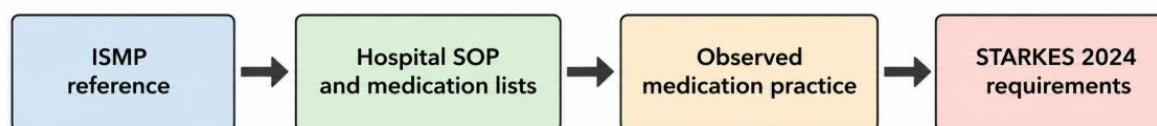


Figure 1. Conceptual crosswalk for evaluating alignment between the ISMP reference, hospital SOP and medication lists, observed medication practices, and STARKES 2024 requirements.

Ethical Considerations

This study received an ethical exemption from the Health Research Ethics Committee of Universitas Muhammadiyah Lamongan (No. 219/EC/KEPK-S1/06/2026), valid from 22 June 2026 to 22 June 2027.

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