



Evaluation of High-Alert Drug Storage in the Central Pharmacy of RSUD Ratu Zalecha Martapura

(Evaluasi Penyimpanan Obat High Alert di Apotek Sentral RSUD Ratu Zalecha Martapura)

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ABSTRACT

Background: High-alert drugs require special attention when used because they can cause adverse reactions. High-alert drugs are classified into 3, namely, concentrated electrolytes, LASA, and cytostatics. **Objectives:** This study aimed to determine the evaluation of High-alert drug storage at the central pharmacy of Ratu Zalecha Martapura Hospital. **Material and Methods:** The research was conducted using a descriptive method, with observational data collection using an observation checklist sheet. The population and study sample took data on all High-alert medicines at the central pharmacy of Ratu Zalecha Martapura Hospital. **Results:** High alert drug storage was based on SOP, placed in a central pharmacy using the FIFO and FEFO methods, was placed in a separate place based on cytotoxic drug groups, electrolyte concentrates, and others. High alert drug storage according to storage temperature requirements for each drug (cold temperature and room temperature), was labeled "high alert" and electrolyte concentrates were only available in pharmaceutical installations. **Conclusions:** The conclusion of this research was High-alert drug storage in the pharmaceutical installation of Ratu Zalecha Martapura Hospital have been qualified seven (7) criteria based on Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of 2016. Good and correct drug storage is very important in order to maintain the quality and quality of drugs.



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INTRODUCTION

Pharmaceutical services are pharmaceutical work prioritizing patient safety (patient-oriented) to avoid medication errors. Pharmaceutical activities in hospitals include clinical pharmacy services and management of pharmaceutical supplies. Storage as part of pharmaceutical work must guarantee efficacy, quality, and safety during the storage period (Minister of Health of the Republic of Indonesia, 2016).

High-alert drugs must be vigilant because they have a high risk of sentinel events and Adverse Drug Reactions (ROTD). Drugs grouped into High-alert are drugs that look similar and sound similar (NORUM/LASA), electrolyte concentrates, and cytostatics (Minister of Health of the Republic of Indonesia, 2016). The results of research by the United States Department of Health and Human Service revealed that High-alert drugs with the highest risk that are often used are insulin, anticoagulants, narcotics, sedatives, and electrolyte concentrates (Haryadi and Trisnawati, 2022). Hospitals must strive to establish and implement Standard Operating Procedures (SPO) for High-alert drugs to minimize the risk of sentinel events and ROTD due to inappropriate drug use (Abdallah, 2014). According to Minister of Health Decision Nu. 1128 of 2022, efforts that can be made to improve patient safety include storage in a separate place, access control, labelling on packaging and medicine boxes, double-checking, and implementing High-alert drug management in all areas of the hospital. According to research by Hidayati et al., (2021) at the Inpatient Pharmacy Installation of Mitra Palumbon Hospital, the results of the suitability of High-alert drug storage were 87.08%, and 12.92% were not suitable. Storage discrepancies are due to the absence of dosage strength in the storage area, stock cards, and High-alert labels. Another study by Haryadi and Trisnawati (2022) at the Juanda Kuningan Hospital Pharmacy Installation obtained a percentage of High-alert drug storage suitability of 100%.

Ratu Zalecha Martapura Regional General Hospital is categorized as a Class B hospital with a plenary predicate owned by the Banjar Regency Government. Ratu Zalecha Hospital Central Pharmacy consists of Outpatient and Inpatient Pharmacy Service Units with High-alert drugs totaling 71 items. Therefore, researchers are interested in researching the Evaluation of High-alert Drug Storage at the Central Pharmacy of Ratu Zalecha Martapura Hospital because the central pharmacy has the most significant number of patient visits.

MATERIAL AND METHODS

Type of Research

The research was conducted descriptively by observing High-alert drugs in the central pharmacy of Ratu Zalecha Martapura Hospital.

Population and Sample

The population of this study was High-alert drugs in the central pharmacy of Ratu Zalecha Martapura Hospital. Researchers used a total sampling technique that used all populations as samples (Yuliana Sari, 2019). The number of drug samples used was 71 items.

Data Collection Technique

The process of collecting data by making direct observations of High-alert drug storage using checklist table tools.

Data Processing Technique

Data processing technique through filling in the *checklist* in the *High-alert* drug storage observation table (Suhartini and Ambo Ralla, 2022). The *High-alert* Drug Guidelines used are based on Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu.72 of 2016. *Checklist* data is presented according to the formula:

$$\text{Formula: Score} \times 100\%$$

The score calculation is based on the following criteria:

As per 1

Not suitable : 0

Data were analyzed descriptively with the percentage of the suitability of the *High-alert* drug storage system divided based on the following criteria (Sandi, 2018).

Very good : 81-100%

Good : 61-80%

Simply : 41-60%

Less : 21-40%

Very less : 1-20%

RESULTS AND DISCUSSION

Based on the results of observations regarding the Evaluation of High-alert Drug Storage at the Central Pharmacy of Ratu Zalecha Martapura Hospital (Table 1), 71 items of High-alert drugs were obtained and stored according to temperature and storage. The percentage of the number of High-alert drugs (Table 2) obtained results for concentrated electrolytes at 8.45%, cytostatics at 11.26%, and other High-alert drugs 80.29%The following is a list of High-alert drugs as follows:

Table 1. List of *High-alert* Drugs at the Central Pharmacy of Ratu Zalecha Hospital

Nu.	Therapy Class	Name of Medicine	Dosage Forms	Storage Temperature	Storage Area
1.	Concentrated Electrolyte	1. Potassium chloride 7.45%	Flash	< 30° C	Special concentrated electrolyte cabinet
		2. MgSO ₄ 20%	Flash	< 30° C	
		3. MgSO ₄ 40%	Flash	< 30° C	
		4. Dextrose 40%	Flash	< 30° C	
		5. Meylon 8.4	Flash	< 30° C	
		6. Otsu Copy 3	Flash	< 30° C	
2.	Narcotics	1. Codein	Tablet	< 30° C	Narcotic medicine cabinet
		2. Pethidine	Injection	< 30° C	
		3. Morphine Sulphate	Injection	< 25° - 30° C	
		4. MST	Tablet	< 25° C	
		5. Durogesic	Patch	< 30° C	
3.	Neuromuscular blockers	1. Atracurium	Injection	2° - 8° C	Special <i>High-alert</i> refrigerator
		2. Ketamine	Injection	15° - 20° C	<i>High-alert</i> injection special cabinet
		3. Prostigmin	Injection	< 25° C	<i>High-alert</i> injection special cabinet
		4. Rocuronium Bromide	Injection	2° - 8° C	Special <i>High-alert</i> refrigerator
Local Anesthesia	Local Anesthesia	1. Bupivacaine HCl	Injection	< 25° C	<i>High-alert</i> injection special cabinet
		2. Lidocaine	Injection	< 25° C	
		3. Lidocaine, epinephrine	Injection	< 25° C	
Inhalation General Anesthesia	Inhalation General Anesthesia	1. Isoflurane	Injection	15° - 30° C	<i>High-alert</i> injection special cabinet
		2. Sevoflurane	Injection	< 25° C	
General Anesthesia IV	General Anesthesia IV	1. Propofol	Injection	< 25° C	<i>High-alert</i> injection special cabinet
Sedative Agent	Sedative Agent	2. Midazolam	Injection	< 25° C	

Nu.	Therapy Class	Name of Medicine	Dosage Forms	Storage Temperature	Storage Area
4.	Anticoagulants/ Thrombolytics	1. Heparin	Injection	< 25° C	<i>High-alert</i> injection special cabinet
		2. Fondaparinux	Injection	< 25° C	<i>High-alert</i> injection special cabinet
		3. Fibrion (Streptokinase)	Injection	< 25° C	Special <i>High-alert</i> refrigerator
		4. Simarc 2 mg (Warfarin 2 mg)	Tablet	< 25° C	<i>High-alert</i> tablet cabinet
		5. Somatostatin	Injection	< 25° C	<i>High-alert</i> injection special cabinet
5.	Antiarrhythmics	1. Amiodaron	Injection	< 25° C	<i>High-alert</i> injection special cabinet
		2. Tiaryt 200 mg (Amiodarone 200 mg)	Tablet	< 30° C	<i>High-alert</i> tablet cabinet
6.	Adrenergic Agonist	1. Epinephrine	Injection	< 25° C	Special <i>High-alert</i> refrigerator
		2. Norepinephrine	Injection	< 25° C	
7.	Inotropic	1. Digoxin	Tablet	< 30° C	<i>High-alert</i> tablet cabinet
		2. Digoxin	Injection	< 30° C	<i>High-alert</i> injection special cabinet
		3. Dopamine	Injection	< 30° C	
		4. Dobutamine	Injection	< 30° C	
8.	Oral Antidiabetics	1. Acarbose 50 mg	Tablet	< 30° C	<i>High-alert</i> tablet cabinet
		2. Acarbose 100 mg	Tablet	< 30° C	
		3. Gliclazide 60 mg	Tablet	< 30° C	
		4. Gliclazide 80 mg	Tablet	< 30° C	
		5. Glibenclamide 5 mg	Tablet	< 30° C	
		6. Glimepiride 1 mg	Tablet	< 30° C	
		7. Glimepiride 2 mg	Tablet	< 30° C	
		8. Glimepiride 3 mg	Tablet	< 30° C	

Nu.	Therapy Class	Name of Medicine	Dosage Forms	Storage Temperature	Storage Area
		9. Glimepiride 4 mg	Tablet	< 30° C	
		10. Metformin 500 mg	Tablet	< 30° C	
		11. Metformin 850 mg	Tablet	< 30° C	
		12. Pioglitazone 15 mg	Tablet	< 30° C	
		13. Pioglitazone 30 mg	Tablet	< 30° C	
		14. Galvus (Vildagliptin)	Tablet	< 30° C	
9.	Insulin	1. Novorapid	Flexpen	2° - 8° C	Special <i>High-alert</i> refrigerator
		2. Novomix	Flexpen	2° - 8° C	
		3. Rhyzodeg	Flexpen	2° - 8° C	
		4. Levemir	Flexpen	2° - 8° C	
		5. Lantus	Flexpen	2° - 8° C	
		6. Humalog	Flexpen	2° - 8° C	
10.	Human Albumin	1. Human Albumin Biotest	Flash	< 25° C	Special <i>High-alert</i> refrigerator
		2. Octalbin 25% 50 cc	Flash	< 25° C	
		3. Octalbin 25% 100 cc	Flash	< 25° C	
		4. Albapure	Flash	< 25° C	
11.	Contrast Material	1. Iopamiro 350/50	Flash	15° - 25° C	<i>High-alert</i> injection special cabinet
		2. Iopamiro 370/50	Flash	15° - 25° C	
		3. Xolmetras 350/50	Flash	15° - 25° C	
12.	Oxytocin IV	1. Oxytocin	Injection	2° - 8° C	Special <i>High-alert</i> refrigerator
13.	Oral Chemotherapy Drugs	1. Tamofen 10 mg	Tablet	<30° C	<i>High-alert</i> tablet cabinet
		2. Hydroxycarbamide 500 mg	Tablet	< 25° C	
		3. Neoral Sandimun 25 mg	Tablet	< 30° C	
		4. Neoral Sandimun 50 mg	Tablet	< 30° C	
		5. Taceral	Tablet	< 25° C	

Nu.	Therapy Class	Name of Medicine	Dosage Forms	Storage Temperature	Storage Area
		6. Letraz 2.5 mg	Tablet	< 30° C	
	Immunosuppressants	1. Imuran	Tablet	< 25° C	<i>High-alert</i> tablet cabinet
		2. Methotrexate 2.5 mg	Tablet	< 30° C	

Table 2. Percentage of *High-alert* Drugs in the Central Pharmacy of Ratu Zalecha Hospital

<i>High-alert</i> Drug Group	Percentage (%)
Electrolyte Concentrate	8,45%
Cytostatics	11,26%
Other <i>High-alert</i> Drugs	80,29%

Based on the results of observations made at the Central Pharmacy of Ratu Zalecha Martapura Hospital (Table 3), 100% conformity was obtained from 7 observation points in the *checklist* table, so it can be said that the SPO has been fully implemented in the *High-alert* drug storage system at the Central Pharmacy of Ratu Zalecha Martapura Hospital.

Table 3. Results of *High-alert* Drug Storage Conformity at the Central Pharmacy of RSUD Ratu Zalecha

Nu.	Standard Operating Procedures for <i>High-alert</i> Drugs According to Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 year 2016	Compatibility	
		As per	Not suitable
1.	Storage of <i>High-alert</i> drugs is based on Standard Operating Procedures (SOP)	1	0
2.	A list of <i>High-alert</i> drugs is placed in the central pharmacy	1	0
3.	Storage of <i>High-alert</i> drugs in storage cabinets following FIFO and FEFO methods	1	0
4.	Storage of <i>High-alert</i> drugs is placed in a separate place based on the group of cytotoxic drugs, electrolyte concentrates, and others.	1	0
5.	Storage of <i>High-alert</i> drugs according to the storage temperature requirements of each drug (cold temperature and room temperature)	1	0
6.	<i>High-alert</i> medicine labels are placed in the medicine storage area	1	0

7. Electrolyte concentrate is only available in the pharmacy, except in units where there is clinical judgment to reduce risk or injury from the use of electrolyte concentrate.	1	0
Observation score	7	0
Percentage of conformity (%)	100%	0%

This study discusses the evaluation of *High-alert* drug storage at the Central Pharmacy of Ratu Zalecha Martapura Hospital by collecting data by directly observing drug storage at the Central Pharmacy of Ratu Zalecha Martapura Hospital. Researchers were directed now by pharmacists at Ratu Zalecha Martapura Hospital, after which the researchers made observations. *High-alert* drugs are drugs with a high risk because they have side effects such as complications or danger due to the existence of a narrow therapeutic dose that will cause the incidence of errors.

Storage of *High-alert* drugs in the central pharmacy of Ratu Zalecha Hospital has been 100% by the SOP for *High-alert Medication Management* at Ratu Zalecha Hospital. The purpose of managing *High-alert* drugs is to improve storage security, and patient safety and prevent errors in administering and using *High-alert* drugs. Examples of *High-alert* drug management include the availability of a list of *High-alert drugs* in related units, red *High-alert* stickers on primary packaging and medicine boxes, storage in separate cabinets and appropriate temperatures, *double checks*, and FIFO / FEFO. Research by Wahyuni et al. (2021) stated that the storage of *High-alert* drugs at the Tk. According to the hospital's SOP, IV Guntung Payung Banjarbaru Hospital was 77.14%.

The results of observations of the list of *High-alert* drugs in the central pharmacy of Ratu Zalecha Hospital were 100% by Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of 2016. The list of *High-alert medicines* in the significant pharmacy is grouped by therapeutic class, drug name, preparation, and storage temperature posted in the outpatient and inpatient pharmacy rooms (Minister of Health of the Republic of Indonesia, 2016, 2022). The purpose of the *High-alert* drug list is so that officers know the *High-alert* drugs in the room to prevent medication errors. The index for high-alert medicines is constantly updated annually based on internal hospital data; if there are changes in drug items, it can be updated temporarily (Minister of Health of the Republic of Indonesia, 2022). Based on previous research by Haryadi and Trisnawati (2022), it is known that the entire list of *High-alert* drugs is also posted at the Juanda Kuningan Hospital Pharmacy Installation.

Storage of *High-alert* drugs in storage cabinets at the central pharmacy of RSUD Ratu Zalecha has 100% used the FIFO and FEFO methods according to Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of 2016. *High-alert* drug storage applies the FIFO and FEFO

systems. The FIFO method is that the first item will be issued first. The FIFO method stores drugs without regard to the *expiration date*. In contrast, the FEFO method is the earliest item near the *expiration date*, so it is issued earlier or placed before a more extended *expiration date*. Using a combination of FIFO and FEFO drug systems in storage can ensure good goods management. The use of the FEFO and FIFO system is applied by placing the previous drug or item near the *expiration date* on the front drug shelf, while if the drug or entity has the same *expiration date*, the new drug or object is placed on the back drug shelf (Anandani, Fauziah, and Rusmana, 2022). Previous research by Hidayati et al. (2021) at the Inpatient Pharmacy Installation of Mitra Plumbon Hospital found that the storage of *High-alert* drugs was also 100% using the FIFO and FEFO methods.

The results of observations of *High-alert* drug storage have been 100% placed in a separate place according to Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of 2016. The storage of *High-alert* drugs is divided into five: narcotics cabinets, concentrated electrolytes, injections, tablets, and a special *High-alert* refrigerator. *High-alert* drugs must be placed in a separate cabinet from other medications to prevent drug administration errors that can cause adverse patient reactions and ensure drug storage safety (Minister of Health of the Republic of Indonesia, 2016). Another study by Ardiani (2020) at Kardinah Hospital, Tegal City, showed that 100% of the *High-alert* drug list was stored in a separate cabinet.

The results of observations of the suitability of drug storage temperatures were 100% by The Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of the year. The drug is stored at a temperature that is by the storage instructions on the drug packaging, namely at cold (2°-8°C), cool (8°-15°C), or room temperature (<30°C) (Minister of Health of the Republic of Indonesia, 2016). Drug storage temperature must be appropriate to ensure the quality of the preparation during storage. The temperature and humidity of drug storage are constantly monitored twice a day (at 08.00 and 14.00) to ensure the suitability of temperature and moisture so that the quality of the preparation is maintained. In addition, drug storage is also equipped with a temperature monitoring device, such as a digital thermometer placed in the medicine cabinet to monitor the medicine's temperature and humidity. According to previous research by Haryadi and Trisnawati (2022), 100% of *high* drugs have also been stored at the appropriate temperature.

The results of observations of *High-alert* drug labeling placed in drug storage areas have been 100% by Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of 2016. *High-alert* drugs are given unique markings in red *High-alert* stickers on each package and drug shelf to ensure officers are more vigilant and double-check when taking and delivering drugs, then was expected can reduce the errors and loss that cause for patients, staff and hospitals (Nahdha et al., 2023). In addition,

in front of the storage cabinet is a red *High-alert* sticker, the cabinet or shelf is marked with a red border, and a list of drugs is in the cupboard. The *High-alert* sticker (Figure 1) reads "**HIGH-ALERT DOUBLE CHECK**" with a red background. Based on the Ratu Zalecha Hospital SOP, the High-alert sticker on narcotic drugs is a red rectangle on concentrated electrolytes and other drugs in a circle. Previous research conducted by Hidayati et al. (2021) found that *High-alert* labeling was 50% appropriate for narcotic drugs and 100% for concentrated electrolytes and other drugs. Another study by Haryadi and Trisnawati (2022) suggested that 100% of *High-alert* drug labels were also appropriate, while another study by Putra (2016) at X Hospital at South Borneo suggested that 96,95% of *High-alert* drug labels were also appropriate.

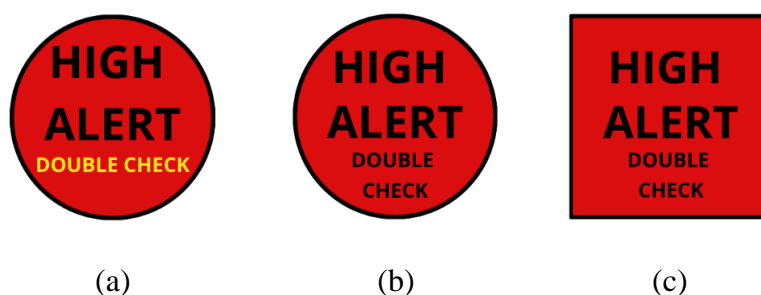


Figure 1. *High-alert* stickers: (a) medicine storage cabinets, (b) concentrated electrolyte drugs and other drugs, (c) narcotic drugs

The results of the observation of the suitability of concentrated electrolytes only available in the pharmaceutical installation were 100% by Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of the year. The high-concentrate electrolyte is also one of the *High-alert* drug categories that must be considered in their storage because they can endanger patients. The storage of electrolyte concentrate is also the same as other *High-alert* drugs and is continuously monitored and monitored by the head of the installation room. According to the *High-alert* Drug Management SOP of RSUD Ratu Zalecha, the storage of electrolyte concentrate outside the pharmaceutical installation is only allowed for the ICU, NICU, ICCU, OK, Emergency Room, and Emergency Room-PONEK. Storage of electrolyte concentrates other than in the Pharmaceutical Installation is only allowed in risky clinical situations and is carried out under proper supervision according to the requirements, namely competent and trained staff who can only access and administer the electrolyte concentrate, separate storage, and *High-alert* labeling (Minister of Health of the Republic of Indonesia, 2022). The high concentrate electrolyte drugs managed include Potassium chloride 7.45%, MgSO₄ 20%, MgSO₄ 40%, Dextrose 40%, Meylon 8.4 and Otsu Salin 3. The results of previous research by Ardiani (2020) show that electrolyte concentrates should also only be available in pharmaceutical installations and ICU, HCU, IBS, ER, and PONEK rooms.

According to Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of 2016, based on the data obtained in Table 3, the results of the suitability of drug storage in the Central Pharmacy of Ratu Zalecha Martapura Hospital on 71 drug items are all appropriate so that a value of 100% is obtained, which means that the suitability of *High-alert* drug storage in the Central Pharmacy of Ratu Zalecha Hospital is excellent. Good and correct drug storage is very important in order to maintain the quality and quality of drugs (Rahmatullah et al, 2023).

CONCLUSION

Storage and writing in the High-alert drug storage area in the pharmaceutical installation of Ratu Zalecha Martapura Hospital for the High-alert group are known from 71 items of drugs stored according to their provisions, and seven (7) requirements have met all so that the criteria are perfect in the storage process based on Minister of Health Decision Nu. 1128 of 2022 and Minister of Health Regulation Nu. 72 of 2016. Good and correct drug storage is very important in order to maintain the quality and quality of drugs.

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CONFLICT OF INTEREST

Authors declare no conflict of interest

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