
**FACTORS ASSOCIATED WITH THE STORAGE OF MEDICINES AT
COMMUNITY HEALTH CENTERS IN KENDARI CITY IN 2025**

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DOI: <https://doi-doi.org/101555/ijarp.7772>**ABSTRACT**

Pharmaceutical logistics storage is a critical component of pharmaceutical management at community health centers (Puskesmas) because it affects the quality, safety, and availability of medications. Issues such as expired medications, substandard storage arrangements, and limited storage facilities are still encountered at several Puskesmas in Kendari City. This study aims to identify factors related to pharmaceutical logistics storage at Community Health Centers in Kendari City in 2025, including spatial arrangement, medication stock organization, medication stock record-keeping, and medication quality monitoring. This study employs a quantitative method with a cross-sectional design. The research was conducted at Community Health Centers in Kendari City in 2025. The study population consisted of all pharmacy staff at community health centers in Kendari City, with total sampling used as the sampling technique. Data were collected using a questionnaire that had been tested for validity and reliability, and analyzed using SPSS with the chi-square test. The results showed a significant relationship between medication inventory recording (p-value = 0.044) and pharmaceutical logistics storage, whereas spatial arrangement (p-value = 0.086), medication stock recording (p-value = 0.065), and medication quality monitoring (p-value = 0.054) did not show a relationship with pharmaceutical logistics storage. This study emphasizes that continuous improvement in storage management is essential in accordance with pharmaceutical service standards.

KEYWORDS: Arrangement, Drug Stock, Stock Recording, Drug Quality Monitoring, and Storage.

INTRODUCTION

The Community Health Center (Puskesmas) is a primary-level healthcare facility available to the public. Pharmaceutical services are one of the health services provided at Puskesmas (Regulation of the Minister of Health of the Republic of Indonesia No. 43 of 2019, 2019). Pharmaceutical services are closely related to the management of pharmaceutical preparations and medical consumables, which constitute a cycle of activities starting from selection, needs planning, procurement, receipt, storage, distribution, disposal and withdrawal, control, and administration required to support pharmaceutical service activities (1).

The drug management cycle consists of four stages, namely selection, planning and procurement, distribution, and use, all of which require support from organizational structures, sustainable financing, information management, and human resources management. Drug management is one of the most important series of activities, receiving 40–50% of the government's health development budget allocation. It encompasses planning, procurement, storage, and distribution processes that must be managed optimally to ensure the availability of appropriate quantities and types of pharmaceutical supplies and medical devices (2).

Medicines must be stored according to established standards to ensure safety, prevent physical and chemical damage, and maintain their quality. Effective logistics management in pharmacy installations is essential, as outlined in the Minister of Health Regulation Number 26 of 2020 concerning Pharmaceutical Service Standards in Primary Health Care Centers. This management includes selection, needs planning, procurement, receiving, storage, distribution, disposal, recall, control, and administration (3).

According to the WHO Global Report on Medicines (2019), the availability of essential medicines in the public sector in Africa is around 50%, while in Southeast Asia it averages 60%. Other studies indicate that in countries with better logistics management systems, such as Vietnam, availability can reach up to 80%. In developed countries, pharmaceutical expenditures account for approximately 10–15% of the total health budget, whereas in developing countries this proportion is higher, ranging from 35–65%, and in Indonesia it is about 39%. The responsibility for procuring essential medicines for primary healthcare services has shifted from the central government to district/city governments (4).

Based on the performance report of the Directorate General of Pharmaceuticals and Medical Devices for the first semester of 2023, the availability of essential medicines in Primary Health Care Centers (Puskesmas) across Indonesia was 87.52%, which is still below the national target of 94%. This result was obtained from the June 2023 reporting period, where 5,396 out of 7,308 reporting Puskesmas had at least 80% availability of essential medicines (40 indicator drug

items). This also indicates a reporting rate of 87.52% out of a total of 10,469 Puskesmas across Indonesia.

Based on data from the Southeast Sulawesi Provincial Health Office (2024), monitoring of drug and vaccine availability in Southeast Sulawesi in 2022 recorded 296 Primary Health Care Centers (Puskesmas), all of which reported data on the availability of essential medicines. Of these, 274 Puskesmas (92.57%) had $\geq 80\%$ availability of essential medicines. This indicates that in 2022, most Puskesmas met the standard for essential medicine availability, although some had not yet achieved the target. In 2023, the number of Puskesmas increased to 307, with all 307 reporting data on the availability of essential medicines and vaccines. However, only 274 Puskesmas (89.25%) achieved $\geq 80\%$ availability. This reflects a decline compared to 2022 and suggests challenges in the pharmaceutical logistics management system, including planning, procurement, distribution, and storage of medicines.

Furthermore, in 2024, the number of Puskesmas increased to 308, with 296 Puskesmas reporting data on essential medicines and vaccines. Among those reporting, 261 Puskesmas (88.18%) achieved $\geq 80\%$ availability. This shows a slight improvement compared to 2023, although it still has not reached the level achieved in 2022.

Literature Review

Primary health care centers

According to the Regulation of the Minister of Health No. 43 of 2019, a Primary Health Care Center is a healthcare facility that provides both public health efforts and individual health services at the primary level, with a greater emphasis on promotive and preventive efforts within its service area (5). Primary Health Care Centers function as technical implementation units of district/city health offices and are responsible for organizing health development within their designated working areas (6). One of the main programs at Primary Health Care Centers is the treatment program. This program represents a form of basic healthcare service that is curative in nature. People also tend to utilize Primary Health Care Center services primarily to receive medical treatment (7).

Drug Storage

Storage is an activity of storing and maintaining the quality of pharmaceutical preparations by placing medicines in a location that is safe from theft and physical disturbances that may damage their quality. According to the Minister of Health Regulation Number 30 of 2014, storage is a process of keeping and maintaining received medicines in a secure place to preserve

their quality (8). Storage aims to maintain drug quality, prevent irresponsible use, ensure availability, and facilitate retrieval and monitoring. This process is very important because it guarantees the integrity and suitability of medicines before they are distributed to patients, thereby playing a role in maintaining patient safety in healthcare services (9). Consistent availability of medicines is also very important, especially in emergency situations where rapid response is required to save patients' lives. Studies show that medicines stored under inappropriate conditions may lose their therapeutic potency, which can endanger patient safety (10).

Drug

Medicines are an essential component in various healthcare services. Most healthcare interventions involve the use of medicines, and the cost of medicines constitutes a significant portion of total healthcare expenditures. Drug-based interventions are also the most commonly used in the implementation of healthcare services (11).

The drug management process consists of several stages, namely planning, procurement, distribution, and use. However, to limit the scope of the study and focus on the stages that play a major role in ensuring drug availability in healthcare services, this research emphasizes the planning and procurement stages (12).

Spatial Arrangement

The arrangement of drug storage space is an important component of pharmaceutical logistics management to ensure that the processes of receiving, storing, and distributing medicines run effectively and efficiently. The layout should be designed to facilitate mobility using flow patterns such as straight, U-shaped, or L-shaped to create an organized logistics flow and minimize work obstacles. Shelf arrangement must consider a maximum distance of 30 cm from the wall and a minimum distance of 10 cm between shelves to support proper air circulation and ease of cleaning. In addition, special storage is required for certain types of medicines, such as narcotics, psychotropics, high-alert drugs, flammable materials, and medicines that require specific temperature conditions, such as storage in refrigerators (13).

Stock Arrangement

Stock arrangement of medicines is a crucial part of logistics management aimed at ensuring availability, orderliness, and safety in storage areas. Based on Good Storage Practices (GSP) by WHO and reinforced by pharmaceutical service standards from the Ministry of Health, stock organization ensures that medicines are well stored, easily accessible, and protected from

physical damage and quality deterioration. This process follows FIFO (First In First Out) and FEFO (First Expired First Out) principles, where medicines received earlier or with nearer expiration dates are prioritized for use to prevent expiry and minimize waste. Additionally, stock arrangement must consider the characteristics of pharmaceutical forms, such as liquids, ointments, tablets, vaccines, and photosensitive products, so that storage conditions can be appropriately adjusted (14).

Drug Stock Recording

Drug stock recording is a process used to monitor the movement of medicines from receipt and storage to distribution. An accurate recording system is essential to prevent stock discrepancies, avoid stockouts, and reduce the risk of expiration. According to pharmaceutical logistics management theory, stock recording must be conducted in real time, accurately, and consistently using tools such as stock cards, inventory logs, or pharmacy management information systems. This system functions as a control mechanism to facilitate audits, drug planning, and reporting, as well as to detect discrepancies through stock-taking activities, which may indicate recording errors, loss, damage, or expiration (15).

Drug Quality Monitoring

Drug quality monitoring is the process of ensuring that stored medicines remain in conditions that meet standards of quality, safety, and efficacy. According to Good Storage Practices, drug quality is influenced by factors such as temperature, humidity, lighting, ventilation, and storage cleanliness. Inappropriate storage conditions can cause physical changes, including alterations in color, odor, consistency, or packaging damage, which may reduce drug stability and effectiveness. Therefore, healthcare facilities must conduct routine temperature monitoring, regular cleaning, and visual inspections, including checking expiration dates, packaging conditions, and potential contamination. Certain medicines, such as vaccines and photosensitive drugs, require special attention due to their sensitivity to environmental changes. Regular quality monitoring enables early detection of damaged or near-expiry medicines, allowing timely actions such as redistribution, disposal, or reporting (16).

Drug Logistics Management

Drug logistics management is a series of activities that include planning, procurement, storage, distribution, and disposal of medicines, which are managed optimally to ensure the accuracy of the quantity and types of drugs in healthcare services. This management aims to meet the needs of basic healthcare services at Primary Health Care Centers and to ensure the

availability, equitable distribution, and affordability of medicines so that they can be obtained at the right time and place in an effective and efficient manner (17).

Drug logistics management is very important for Primary Health Care Centers because imbalances in inventory, whether excessive or insufficient, can cause economic losses and disrupt service operations. Ineffective drug management also has negative medical and financial impacts. Therefore, logistics management aims to ensure the availability of goods in the right quantity, condition, time, and location at the lowest possible cost, thereby providing time and place utility in healthcare services (18).

Pharmaceutical Services

Pharmaceutical services are integrated activities aimed at identifying and resolving problems related to medicines and health. Their development is marked by a shift in paradigm from being product-oriented (*drug oriented*) to patient-oriented (*patient oriented*) through the concept of *pharmaceutical care*, so that services are no longer focused solely on drug management but also on improving patients' quality of life (19).

Pharmaceutical services are an important part of the healthcare system because most medical services involve the use of medicines and pharmaceutical supplies. Therefore, pharmaceutical services play a role in ensuring the availability, safety, and rational and optimal use of medicines to support the effectiveness of healthcare services (20).

Objective

This study aims to identify factors related to pharmaceutical logistics storage at Community Health Centers in Kendari City in 2025 based on pharmaceutical service standards by evaluating four main aspects: spatial layout, medication stock organization, medication stock record-keeping, and medication quality monitoring. Additionally, this study aims to identify the relationship between each of these aspects and the quality of pharmaceutical logistics storage, as well as to evaluate the extent to which pharmaceutical logistics management principles are being applied.

METHODOLOGY

This study employed a quantitative research design with a cross-sectional approach to analyze pharmaceutical logistics storage at Public Health Centers (Puskesmas) in Kendari City in 2025. The study was conducted across several Puskesmas in Kendari City within the specified research period. The population of this study consisted of all pharmacy personnel working at Public Health Centers in Kendari City. The sampling technique used was total sampling, in

which all members of the population were included as respondents to ensure comprehensive data representation. Data were collected using a structured questionnaire that had been tested for validity and reliability prior to data collection. The instrument was designed to assess four main variables: spatial arrangement, drug stock organization, drug stock recording, and drug quality monitoring, as well as the dependent variable, namely pharmaceutical logistics storage quality.

The data collection process involved direct distribution of questionnaires to respondents, accompanied by explanations to ensure accurate understanding of each item. The collected data were then systematically processed, coded, and entered into statistical software for analysis. Data analysis was conducted using both descriptive and inferential statistical methods. Descriptive analysis was used to present the characteristics of respondents and the distribution of each variable. Inferential analysis was performed using the chi-square test to examine the relationship between independent variables (spatial arrangement, drug stock organization, drug stock recording, and drug quality monitoring) and the dependent variable (pharmaceutical logistics storage). This methodological approach enabled an objective and evidence-based evaluation of factors associated with pharmaceutical logistics storage, providing a comprehensive understanding of storage practices in accordance with pharmaceutical service standards.

RESULT

Tabel 1. Characteristics of Respondents.

Variables	Frequency	Percent (%)
Age		
21-40	53	74.6
> 40	18	25.4
Gender	2	2.8
Male Female	69	97.2
Highest level of education		
Diploma in Pharmacy	23	32.4
Bachelor of Pharmacy	24	33.8
Pharmacist Professional Degree	24	33.8
Years of Service (years)	40	56.3
<5	31	43.7
>5		
Position	19	26.8
Pharmacist Pharmacy Technician Staff	35	49.3
	17	23.9

Source: Primary Data, 2026

A total of 71 respondents participated in this study. The majority of respondents were aged 21–40 years (74.6%), while 25.4% were aged over 40 years. Based on gender, respondents were predominantly female (97.2%), while males accounted for 2.8%. In terms of educational level, most respondents held a Bachelor of Pharmacy degree (33.8%), followed by a Pharmacist Professional Degree (33.8%) and a Diploma in Pharmacy (32.4%). Regarding years of service, 56.3% of respondents had worked for less than 5 years, while 43.7% had worked for more than 5 years. Based on job position, the majority of respondents were pharmacy technicians (49.3%), followed by pharmacists (26.8%), and staff (23.9%).

Tabel 2. Univariate Analysis.

Variables	Frequency	Percent (%)
Spatial Arrangement	20	28.2
Less Good	51	71.8
Stock Arrangement	24	33.8
Less Good	47	66.2
Drug Stock Recording	18	25.4
Less Good	53	74.6
Monitoring Drug Quality	21	29.6
Less Good	50	70.4
Logistics Of Drug Storage	31	43.7
Less Good	40	56.3

Source: Primary Data, 2026

Univariate analysis showed that the majority of respondents assessed spatial arrangement as being in the good category, with 51 respondents (71.8%), while 20 respondents (28.2%) rated it as less good. For drug stock organization, 47 respondents (66.2%) rated it as good, whereas 24 respondents (33.8%) rated it as less good. Furthermore, most respondents assessed drug stock recording as good, with 53 respondents (74.6%), while 18 respondents (25.4%) rated it as less good. In terms of drug quality monitoring, 50 respondents (70.4%) rated it as good, whereas 21 respondents (29.6%) rated it as less good. Regarding pharmaceutical logistics storage, the majority of respondents were categorized as good, with 40 respondents (56.3%), while 31 respondents (43.7%) were categorized as less good.

Tabel 3. Bivariate Analysis

Variabel	Logistics Of Drug Storage				P-Value
	Less Good		Good		
	n	%	n	%	
Spatial Arrangement					
Less Good	5	25	15	75	0,086
Good	26	51	25	49	

Stock Arrangement					
Less Good	6	10,5	18	13,5	0,044
Good	25	20,5	22	26,5	
Drug Stock					
Recording					
Less Good	4	22,2	14	77,8	0,065
Good	27	50,9	26	49,1	
Monitoring Drug Quality					
Less Good	5	23,8	16	76,2	0,054
Good	26	52	24	48	

Source: Primary Data, 2026

The results of the bivariate analysis showed a significant relationship between spatial arrangement, drug stock organization, drug stock recording, and drug quality monitoring with pharmaceutical logistics storage at Public Health Centers in Kendari City.

For spatial arrangement, it was found that among 20 respondents who assessed spatial arrangement as less good, 5 respondents (25.0%) had poor pharmaceutical logistics storage and 15 respondents (75.0%) had good pharmaceutical logistics storage. Furthermore, among 51 respondents who assessed spatial arrangement as good, 26 respondents (51.0%) had poor pharmaceutical logistics storage and 25 respondents (49.0%) had good pharmaceutical logistics storage. The results of the Chi-Square statistical test with Continuity Correction showed that the p-value was 0.086, thus $p\text{-value} > 0.05$, so H_0 was accepted and H_1 was rejected. This means that there is no significant relationship between spatial arrangement and pharmaceutical logistics storage at public health centers in Kendari City in 2025.

For drug stock organization, it was found that among 24 respondents who assessed drug stock organization as less good, 6 respondents (10.5%) had poor pharmaceutical logistics storage and 18 respondents (13.5%) had good pharmaceutical logistics storage. Furthermore, among 47 respondents who assessed drug stock organization as good, 25 respondents (20.5%) had poor pharmaceutical logistics storage and 22 respondents (26.5%) had good pharmaceutical logistics storage. The Chi-Square test results showed a p-value of 0.044 ($p < 0.05$), indicating a significant relationship between drug stock organization and pharmaceutical logistics storage at Public Health Centers in Kendari City in 2025.

For drug stock recording, it was found that among 18 respondents who assessed drug stock recording as less good, 4 respondents (22.2%) had poor pharmaceutical logistics storage and 14 respondents (77.8%) had good pharmaceutical logistics storage. Furthermore, among 53 respondents who assessed drug stock recording as good, 27 respondents (50.9%) had poor pharmaceutical logistics storage and 26 respondents (49.1%) had good pharmaceutical

logistics storage. The results of the Chi-Square statistical test with Continuity Correction showed that the p-value was 0.065, thus $p\text{-value} > 0.05$, so H_0 was accepted and H_1 was rejected. This means that there is no significant relationship between drug stock recording and pharmaceutical logistics storage at public health centers in Kendari City in 2025.

Furthermore, for drug quality monitoring, it was found that among 21 respondents who assessed drug quality monitoring as less good, 5 respondents (23.8%) had poor pharmaceutical logistics storage and 16 respondents (76.2%) had good pharmaceutical logistics storage. Furthermore, among 50 respondents who assessed drug quality monitoring as good, 26 respondents (52.0%) had poor pharmaceutical logistics storage and 24 respondents (48.0%) had good pharmaceutical logistics storage. The results of the Chi-Square statistical test with Continuity Correction showed that the p-value was 0.054, thus $p\text{-value} > 0.05$, so H_0 was accepted and H_1 was rejected. This means that there is no significant relationship between drug quality monitoring and pharmaceutical logistics storage at public health centers in Kendari City in 2025.

DISCUSSION

Spatial layout is an important component in supporting proper pharmaceutical storage in community health center pharmacies, as outlined in Ministry of Health Regulation No. 26 of 2020. However, this study found that spatial layout does not always correlate with the quality of pharmaceutical logistics storage. Both conditions were observed: suboptimal spatial layout with adequate storage, and good spatial layout with inadequate storage. Statistical analysis showed no significant relationship between spatial layout and pharmaceutical logistics storage ($p\text{-value} = 0.086$; $p > 0.05$), indicating that other factors play a more dominant role. These include adherence to standard operating procedures (SOPs), staff competence, and the availability of supporting storage facilities. Competent and disciplined staff can maintain proper storage practices despite spatial limitations. These findings are consistent with Ladu Day et al. (2020) and Friska et al. (2025), which highlight that management practices and implementation of standards are more influential than physical infrastructure alone. Therefore, improving pharmaceutical storage quality requires not only adequate spatial arrangements but also strong managerial practices and human resource capacity.

Drug stock arrangement refers to how health personnel organize medicines to ensure they are orderly, easily accessible, and protected from mix-ups and expiration. The findings show that drug stock arrangement has a significant relationship with drug logistics storage, indicating that proper stock arrangement improves the effectiveness and efficiency of storage systems. In

theory, stock arrangement should follow the FIFO (First In First Out) and FEFO (First Expired First Out) principles to prevent stock accumulation and drug expiration. However, in practice, improper arrangements are still observed, such as drugs not being organized based on expiration dates and unsystematic placement. This finding is in line with Lestari et al. (2021), who reported that inappropriate stock arrangement can lead to reduced drug quality and effectiveness, as well as an increased risk of expired drugs in healthcare facilities.

Medication inventory recording is an essential administrative process to ensure consistency between physical and recorded stock, as outlined in Ministry of Health Regulation No. 26 of 2020. Proper recording is conducted routinely, accurately, and continuously to support effective stock control and prevent discrepancies.

This study found that inventory recording does not always correspond with the quality of pharmaceutical logistics storage. There were instances where recording practices were good but storage remained inadequate, and conversely, where recording was suboptimal but storage was still well maintained. These findings indicate that inventory recording is not the primary determinant of storage quality. Statistical analysis confirmed no significant relationship between medication inventory recording and storage quality (p -value = 0.065; $p > 0.05$). More influential factors include the condition of storage facilities, the implementation of FIFO/FEFO systems, and the competence and experience of pharmacy staff. These results are consistent with studies by Sari et al. (2024) and Pratama et al. (2022), which emphasize that operational practices and infrastructure play a more dominant role than administrative aspects. Therefore, improving pharmaceutical storage quality requires not only accurate inventory recording but also adequate facilities, proper storage systems, and competent human resources.

Drug quality monitoring is a periodic evaluation of the physical condition, stability, and suitability of drugs during storage, as regulated by Ministry of Health Regulation No. 26 of 2020. This activity aims to ensure that drugs remain safe, effective, and suitable for use through inspections of their physical condition and expiration dates, as well as monitoring of the storage environment. Research results indicate that drug quality monitoring does not always align with the quality of drug logistics storage. Situations were found where quality monitoring was adequate but storage conditions were suboptimal, and conversely, where quality monitoring was inadequate but storage conditions remained good. This suggests that quality monitoring is not the primary factor determining storage quality but rather serves as an evaluative assessment of the drug's condition. Statistical analysis indicates no significant relationship between drug quality monitoring and pharmaceutical logistics storage (p -value = 0.054; $p > 0.05$). Other more influential factors include storage facility conditions, spatial layout, implementation of the

FIFO/FEFO system, as well as staff competence and adherence to SOP. These findings are consistent with the research by Ladu Day et al. (2020) and Ardianty and Sukarmin (2024), which indicate that storage systems and the availability of facilities play a greater role in maintaining drug quality. Thus, drug quality monitoring serves primarily as an indicator of storage quality rather than as a factor that directly influences the drug logistics storage process.

CONCLUSION

This study shows that only drug stock organization has a significant relationship with pharmaceutical logistics storage. Meanwhile, spatial arrangement, drug stock recording, and drug quality monitoring do not show a significant relationship with pharmaceutical logistics storage. This indicates that drug stock organization is a more influential factor in supporting the effectiveness of pharmaceutical logistics storage compared to other aspects examined in this study.

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