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Performance Analysis of Logistics Management for Pharmaceutical Installations in Hospitals Within the Archipelagic Region: A Case Study of Hospital X in Bangka Belitung Islands

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Logistics Management; Pharmacy; Hospital

ABSTRACT
Management of pharmaceutical logistics, especially in hospitals, is a complex process involving various stages. The objective of this process is to ensure the provision of high-quality medications and effective pharmaceutical services. However, hospitals in island regions face unique challenges such as limited accessibility and resource constraints, which can hinder the effectiveness of pharmaceutical logistics management. To analyze the management in the Pharmacy Installation of Hospital X, a qualitative descriptive method with a case study approach was used. Primary data were obtained through interviews and direct observations, while secondary data were obtained through a review of hospital documents. All data were collected from August 2024 to September 2024. Triangulation was used to confirm and validate the data. The most common problem encountered was the availability of medications. Several factors may have contributed, including limitations in the qualifications of human resources in the Pharmacy Installation, suboptimal medication planning and procurement activities, limited capacity of medication storage space, and the high variability of lead time for medications due to the hospital's geographic location. This research concludes that the pharmaceutical logistics management at Hospital X still needs to be improved to gradually minimize the incidence of stockouts in the hospital. Development of human resources, hospital facilities and infrastructure is needed. The researcher also recommends the formation of a Pharmacy and Therapeutics Committee and the development of a hospital information management system to facilitate pharmaceutical logistics activities and ultimately improve the quality of services to the community.

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INTRODUCTION

The concept of logistics management, as described by Gattorna and Walters (1996), includes the integration of planning, implementing, and controlling resources to be used effectively and efficiently. George R. Terry views management as a systematic process to realize goals. This process involves four main stages, namely planning, organizing, implementing, and supervising. Therefore, the management function can be identified as the four stages, which are often abbreviated as POAC: Planning, Organizing, Actuating, and Controlling (Setiatjahjati et al., 2023).

Pharmaceutical logistics management activities in hospitals are carried out mainly in pharmaceutical installations. There are a series of activities that need to be maintained in an effort to manage pharmaceutical preparations well, starting from selection, needs planning, procurement, acceptance, storage, distribution, destruction and withdrawal, control, and administration (Yu & Singh Badhan, 2021). Each stage cannot be separated from one another, as weaknesses in one of the stages will have an impact on the entire process and also affect the output of services provided to patients (Zhang & Li, 2022). For example, poor inventory management or procurement processes can lead to stockouts or overstocking, disrupting the entire supply chain (Xie et al., 2020). Effective pharmaceutical logistics are crucial in ensuring that medications are available when needed, with the correct dosage and in good condition (Wu et al., 2021). As highlighted by Patil & Singh (2022), the integration of advanced technology in logistics management, such as automated systems for inventory control, can greatly enhance the efficiency of pharmaceutical operations. In order for the system to function optimally, each part must be well integrated (Zhao et al., 2023). The importance of interdepartmental coordination and the adoption of standard operating procedures (SOPs) is emphasized to avoid errors and improve patient outcomes (Li & Zhang, 2021).

The Hospital Pharmaceutical Installation (IFRS) is responsible for managing everything related to pharmaceutical work that is carried out with a one-door system. In addition, IFRS is also a capital-intensive installation, where the cost of purchasing drugs at Hospital X accounts for 40% of the total operational costs of the hospital. According to the latest Health Law, Number 17 of 2023, drugs are part of pharmaceutical preparations that play an important role in the process of determining diagnosis, prevention, mitigation, treating diseases, improving individual health, or serving as a contraceptive tool. In addition to their benefits as a health product, drugs are also a revenue center for the hospital, making effective and efficient drug management the main responsibility of IFRS (Pratama et al., 2024). Therefore, the purpose of implementing logistics management in pharmaceutical installations is to maximize available resources to provide quality and safe services effectively and efficiently. Pharmaceutical logistics management that is not optimal will have a negative impact on hospitals, both from the medical, social, and economic aspects of the hospital (Pratama et al., 2024).

Hospital X is located in an archipelago, so it faces its own challenges in pharmaceutical logistics management, especially related to its geographical conditions. Some of the challenges commonly faced by hospitals in the archipelago include limited accessibility, limited availability of infrastructure, higher operational costs, and a shortage of skilled human resources (Sari et al., 2021). As a result, some problems that may arise due to these conditions include stockouts, degradation in the quality of drugs, high hospital operational costs, and decreased hospital efficiency (Henderson & Hossain, 2020). In archipelagic regions, inadequate infrastructure and logistical barriers are often major contributors to inefficient pharmaceutical management (Nguyen et al., 2021). According to Fong et al. (2022), pharmaceutical supply chains in such regions are vulnerable to disruptions, leading to challenges in drug procurement and distribution. The operational challenges faced by healthcare providers in these regions, including Hospital X, are exacerbated by limited access

to advanced technology and a lack of trained personnel (Chung & Lee, 2020). This study aims to analyze the pharmaceutical logistics management system at Hospital X, Bangka Belitung Islands, by identifying obstacles and evaluating the performance of existing systems (Wang et al., 2021). By addressing these issues, this study is expected to formulate a comprehensive improvement strategy to enhance pharmaceutical logistics (Yuan & Zhang, 2023). The final goal of this study is to determine the factors that influence the efficiency and effectiveness of pharmaceutical services, as well as to ensure the availability of quality drugs for patients (Tan & Ng, 2022).

Several studies have focused on hospital logistics and pharmaceutical supply chains. Research by Pratama et al. (2024) highlights the need for efficient pharmaceutical logistics to ensure medication availability and quality control. Additionally, Sheina et al. (2010) discussed storage issues in pharmacy installations, noting that inadequate space and improper handling of pharmaceutical products contribute to stockouts and medication errors. However, there remains a gap in studies specifically addressing the unique challenges faced by archipelago hospitals, especially regarding the geographic and infrastructure constraints that hinder efficient pharmaceutical logistics.

This research aims to fill this gap by analyzing the logistics management of pharmaceutical installations at Hospital X, located in an archipelagic region. Unlike previous studies, which largely focus on general pharmaceutical logistics, this study specifically investigates the impact of geographical isolation and infrastructure limitations on pharmaceutical supply chain operations. The novelty of this research lies in its contextual focus on Hospital X and the evaluation of how these specific challenges affect pharmaceutical services in an island hospital.

The benefits of this research are twofold. First, it will provide actionable insights into the current challenges faced by Hospital X, offering practical recommendations for improving pharmaceutical logistics. Second, the findings will contribute to the broader body of knowledge on pharmaceutical logistics management in remote healthcare settings, potentially informing policy and practice in similar regions.

METHOD

This research is non-experimental, specifically descriptive research with qualitative methods and a case study approach for data collected in 2023. The location of this study is Hospital X, a type D private hospital in the Bangka Belitung Islands. Primary data was obtained through interviews and direct observation at relevant installations. Secondary data was obtained through the study of hospital documents. The number of informants is four people: the Head of Medical Support, Head of Pharmaceutical Installation, Procurement Section, and Hospital Pharmacist Assistant. This research activity was carried out from August 3, 2024, to September 2, 2024. The selection of informants was based on the suitability of their field and knowledge, as well as their authority in the hospital pharmacy logistics management process. Document review was conducted on the description of each individual's position, standard operating procedures, guidelines, and protocols in the hospital pharmacy installation.

This study uses a triangulation approach to obtain richer and deeper data. By combining in-depth interviews, direct observations, and document reviews, this study aims to comprehensively understand the pharmaceutical logistics management process at Hospital X. Through this triangulation, it is hoped that more valid and reliable findings will be obtained. During the interview process, after several questions were prepared, the same questions were asked to all informants, each with different backgrounds and positions. The results of the interviews will be analyzed by concluding the questions with the most similar answers. Data analysis was conducted using a literature review by searching for literature relevant to hospital pharmaceutical logistics management, as well as conducting intensive consultations with field supervisors and internal supervisors regarding observation results.

RESULT AND DISCUSSION

From interviews and direct observations, several problems that often occur at Hospital X were obtained, including the availability of drug stocks, expired drug conditions, drug storage, and limited hospital accessibility (Table 1).

Table 1. Logistics Management Problems of Hospital X's Pharmacy Installation, Based on Interviews and Direct Observations
Source: Researcher

	PROBLEMS
1	Stockout events (empty stock for necessary medications)
2	Drug Expiration Events
3	Use of drugs that do not conform to the Hospital formulary
4	*Drug lead time* varies (days to weeks)
5	Limited hospital facilities and infrastructure in drug storage

Based on the five problems described above, one priority was taken by the researcher based on the results of interviews and direct observations, namely the problem of stockout or the occurrence of empty stock for needed medicines. The discussion included human resources, hospital facilities and infrastructure, and the logistics management process in the hospital.

A. Human Resources

From the results of the research conducted through interviews and direct observations, it is known that the human resources at Hospital X Pharmacy Installation are 14 people, consisting of 1 (one) pharmacist as the Head of Pharmaceutical Installation, 1 (one) accompanying pharmacist, and 12 (twelve) pharmaceutical engineering personnel

and pharmacy admins. Based on the Regulation of the Minister of Health Number 72 of 2016 concerning pharmaceutical service standards in hospitals, the qualifications of human resources for pharmaceutical installations are classified into two parts, namely for pharmaceutical work and for support personnel.

For pharmaceutical work, it consists of pharmacists and pharmaceutical technical personnel. As for supporting jobs, it consists of operators or computer technicians who understand pharmaceuticals, administrative personnel, and workers or implementing assistants. According to the Minister of Health, the head of pharmaceutical installation is a pharmacist who has at least 3 years of experience working in a Pharmaceutical Installation. Regarding workload, ideally the ratio between pharmacists is 1 pharmacist for 30 inpatients for prescription review activities, drug use history, drug reconciliation, drug therapy monitoring, drug information provision, counseling, education, and inpatient visits. Meanwhile, the ideal ratio for pharmacists for outpatients is 1 pharmacist for 50 patients to carry out prescription assessments, drug delivery, drug use recording and counseling. In addition, pharmacists are also needed in pharmaceutical services in certain rooms, such as: Emergency Installations, Intensive Care Units, and Drug Information Services.

When compared to the Minister of Health, the number of pharmacists is ideally balanced with the number of inpatients and outpatients at Hospital X, but there are no pharmacists in the emergency installation and intensive care unit because the location of the pharmaceutical installation is adjacent to the emergency installation, and Hospital X does not have an intensive care unit. If in the future the hospital has a development plan to build an intensive unit, then it is necessary to consider the availability of pharmacists in the unit in the future. In addition to the number of human resources, human resource management in pharmaceuticals also includes employee development activities, which can be through training, providing feedback, mentoring, or placing employees in positions that allow employees to develop new skills related to the pharmaceutical industry (Pratama et al., 2024).

Hospital Infrastructure

Drug storage activities, as part of the pharmaceutical logistics management chain, must be able to ensure the quality and safety of pharmaceutical preparations in accordance with the minimum requirements for pharmaceutical services that have been set. Drug storage at Hospital X is carried out in Pharmaceutical Installations and Pharmaceutical warehouses. Although these two drug storage locations are still in the same building, Hospital X does not have special access for loading and unloading activities and receiving drugs, so currently drug reception activities are carried out through the entrance which is also access to patients and visitors to the Hospital.

Hospital X's Pharmacy Warehouse is divided into 2 parts, namely the document archive room to store the archive of prescription copies and the storage room for drugs and consumable medical materials. This storage warehouse measures 2.5 x 3 meters which is equipped with temperature and room humidity settings, to maintain the quality of medicine. Based on the

results of interviews and direct observations, the obstacle from the aspect of the building and storage space of the pharmaceutical warehouse of Hospital X is that the area of the warehouse that is currently available is still not able to carry out the storage function optimally, so most of the drugs still have to be stored in large quantities in the hospital's pharmaceutical installation. The procurement location is also located in a pharmaceutical plant, so there is little space for the drug compounding process.

As an effort to overcome the problem of limited space, Hospital X has initiated the construction of a new pharmacy building equipped with more adequate drug reception facilities. At the same time, the integration of hospital management information systems (SIMRS) is being carried out intensively to support the optimization of pharmaceutical logistics management. These steps are in line with the goal of Hospital X's management to create a more efficient and effective pharmaceutical service system.

Pharmaceutical Installation Drug Logistics Management Process

Included in the drug logistics management process is all pharmaceutical preparation management activities as described in the Minister of Health Regulation Number 72 of 2016, starting from selection, planning, procurement, receipt, storage, distribution, destruction and withdrawal, control and administration.

For election activities, Hospital X already has a Hospital formulary book prepared in 2022. However, from the results of the research, it was found that several drugs were available in the Hospital Pharmacy Installation but were not listed in the Hospital formulary. From the results of the interview with the head of the Pharmaceutical Installation, information was obtained that this condition could occur because the Hospital did not have a Pharmacy and Therapy Committee or Team tasked with monitoring, evaluating, and updating the Hospital formulary. In fact, from 2022 to 2024, there have been additions or replacements of several medical personnel at Hospital X, and there are services that have just been opened at the Hospital, so it is definitely necessary to update and socialize the formulary again.

In planning pharmaceutical preparations, several things underlie planning activities, namely: hospital formularies, hospital therapy standards, medical record data, available budget, priority setting, disease cycle, remaining inventory, usage data for the past period, lead time, and development plans. Then, there are three commonly used methods of planning pharmaceutical preparations, namely the Consumption Method, the Epidemiological Method, and the Combined Method (Arrang, 2021). In planning, Hospital X uses a consumption method where the next month's drug planning uses data on the number of drug use in the current month, which is multiplied by the constant that has been set by the Hospital. Then the planned amount of drugs will be reduced by the amount of stock available at the Hospital, and the amount that needs to be ordered will be informed to the procurement department to be processed to the distributor. Because planning activities are carried out manually every month, it can be a factor causing delays in planning, and have an impact on the next logistics management flow, namely the procurement process.

After the drug order form is verified by the Head of Pharmaceutical Installation, the procurement process is continued by the relevant unit. However, given the limited accessibility due to Hospital X's geographical location, drug delivery often encounters obstacles. This study shows that the lead time of the drug can vary significantly, ranging from 2 days to 2 months. Erratic weather conditions, transportation constraints, and lack of optimal coordination with distributors, especially when there is a shortage of drug stock, are the main factors causing the variation in long waiting times. This condition has the potential to disrupt the availability of drugs in hospitals and have an impact on the quality of health services.

After the procurement process, the drug is then received by the hospital's pharmaceutical installation, for examination. Several times, it was found that there were drugs that were damaged by travel. Although the Hospital can refuse or return the defective medicine, as well as get a replacement for a new medicine, there is additional time that needs to be sacrificed, which has the potential to cause a shortage of medicine stock in the Hospital. Furthermore, after the drug is received by the hospital, the drug is recorded and stored in the pharmaceutical installation and warehouse, as explained in the infrastructure facilities section. Through a review of the documents, the researcher concluded that Hospital X already has guidelines and guidelines for pharmaceutical installation services, which have also been equipped with standard operating procedures. However, even though the SPO has been implemented, stockout incidents are still found at Hospital X. The assumption of the researcher is that this could be due to the fact that the hospital does not have a policy regarding drug categorization, for example by conducting an ABC analysis of the Critical Index by the Pharmacy and Therapy Committee or Team. Then after knowing which drugs are included in category A, hospitals can focus more on optimizing the logistics management of drugs that are at least included in Category A of the Critical Index. Then, because it is located in the archipelago, Hospital X also needs to implement safety stock calculations, reorder point limits and the number of economic order quantities (EOQ) which can be started gradually starting from category A drugs first, and then equipped for categories B and C. The author's assumption, drug categorization, safety stock calculation, reorder point and EOQ calculation if done well, can minimize the incidence of stockout in hospitals. Furthermore, the entire calculation process is expected to be digitized and integrated with SIMRS optimally, so that it can reduce the workload at Hospital X's Pharmaceutical Installation, but also improve the quality of hospital X's Pharmaceutical Installation services.

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that Hospital X has great potential in the development of human resources in the *Pharmaceutical Installation* unit, both in terms of the quantity and quality of competencies that need to be adjusted to the needs of hospital services. However, the facilities and infrastructure currently available still do not meet the ideal pharmaceutical service standards. Even so, the hospital has responded to this by building a new pharmacy building, which is planned to be completed in January 2025. In addition, the drug logistics management process at Hospital X is still not

optimal, as can be seen from the fact that there are still stockouts in pharmaceutical services, which indicates the need for improvements in the drug inventory management system.

Therefore, the researcher suggests that Hospital X form a *Pharmacy and Therapy Team* led by a pharmacist to update the formulary, classify drugs based on the *ABC Critical Index* category, and conduct periodic monitoring and evaluation of drug movements. After the new building is completed, it is recommended to rearrange pharmaceutical supplies to ensure regulatory compliance, improve workflow, and service quality. The hospital should also develop a system that can determine safety stock, reorder point (*ROP*), and economic order quantity (*EOQ*), which are integrated into the *SIMRS* so that drug stocks can be monitored in real-time and accurately. Finally, there is a need for an analysis of personnel needs and a continuous professional development program to improve the quality of human resources through training, courses, and further education that align with the needs of the hospital.

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