Enhancing Inventory Management of Saline in Wards: A Case Study of a Hospital in Thailand

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Abstract

This study aims to improve the management of saline solution in patient wards by reducing the frequency of emergency saline requests caused by occasional shortages. The research begins by collecting data on saline inventory management at a hospital in Thailand, analyzing and defining the scope of emergency saline requests, and determining the appropriate amount of saline to be stored in the wards. The study categorizes all saline usage data using ABC classification to prioritize usage and compares two inventory replenishment models: the Periodic Review Policy and the Continuous Review Policy. The objective is to determine which method is most effective in managing saline inventory levels. The results indicate that the Periodic Review Policy is the most suitable method for managing saline in patient wards. It allows for the calculation of the optimal storage quantity and the maintenance of an emergency reserve. The replenishment cycle is set at one day, with a delivery lead time of no more than three hours. This method ensures a 99% service level and significantly reduces emergency saline requests, stabilizing them at approximately 1,000 bottles per month. As a result, the overall management of saline is improved, and shortages in emergency situations are minimized.

Keywords: Inventory, Inventory Requisition, Saline, Replenishment

1. Introduction

A hospital in Thailand is a tertiary-level university hospital serving the population of 14 southern provinces in Thailand. With a capacity of 853 beds, provides extensive inpatient, outpatient, and emergency services. The hospital treats approximately 4,000 inpatients and 90,000 outpatients per month, underscoring the critical need for effective healthcare service management. One significant challenge is the management of essential medical supplies, such as medications, saline solutions, and medical consumables, which directly affect patient outcomes. Overstocking leads to unnecessary financial burdens and wastage, while understocking causes shortages, delays in treatment, and potential risks to patient safety [1],[2].

A critical problem faced by this hospital is the inefficient management of saline solution inventory, a vital resource for continuous patient care. Between October 2019 and September 2020, the hospital experienced an average of 19,599 emergency saline requisitions monthly. This high volume of emergency requests primarily stems from poorly defined inventory levels in each ward, resulting in imbalanced saline distribution. Some wards maintain excessive stock beyond their actual needs, leading to wastage through expiry and increased holding costs, while others face frequent shortages, disrupting patient care and forcing emergency requisitions [3],[4].

This imbalance has several serious consequences. It negatively impacts the quality and continuity of medical services, increases the risk of treatment delays, and compromises patient safety. Furthermore, it places significant operational burdens on hospital staff, increasing workload and complexity in requisitioning, transportation, and overall stock management. Such inefficiencies also contribute to increased operational costs and resource misallocation, which can strain the hospital's budget and reduce overall service effectiveness.

These challenges highlight the urgent need to improve inventory management systems by analyzing saline usage trends within each ward, implementing accurate demand forecasting, and establishing appropriate minimum and maximum stock levels. This will ensure balanced resource allocation, reduce waste, and maintain adequate stock to meet patient needs consistently. Addressing these issues is vital not only for enhancing operational efficiency but also for ensuring sustainable, high-quality patient care [5-8].

Effective saline inventory management is therefore critical to maintaining uninterrupted patient care. Many hospitals face similar challenges with stock imbalances causing either shortages or overstocking, resulting in frequent emergency requisitions. To address this, the present study analyzes actual saline consumption data by ward and employs ABC classification to prioritize inventory control efforts. It further compares two inventory management models—the Periodic Review Policy and the Continuous Review System—to determine the most suitable approach for maintaining optimal inventory levels. The primary objective is to align saline inventory preparedness with actual demand, minimize losses from expired or excess stock, and ensure timely and effective patient care [9–13].

2. Methodology

This research addresses the issue of frequent emergency saline requisitions in hospital patient wards by developing a systematic approach to determine the optimal quantity of saline to be stored in each ward. By analyzing historical usage data and applying ABC Analysis, the study categorizes saline solutions based on their importance and frequency of use. It then evaluates two inventory replenishment methods—the Periodic Review Policy and the Continuous Review Policy—by simulating their performance in relation to key indicators such as stock availability, requisition frequency, and cost efficiency. Through this process, the research identifies the most effective policy for ensuring a stable and sufficient supply of saline while minimizing operational disruptions.

The findings of the study contribute significantly to improving hospital inventory management. By implementing a data-driven system tailored to real usage patterns, the hospital can reduce unnecessary emergency requests, lower inventory costs, and enhance the continuity of patient care. Moreover, the proposed system is designed to be flexible and sustainable, allowing for continuous monitoring and improvement. The methodology developed can also be adapted to manage other critical medical supplies, providing a scalable solution for broader hospital logistics and healthcare resource planning. The steps involved in this process are as follows:

2.1 Research and Data Collection

This study aims to analyze saline usage in various hospital wards by collecting data from October 2019 to September 2020, including identified usage (accurately documented and assigned to specific patients), unidentified usage (not clearly linked to particular cases), and emergency requisitions (urgent requests due to unexpected shortages). By examining these data categories, the research seeks to understand actual consumption patterns and the root causes of emergency requisitions. The analysis will focus on average usage rates and demand variations across wards, enabling the development of a predictive model to determine the appropriate amount of saline each ward should store. This model is intended to ensure adequate supply, reduce emergency requests, prevent overstocking, and ultimately improve inventory management and operational efficiency within the hospital.

2.2 Conceptual Framework Design

Designing a conceptual framework to address the problem in this research is crucial, as the core issue revolves around the effective management of saline inventory in hospital wards. Poor inventory control can lead to either shortages, which compromise timely patient care, or excessive stockpiling, which results in wasted resources and inefficient storage use. These challenges impact not only operational efficiency but also the quality and continuity of healthcare services. A well-defined conceptual framework provides a structured approach to understanding the relationships between key variables such as saline consumption patterns, inventory policies, replenishment methods, and supply outcomes. It serves as a guiding model that supports the identification of root causes and the development of targeted solutions. As illustrated in **Figure 1**, the framework integrates these components to enable comprehensive analysis and inform evidence-based decision-making in the management of hospital saline supplies.

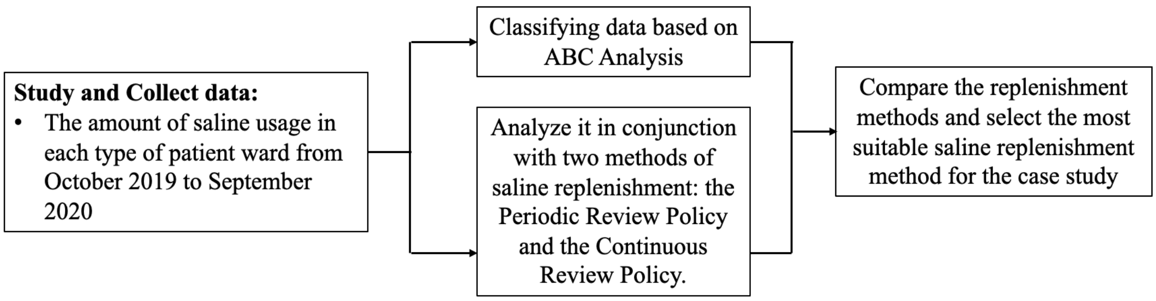

Figure 1 Conceptual Framework

2.3 Sample Population

The sample population in this study comprises hospital inpatient wards that utilize saline solutions as part of their routine medical treatment. Specifically, the study will focus on all wards within the hospital that demonstrate significant levels of saline usage, based on historical inventory data collected over the past 12 months. This includes, but is not limited to, general medical wards, surgical wards, intensive care units (ICUs), and emergency departments.

To identify the most critical wards and saline types for analysis, an ABC classification method will be applied to the total saline consumption data. This method categorizes inventory items into three groups—A (high usage value), B (moderate usage value), and C (low usage value)—based on their consumption value and frequency. Wards and saline products falling into the 'A' category will be prioritized for further analysis due to their high impact on inventory control and patient care.

Once the sample population is classified, the study will evaluate and compare saline replenishment requirements under two inventory management models: the Periodic Review Policy, where inventory is reviewed and restocked at fixed intervals, and the Continuous Review Policy, where stock is replenished whenever it falls below a set threshold. This comparative analysis aims to identify the most effective inventory strategy for each ward type, ensuring both supply continuity and operational efficiency.

2.4 Designing the saline replenishment method

The Periodic Review Policy and the Continuous Review Policy. The Periodic Review Policy is suitable for managing multiple types of products in a single cycle, helping to reduce ordering costs, but it carries the risk of stockouts between review cycles. On the other hand, the Continuous Review Policy reduces the risk of stockouts and lowers inventory holding costs, but it requires continuous monitoring systems and may increase ordering frequency and costs [14–18]. Statistical distribution testing using the Kolmogorov-Smirnov method will be applied at a significance level of 0.05.[19]

2.4.1 Periodic Review Policy

In this section, the replenishment cycle for saline In this section, the replenishment cycle for saline will be determined for each period [5]. The amount of saline replenished during each cycle will vary depending on the remaining inventory in the warehouse. The maximum quantity of saline to be stored in each ward can be calculated using Eq. (1), and the reserve inventory can be calculated using Eq. (2), which applies normal distribution for calculations as follows [16]. This replenishment approach is suitable for managing multiple product types within a single cycle, helping to reduce ordering costs; however, it carries the risk of stockouts occurring between review periods.

To ensure appropriate stock levels and service continuity, the inventory status is reviewed daily (or at suitable intervals based on usage behavior), and the replenishment quantity is determined accordingly. In normal operations, saline is delivered to each ward once per day, based on the hospital's current logistics routine. Therefore, the replenishment review period is set at 3 hours, which reflects the actual time taken from the moment an order is placed until the saline is restocked in the ward.

$$\mathrm{R} = (\mathrm{T} + \tau)\mu_{\mathrm{D}} + \mathrm{ss} \quad (1)$$

$$\mathrm{ss} = F_s^{-1}(CSL) \times (\sqrt{\mathrm{T} + \tau} \times \mathrm{S_D}) \quad (2)$$

Where:

- R = Maximum saline quantity to be stored in the ward (bottles)
- T = Replenishment cycle time (days)
- τ = Time from order placement to saline delivery (days)
- μ_D = Average saline demand (bottles per day)
- S_D = Standard deviation of saline demand (bottles per day)
- ss = Saline reserve to prevent shortages in the ward (bottles)
- CSL = Cycle Service Level (level of service in the replenishment cycle)

2.4.2 Continuous Review Policy

This method involves replenishing saline in fixed, equal quantities (Q) each time. Inventory levels are continuously monitored in real-time, and a replenishment order of size Q is triggered immediately once the stock falls to or below the reorder point. This continuous review system helps reduce the risk of stockouts and lowers inventory holding costs; however, it requires a continuous monitoring system and may increase the frequency and costs of ordering. The reorder point, the maximum quantity of saline to be stored, and the reserve inventory are calculated using Eqs. (3)–(5), respectively, to align precisely with the actual usage patterns in each patient ward. Analysis of the collected data showed that saline usage follows a normal distribution; therefore, these calculations apply normal distribution assumptions as detailed below [16]:

$$\mathrm{R} = \mathrm{r} + \mathrm{Q} \quad (3)$$

$$\mathrm{r} = \mathrm{ss} + (\mu_{\mathrm{D}} \times \tau) \quad (4)$$

$$\mathrm{ss} = F_s^{-1}(CSL) \times (\sqrt{\tau} \times \mathrm{S_D}) \quad (5)$$

Where:

- R = Maximum saline quantity to be stored in the ward (bottles)
- r = Reorder point for saline replenishment (bottles)
- Q = Replenishment quantity per order (bottles per order)
- τ = Time from order placement to saline delivery (days)
- μ_D = Average saline demand (bottles per day)
- S_D = Standard deviation of saline demand (bottles per day)
- ss = Saline reserve to prevent shortages in the ward (bottles)
- CSL = Cycle Service Level (level of service in the replenishment cycle)

Before calculating the maximum quantity of saline to be stored in the patient ward, it is necessary to first calculate the replenishment quantity of saline for each order. This value will then be used in subsequent calculations. The replenishment quantity can be calculated using the following formula (Eq. (6)) [20]:

$$\mathrm{Q} = \sqrt{\frac{2\mathrm{SD}}{\mathrm{H}}} \quad (6)$$

When:

- Q = Replenishment quantity per order (bottles per order)
- S = Cost of replenishing saline per order (THB per order)
- D = Demand for saline (bottles per order)
- H = Holding cost for saline (THB per bottle per order)

3. Results and Discussion

The researcher collected data on the usage of saline in different types of patient wards and the saline demand in each ward. This data was systematically analyzed to design an efficient saline replenishment process. The data analysis included studying the current operational conditions, applying ABC priority classification, implementing periodic review replenishment, and using continuous review replenishment. These approaches ensure that the design of the saline replenishment process is accurate and can be effectively applied to the case study.

3.1 Current Working Conditions

In the present year, the saline replenishment process involves the delivery of saline five days a week. The replenishment quantity for each ward from Monday to Thursday (Q1) is calculated using Eq. (7), and the replenishment quantity for each ward on Friday (Q2) is calculated using Eq. (8) [9]. As a result, the amount of saline stored varies each day, leading to the need for emergency saline requisitions to meet the daily demand. On average, the amount of emergency saline requisitioned from October 2019 to September 2020 was 19,599 bottles, as shown in **Figure 2**.

$$Q_1 = \text{Avg. Demand for 3 days} \times \text{Factor} \quad (7)$$

$$Q_2 = \text{Avg. Demand for 3 days} \times \text{Factor} \times 3 \quad (8)$$

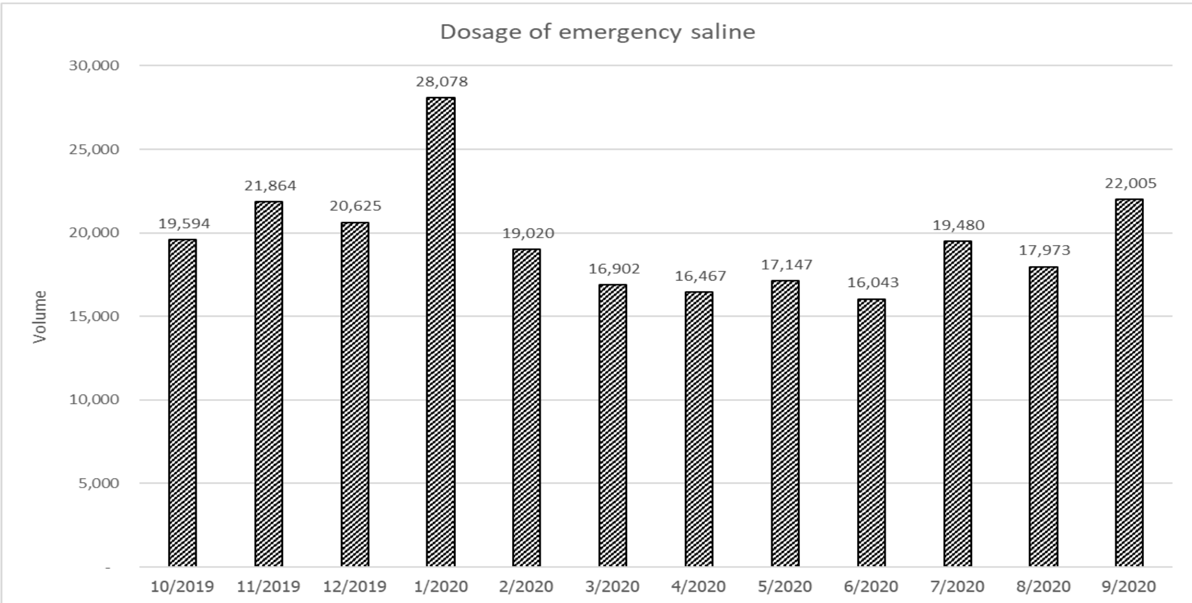

Figure 2 The amount of emergency saline requisitioned from October 2019 to September 2020 was 19,599 bottles.

3.2 ABC Classification

The results of the ABC classification for the total saline usage data across different types of patient wards are as follows [11]:

Priority Group A consists of 2 types of saline, accounting for 47.49% of the total saline usage.

Priority Group B consists of 12 types, accounting for 48.36% of total usage.

Priority Group C includes 18 types, contributing only 4.15% of the usage.

These results are shown in **Figure 3**.

Although ABC theory typically suggests that Category A covers approximately 80% of total usage value, in practice, the top two saline types showed significantly higher usage than all others. As a result, only these two were classified into Category A due to their disproportionately high usage, which had a clear impact on inventory operations. This deviation from the theoretical 80% threshold reflects the real-world distribution of saline consumption within the hospital.

While specific technical thresholds and classification cut-offs were not the primary focus of this section, the categorization was guided by the practical goal of prioritizing inventory control based on usage value and operational importance, consistent with the objectives of effective inventory management.

The patient wards with the highest saline usage in Priority Group A include the Male General Medicine Ward 1, the Obstetrics and Gynecology Ward, and the Surgical Intensive Care Unit. Additionally, the saline usage data for each ward followed a normal distribution, as shown in **Table 1**

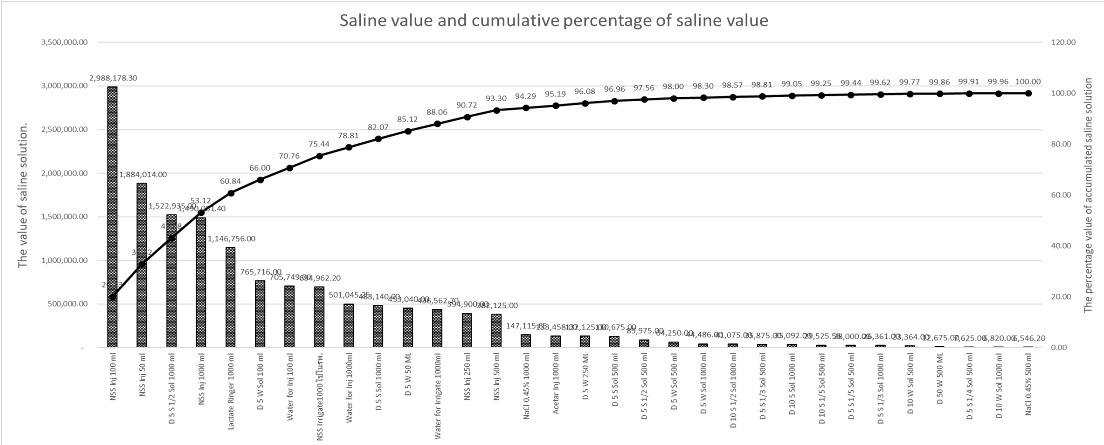

Figure 3 ABC Priority Classification of Saline

3.3 Saline Replenishment Based on Periodic Review

The results from designing the saline replenishment model using the Periodic Review Policy demonstrate how the maximum stock levels and safety stock for each patient ward were calculated to optimize inventory control and prevent shortages. Specifically, the model computes the maximum amount of saline that should be stored in each ward (expressed in number of bottles), as well as the reserve stock needed to maintain a high service level. The replenishment cycle is set to 1 day, with a lead time of 3 hours between ordering and delivery, and a target cycle service level of 99%, as outlined in **Table 2**.

The input parameters for the model, including the average daily demand and the standard deviation of saline usage, were derived from historical usage data compiled in **Table 1**. Eqs. (1)–(2) were used to calculate the maximum stock level (R) and safety stock (ss), ensuring that inventory levels reflect actual consumption patterns and variability.

According to **Table 2**, the model recommends storing a maximum of 112 bottles of NSS Injection 100 ml with a safety stock of 47 bottles, and 44 bottles of NSS Injection 50 ml with a safety stock of 23 bottles in the Male General Medical Ward 1. In the Gynecology Ward, the maximum stock levels are 88 bottles and 41 bottles for NSS Injection 100 ml and 50 ml, respectively, with safety stocks of 31 and 22 bottles. Meanwhile, in the Surgical Care Unit, the recommended maximum storage levels are 48 bottles (NSS Injection 100 ml) and 31 bottles (NSS Injection 50 ml), with safety stocks of 16 and 18 bottles, respectively.

These findings, which show that the Periodic Review Policy can reduce the frequency of emergency saline requests and maintain stable inventory levels, align with existing literature suggesting that this policy is well-suited for managing multiple product types in a single cycle and helps lower overall ordering costs. The establishment of a one-day replenishment cycle, combined with a short lead time of 3 hours and a service level target of 99%, has proven highly effective in the context of a large hospital with high saline demand. This approach adheres to inventory management principles focused on maintaining service levels while minimizing operational costs.

3.4 Continuous Saline Replenishment

The results of designing the saline replenishment system using the continuous replenishment method include an analysis of the associated operating costs. The operating cost for each replenishment event was calculated based on a fixed staff transportation cost of 26.32 Baht per trip. In addition, the holding cost for maintaining saline inventory was set at 20% of the price of each specific type of saline solution.

According to **Table 3**, these costs are summarized as they relate to the continuous replenishment process. For NSS Injection 100 ml, the replenishment cost is consistently 26.32 Baht per replenishment, while the holding cost per bottle per replenishment cycle is 2.14 Baht. To maintain optimal inventory levels and control expenses, the replenishment volumes per cycle have been determined for each ward: 38 bottles for the Male General Medical Ward 1, 36 bottles for the Gynecology Ward, and 27 bottles for the Surgical Care Unit.

Table 1 Example Showing the Distribution and Parameters of Saline Usage Data

Parameter	NSS Inj 100 ml.			NSS Inj 50 ml.		
	Male General Medical ward 1	Gynecology ward	Surgical Care Unit	Male General Medical ward 1	Gynecology ward	Surgical Care Unit
Distribution	Normal	Normal	Normal	Normal	Normal	Normal
Average (bottles per day)	57.38	50.17	28.34	18.66	16.08	16.82
SD. (bottles per day)	18.71	12.54	6.091	9.002	8.597	7.108
Statistical test	0.115	0.085	0.219	0.088	0.081	0.079

Table 2 Example of Calculating Saline Replenishment Based on Periodic Review Policy

Parameter	NSS Inj 100 ml.			NSS Inj 50 ml.		
	Male General Medical ward 1	Gynecology ward	Surgical Care Unit	Male General Medical ward 1	Gynecology ward	Surgical Care Unit
Maximum Saline to be Stored (Bottles)	112	88	48	44	41	31
Reserve Saline (Bottles)	47	31	16	23	22	18

Similarly, for NSS Injection 50 ml saline, the replenishment cost remains the same at 26.32 Baht per trip, but the holding cost per bottle per cycle is higher at 2.90 Baht. The replenishment volumes per cycle are 19 bottles for the Male General Medical Ward 1, 18 bottles for the Gynecology Ward, and 18 bottles for the Surgical Care Unit.

With the replenishment volumes established, the maximum storage volume, reorder points, and safety stock for each patient ward were calculated to maintain optimal inventory levels while minimizing the risk of shortages. These calculations were performed using Eqs. (3)–(5), based on a service level of 99% per usage cycle to ensure reliable availability of saline for patient care. The replenishment quantity per cycle (Q), which factors into these calculations, was determined using Eq. (6), with cost parameters such as ordering cost (S) and holding cost (H) drawn from **Table 3**. The resulting inventory parameters for each ward are detailed in **Table 4**, providing a comprehensive view of the inventory control targets needed to balance supply reliability with cost efficiency.

Although the Continuous Review Policy theoretically offers advantages in reducing stockout risks and lowering holding costs, this study's findings indicate that it incurs higher operating costs, particularly transportation costs (26.32 Baht per trip) and additional holding expenses. This outcome reinforces limitations noted in the literature, which highlight that this policy typically requires continuous monitoring systems and may lead to increased ordering frequency and costs in practice. These results emphasize that implementing such a policy must carefully consider the specific organizational context and associated costs.

Table 3 Example of Saline Replenishment Costs Under the Continuous Review Policy

Parameter	NSS Inj 100 ml.			NSS Inj 50 ml.		
	Male General Medical ward 1	Gynecology ward	Surgical Care Unit	Male General Medical ward 1	Gynecology ward	Surgical Care Unit
Replenishment Cost (Baht per Time)	26.32					
Holding Cost (%)	2.14			2.90		
Volume of Saline Replenishment per Time (Bottles per Time)	38	36	27	19	18	18

Table 4 Example of Continuous Replenishment Calculation Results

Parameter	NSS Inj 100 ml.			NSS Inj 50 ml.		
	Male General Medical ward 1	Gynecology ward	Surgical Care Unit	Male General Medical ward 1	Gynecology ward	Surgical Care Unit
Maximum Storage (Bottles)	94	85	55	38	35	35
Reorder Point (Bottles)	56	49	28	19	17	17
Backup Volume (Bottles)	48	42	4	16	14	14

According to **Table 4**, the optimized saline inventory levels for various hospital wards were carefully calculated to improve stock management and prevent shortages. In the Male General Medical Ward 1, the maximum stock for NSS Inj 100 ml is set at 94 bottles, with a reorder point of 56 bottles and a backup volume of 48 bottles. For NSS Inj 50 ml, the maximum stock is 38 bottles, with a reorder point of 19 bottles and a backup volume of 16 bottles. Similarly, in the Gynecology Ward, the maximum stock for NSS Inj

100 ml is 85 bottles, with a reorder point of 49 bottles and a backup volume of 42 bottles, while for NSS Inj 50 ml, the maximum stock is 35 bottles, with a reorder point of 17 bottles and a backup volume of 14 bottles. In the Surgical Care Unit, the maximum stock for NSS Inj 100 ml is set at 55 bottles, with a reorder point of 28 bottles and a backup volume of 24 bottles, while for NSS Inj 50 ml, the maximum stock is 35 bottles, with a reorder point of 17 bottles and a backup volume of 14 bottles. These levels were determined based on careful analysis of historical usage, patient needs, and lead time for replenishment, ensuring a stable supply without overstocking.

The backup volumes and reorder points are strategically set to account for demand fluctuations and supply chain delays, ensuring that saline supplies are always available when needed. These calculated inventory levels have significantly reduced emergency saline requisitions, stabilizing the average requisition volume at around 1,000 bottles per month. The optimized levels strike a balance between ensuring adequate supply and minimizing excess stock, thus reducing storage costs. By adopting these inventory strategies, the hospital has enhanced operational efficiency, reduced procurement delays, and maintained a reliable saline supply across all wards, ensuring that patient care remains uninterrupted while optimizing resource use.

3.5 Performance Comparison and Improvement Evaluation

This section presents a comparative evaluation of the saline inventory management performance before and after the implementation of the Periodic Review Policy. The baseline data, representing the current situation prior to the policy change, indicated an average monthly emergency saline requisition of approximately 19,599 bottles during the period from October 2019 to September 2020.

Following the implementation of the improved Periodic Review Policy in January 2020, a significant reduction in emergency saline requisitions was observed. The average monthly emergency saline requisitions decreased from approximately 19,599 bottles to 1,000 bottles, resulting in a reduction of 18,599 bottles per month. The percentage reduction is therefore calculated as (18,599 / 19,599) × 100% ≈ 94.9%. This substantial decrease clearly demonstrates the effectiveness of the Periodic Review Policy in optimizing inventory levels, reducing emergency demands, and improving supply chain reliability.

The comparison underscores the importance of aligning inventory control parameters with actual usage patterns and demand variability in each ward. By minimizing stockouts and preventing overstocking, the policy not only ensures timely patient care but also reduces operational burdens and wastage.

4. Conclusion

The case study conducted at a hospital in Thailand focused on optimizing saline inventory management in patient wards, aiming to reduce emergency saline requisitions. The findings confirmed that the Periodic Review Policy is the most effective approach for managing saline in this hospital's wards. This aligns with existing literature highlighting the suitability of this policy in high-demand, resource-constrained environments, particularly in tertiary hospitals with large bed capacity and high patient volumes. The results provide empirical evidence that the policy significantly reduces emergency requisitions, consistent with inventory management objectives to ensure material availability while enhancing operational efficiency.

To improve inventory control, the study applied ABC classification to categorize saline usage, facilitating better resource allocation. The Periodic Review Policy enabled precise calculation of maximum stock levels and safety stock per ward, with a daily replenishment cycle, a 3-hour lead time, and a 99% service level target.

In contrast, the Continuous Review System showed higher operational costs, especially due to transportation expenses of 26.32 Baht per replenishment and increased holding costs. This highlights practical challenges in implementing continuous stock monitoring in hospital settings, which may not be cost-effective without significant investment in automation or a markedly different cost structure. This supports the view that no single inventory policy fits all scenarios; careful consideration of the organization's specific context is essential.

Since the implementation of the optimized Periodic Review Policy in January 2020, emergency saline requisitions have steadily declined and stabilized at approximately 1,000 bottles per month. This stabilization has reinforced inventory management effectiveness, ensuring a reliable supply of saline and preventing shortages during emergencies, ultimately improving operational efficiency and reducing the burden on urgent procurement processes.

5. Limitations

The study was conducted in only one hospital, so the findings may not represent other hospitals. The data used were historical and may not reflect the current situation. Applying the approach in other contexts requires adaptation to fit each organization's systems and resources. Additionally, the readiness of technology and personnel is a crucial factor for the successful implementation of the proposed methods.

6. Suggestion

The findings from the research on inventory management of saline solution in the patient wards at a hospital in Thailand provide invaluable insights with the potential to create substantial benefits across a wide range of applications. The strategies developed can be applied to various hospital departments, such as other patient wards, the pharmacy, and supply chain management units, thereby improving operational efficiency, reducing stock shortages, and lowering the costs associated with maintaining excessive inventory.

Additionally, the methodology proposed in this study offers a scalable solution that can be implemented in other hospitals and healthcare facilities, addressing the need for precise inventory control of medical supplies and pharmaceuticals. This approach is not limited to the healthcare sector alone; it can also be adapted for industries that rely heavily on inventory management, such as the pharmaceutical industry, consumer goods manufacturing, and raw material management in factories. By optimizing inventory levels and reducing unnecessary stock accumulation, organizations can significantly cut down on storage costs, improve resource allocation, and boost overall operational efficiency.

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