INVENTORY CONTROL OF DISPOSABLE MEDICAL SUPPLIES USING REORDER POINT METHOD

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Abstract: Inventory management of consumable medical devices and drugs plays a crucial role in maintaining the continuity of healthcare operations. However, Jelita Dental Care still faces challenges in recording and controlling stock due to manual procedures, which can lead to data inaccuracy, procurement delays, and the risk of stockouts. To address these issues, this study aims to develop a web-based Electronic Supply Chain Management (E-SCM) system that integrates stock monitoring and procurement processes. The Reorder Point (ROP) method is applied to determine the optimal reorder point based on average demand, lead time, and safety stock. This system was built using the PHP programming language and MySQL database. The results show that the JelitaMed system is able to improve the effectiveness and accuracy of inventory management, simplify the structured procurement submission process between the admin, owner, and supplier, and support decision-making in maintaining the availability of consumable medical devices and drugs. Thus, the implementation of E-SCM combined with the ROP method is a practical solution to improve inventory control in small-scale health clinics.

Keywords: e-scm; inventory; information system; medical supplies; reorder point.

Abstrak: Pengelolaan persediaan alat dan obat medis habis pakai memiliki peran penting dalam menjaga keberlangsungan operasional layanan kesehatan. Namun, Jelita Dental Care masih menghadapi kendala dalam pencatatan dan pengendalian stok akibat prosedur manual, yang dapat menyebabkan ketidaktepatan data, keterlambatan pengadaan, serta risiko kekurangan persediaan. Untuk mengatasi permasalahan tersebut, penelitian ini bertujuan mengembangkan sistem Electronic Supply Chain Management (E-SCM) berbasis web yang mengintegrasikan pemantauan stok dan proses pengadaan. Metode Reorder Point (ROP) diterapkan untuk menentukan waktu pemesanan ulang yang optimal berdasarkan permintaan rata-rata, lead time, dan safety stock. Sistem ini dibangun menggunakan bahasa pemrograman PHP dan database MySQL. Hasil penelitian menunjukkan bahwa sistem JelitaMed mampu meningkatkan efektivitas dan akurasi pengelolaan persediaan, mempermudah proses pengajuan pengadaan secara terstruktur antara admin, owner, dan supplier, serta mendukung pengambilan keputusan dalam menjaga ketersediaan alat dan obat medis habis pakai. Dengan demikian, penerapan E-SCM yang dikombinasikan dengan metode ROP menjadi solusi praktis untuk meningkatkan pengendalian persediaan pada klinik kesehatan skala kecil.

Kata kunci: alat medis; e-scm; persediaan; reorder point; sistem informasi.

INTRODUCTION

The healthcare sector is one of the fields significantly affected by the rapid development of information technology. Integrated information systems are increasingly needed to support healthcare service performance and operational efficiency, particularly in managing medical equipment, pharmaceuticals, and administrative processes [1].

In healthcare services, supply chain management (SCM) plays an essential role in ensuring the efficient flow of medical supplies from suppliers to end users. SCM covers demand planning, procurement, storage, distribution, and supervision of medical tools and consumables, all of which directly influence service continuity and quality [2].

The integration of SCM with information technology is implemented through Electronic Supply Chain Management (E-SCM) [3]. E-SCM enables digital coordination of procurement and inventory activities, provides real-time information, and supports systematic reporting for managerial decision-making.

One effective inventory control approach is the Reorder Point (ROP) method, which determines the minimum stock level at which replenishment must be initiated to prevent shortages [4]. When integrated into an E-SCM system, ROP can automatically notify administrators when inventory reaches a critical threshold.

Several previous studies have highlighted the benefits of web-based inventory systems and ROP implementation in healthcare environments. Widiyastuti et al, demonstrated that centralized inventory applications reduce manual recording errors [5], while in research Sihombing showed improvements in stock monitoring and procurement speed in dental clinics [6]. Another study at RSUD Ko-tamobagu reported that integrating ROP with EOQ helps prevent stock shortages in fast-moving medicines [7]. Similarly, research at a community health center in 2023 confirmed that ROP combined with planning techniques supports the availability of essential drugs [8]. Meanwhile, research by Mahmudi et al. emphasized the importance of integrated inventory information systems in supporting the optimization of medical logistics management and improving the accuracy of decision-making [9].

However, although previous studies have developed inventory management systems and applied the ROP method in healthcare settings, most of them focus on general clinical environments or large-scale hospitals [6]. To the best of our knowledge, very limited research specifically addresses the implementation of a web-based E-SCM system integrated with ROP for small-scale dental clinics, where inventory processes are still handled manually and procurement requires coordination between multiple actors (admin, owner, and suppliers).

Jelita Dental Care is a dental clinic in Kisaran, North Sumatra, Indonesia, that still relies on manual inventory recording for disposable medical equipment and supplies. Procurement is conducted through WhatsApp-based ordering without integrated digital stock monitoring, leading to discrepancies between recorded and actual inventory levels.

The main problem faced by Jelita Dental Care is the frequent discrepancy between recorded inventory data and actual stock conditions. The clinic often experiences stock shortages (stockouts) due to the absence of clear inventory control, causing items to run out before reordering is performed. This situation forces the clinic to make unit purchases from nearby pharmacies, which are generally

more expensive and inefficient. In the context of medical services, stock shortages can lead to treatment delays or even cancellation of patient appointments [5]. In addition, delivery delays from suppliers often occur, as all suppliers collaborating with Jelita Dental Care are located outside the city. Therefore, efficient and well-planned inventory management has become an urgent necessity.

Therefore, this study aims to design and develop a web-based Electronic Supply Chain Management (E-SCM) system named "JelitaMed" to support integrated inventory monitoring and procurement management at Jelita Dental Care. The ROP method is applied to determine the optimal replenishment time based on usage levels, lead time, and safety stock.

This research provides a novel contribution by combining inventory control using the Reorder Point (ROP) method with an E-SCM platform that supports real-time stock monitoring and structured procurement submission specifically in a small-scale dental clinic setting. Unlike prior research that mainly focuses on larger institutions, JelitaMed adapts E-SCM concepts to dental healthcare services where inventory management is typically still manual and unintegrated.

METHOD

Research methodology serves as a framework that guides the implementation of the study through systematic procedures used to collect, analyze, and interpret data in order to address the research problem and achieve the research objectives.

This study employs a mixed-methods approach, which integrates qualitative and quantitative methods within a single study, allowing both types of data to be combined to obtain more comprehensive research results [10]. The qualitative method is used to analyze supply chain workflows through the formulation of research questions, field observations, interviews with related stakeholders, and documentation review. Meanwhile, the quantitative method is applied to calculate inventory control using the Reorder Point (ROP) method.

Reorder Point (ROP) is a method used to determine the minimum inventory level of an item that indicates when replenishment must be initiated.

By applying the ROP method, organizations can maintain supply continuity and ensure inventory availability in accordance with operational needs [16]. The formula used to calculate the Reorder Point (ROP) is presented as follows:

$$ROP = (\text{average demand} \times \text{lead time}) + \text{safety stock} \quad (1)$$

Description:
Average Demand (avg) represents the average demand per period. Lead Time (LT) refers to the waiting time between ordering and receiving inventory.
Safety Stock (SS) is the buffer stock maintained to anticipate delivery delays or sudden increases in demand.

After determining the inventory control method applied in this study, the next stage involves the collection of quantitative data used as the basis for Reorder Point (ROP) calculations. The data consist of historical usage records of disposable medical equipment and supplies at Jelita Dental Care over a specified period.

Table 1. Medical Equipment Usage Data

Product	Month	Initial Stock	Usage Stock
Anesthetic (per Cartridge)	November 2024	30	15
	December 2024	35	23
	January 2025	25	18
	February 2025	17	10
	March 2025	7	5
	April 2025	30	15
	May 2025	30	17
	June 2025	35	20
	July 2025	30	20
	August 2025	30	10
	September 2025	20	7
	October 2025	13	13
Product	Month	Initial Stock	Usage Stock
Orthodontic Wire (per Set)	November 2024	5	2
	December 2024	6	6
	January 2025	10	7
	February 2025	6	2
	March 2025	6	2
	April 2025	5	2
	May 2025	6	2
	June 2025	7	5
	July 2025	7	4
	August 2025	6	3
	September 2025	5	2
	October 2025	5	3
...	...	...	...
Product	Month	Initial Stock	Usage Stock
Mouthwash Cup (per Piece)	November 2024	60	30
	December 2024	100	55
	January 2025	45	45
	February 2025	50	34
	March 2025	66	36
	April 2025	60	30
	May 2025	60	38
	June 2025	52	50
	July 2025	63	55
	August 2025	78	39
	September 2025	69	33
	October 2025	50	31
Product	Month	Initial Stock	Usage Stock
Bracket Rubber (per Piece)	November 2024	240	160
	December 2024	300	280
	January 2025	250	220
	February 2025	230	200
	March 2025	220	180
	April 2025	220	180

Product	Month	Initial Stock	Usage Stock
	May 2025	240	180
	June 2025	300	260
	July 2025	320	280
	August 2025	220	180
	September 2025	200	160
	October 2025	200	160

In this study, the reorder point (ROP) calculation was conducted by selecting one product as an example, namely Anesthetic. The selection of this product was based on its high usage level and its crucial role in the medical service process. The ROP calculation for other products was carried out using the same stages.

Based on the anesthetic usage data for 12 months (November 2024 – October 2025), the total monthly usage is:

$$15 + 23 + 18 + 10 + 5 + 15 + 17 + 20 + 20 + 10 + 7 + 13 = 173 \text{ catridge}$$

Average demand is calculated by dividing the total usage by the number of periods (months):

$$\text{average demand} = \frac{173}{12} = 14{,}42$$
$$\approx 14 \text{ catridge/month}$$

For daily requirements (assuming 30 working days per month):

$$\text{daily demand} = \frac{14}{30} = 0{,}47$$
$$\approx 0{,}47 \text{ catridge/day}$$

Lead time is the waiting time from ordering until the goods are received. Based on observations and interviews with the clinic, the lead time for ordering medical supplies is 7 days.

Safety stock is determined to anticipate delivery delays and demand surges. In this study, safety stock is set at 5 cartridges, considering fluctuations in monthly usage.

ROP = (0,47 x 7) + 5 = 3,29 + 5 = 8,29
~ 8 catridge

From the results, the reorder point (ROP) for Anesthetic is 8 cartridges. This means that when the anesthetic stock reaches 8 cartridges, the clinic must immediately place a reorder to prevent stockouts and ensure that medical service processes continue to run smoothly.

Table 2. Reorder Point (ROP) Calculation Results

Products	Avg/ days	LT (days)	SS	ROP
Anesthetic	0,47	7	5	8
Dental Composite Resin	0,47	7	5	8
Orthodon- tic Wire	0,11	7	2	3
Chlorhex- idine	0,08	7	1	2
Calcium Hydroxide 10 g	0,08	7	1	2
Mouth- wash Cups	1,33	7	10	20
Bracket Rubber	6,78	7	30	78

RESULT AND DISCUSSION

The outcomes of the implemented JelitaMed system, focusing on the user

interface and the main functions that support data management and operational processes. Before the system was developed, inventory recording and procurement activities at Jelita Dental Care were handled manually through handwritten notes and WhatsApp-based ordering, which often resulted in stock discrepancies, delays in replenishment, and limited monitoring of consumable medical supplies. After implementation, JelitaMed enables structured inventory control, real-time stock updates, and a more systematic procurement workflow involving the admin, owner, and suppliers.

This improvement aligns with previous studies highlighting that web-based inventory systems can reduce manual recording errors and improve centralized data management (Widiyastuti et al., 2024) [5]. In addition, technology-supported procurement workflows have been shown to accelerate ordering processes and enhance stock monitoring accuracy in dental clinics (Sihombing, 2024) [6].

Therefore, the implementation of JelitaMed demonstrates a practical contribution in applying E-SCM concepts for small-scale dental healthcare services, supporting more efficient and data-driven inventory management.

Admin Create Request

Image 1. Admin Create Request

The material request interface by the admin is presented to illustrate the process of inputting medical equipment and consumable supply requirements based on the current stock conditions. Through this interface, the admin can submit procurement requests in a structured manner as part of the inventory control process.
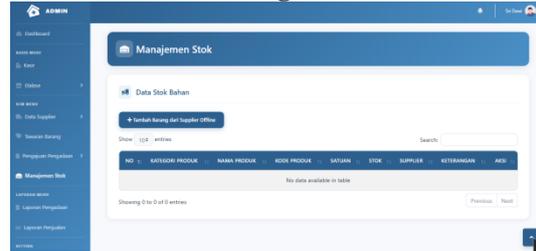
Admin Stock Management

Image 2. Admin Stock Management

Next, the admin stock management interface is presented to describe the process of managing inventory data, including monitoring stock quantities and updating material data. This interface plays an important role in ensuring that the availability of medical equipment and supplies is maintained according to operational needs.
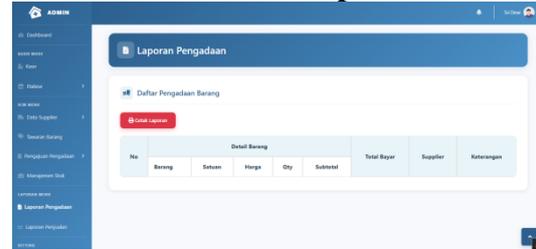
Admin Procurement Report

Image 3. Admin Procurement Report

As a system output, the admin procurement report interface is presented to display a summary of procurement data based on a specific period. This report is used as a reference for evaluation and documentation of the procurement processes that have been carried out.
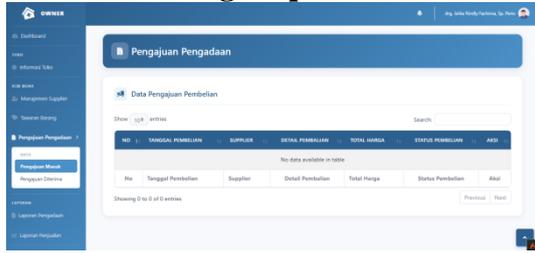
Owner Incoming Request

Image 4. Owner incoming Request

From the decision-making perspective, the incoming request interface for the owner is presented to show the process of verification and approval of requests submitted by the admin. This stage highlights the owner's role in controlling the procurement process before it is forwarded to the supplier.
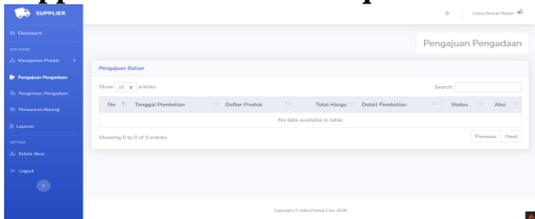
Supplier Procurement Request

Image 5. Supplier Procurement Request

As a form of integration with external parties, the procurement request interface for suppliers is presented to demonstrate the process of receiving and confirming material requests. This interface reflects the involvement of suppliers in fulfilling inventory needs based on approved requests.

CONCLUSION

This research demonstrates that the implementation of the Reorder Point (ROP) method within an Electronic Supply Chain Management (E-SCM) system is able to support more planned and data-driven inventory control of consumable medical equipment and supplies at Jelita Dental Care. The ROP calculation assists in determining the appropriate timing for reordering, thereby minimizing the risks of stockouts as well as excessive inventory accumulation. The results of this study provide a practical contribution to the application of digital inventory management in healthcare clinics and open opportunities for further development by integrating the ROP method with other inventory control techniques to achieve a more optimal system.

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