

Investigating Challenges of Inventory Management in the Healthcare Sector

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Abstract

Purpose: The purpose of this study is to investigate the challenges of inventory management within the public healthcare sector in Egypt. Therefore, it aims to identify and prioritize these challenges to establish recommendations for improving the effectiveness and efficiency of the “medical supply management”.

Design/Methodology/Approach: The study employed a three-phase research design. First, a comprehensive literature review identified eight preliminary inventory challenges. Second, these challenges were validated through exploration interviews and a 5-point Likert scale survey with practitioners at the Public Children's Hospital, which resulted in the addition of two context-specific challenges. Finally, the Analytical Hierarchy Process (AHP) was used based on a pairwise comparison survey to rank and prioritize the identified challenges based on experts' judgments.

Findings: The research identified ten validated challenges affecting public hospital inventory systems. The findings of the AHP indicated that the “Stockout” remains the highest challenge with (25.2%), followed by “Limited Warehouse Space,” which ranked (19.6%), and “Lack of Technology and Automation” with (17.4%). Other notable challenges included “Insufficient Staff Training” and “Overstocking.”

Research Implications/Limitations: This study contributes to the literature by addressing a research gap regarding hospital inventory management solutions specifically tailored for developing countries. However, the findings are limited by their geographical focus on public hospitals within the Egyptian Governorate. Challenges may vary in other regions or different healthcare settings, such as private or specialized clinics, due to local administrative structures and resource availability.

Practical Implications: The study proposes actionable recommendations to improve inventory management performance, such as implementing Electronic Logistics Management Information Systems (ELMIS) and Warehouse Management Systems (WMS) to automate tracking and optimize storage. Enhancing these procedures can lower the operational costs of managing inventory, reduce medication waste, and consequently improve the quality of patient healthcare.

Originality: This research offers a novel application of the Analytic Hierarchy Process (AHP) to prioritize specific inventory management hurdles in the Egyptian public healthcare context. By mixing scholarly literature with the focus medical practitioner perceptions from a specialized children's hospital, the study provides a constructed and empirical framework for decision-making in resource-constrained settings.

Keywords: Hospital Inventory Management, Public Healthcare, Analytic Hierarchy Process (AHP), and Medical Supply Chain.

1. Introduction

The “Healthcare Logistics” in the healthcare industry engages in managing the flow of pharmaceutical and medical goods. Healthcare logistics are extremely complicated due to the high cost of items acquired and stored, as well as the unpredictability of demand associated with the fluctuating demands of patients. Given that this industry affects everyone’s lives and is more than simply a business, a high degree of accuracy and a quick lead time must be ensured (Rathi et al., 2021). Therefore, effective inventory management has a positive impact on both the cost and the caliber of the healthcare services provided (Preziosa *et al.*, 2025). Specifically, hospitals’ proper stock holding management has been acknowledged as a key factor in the efficacy and efficiency of their medical services (George and Elrashid, 2023). In developing countries, such as Egypt, their healthcare systems are currently facing such difficulties. However, Egypt’s healthcare industry has seen the most severe economic downturn as a result of the national revolutions of the 1950s and the wars of 1967 and 1973. The Health Insurance Organization (HIO) Act, which embodies radical reforms, has caused the healthcare sector to suffer in previous decades. However, the present conflicts within Egypt have increased scarcity, poverty, and Lack of essential services, making inventory management a growing concern for public hospitals in Egypt. 9.6 million AIGAs and their families are insured by public hospitals, including 1 million health insurance cards, according to government reports. The benefiting citizens are eligible for free inpatient care, prescription drugs, lab testing, and curative therapy. Owing to the inadequate quality of care provided in public hospitals, these illnesses are highly prevalent and frequently require medication. Patients typically take eight different oral drugs on average each time they visit the pharmacy. Efficient inventory management in public hospitals is essential to guarantee the medical supplies’ availability, as well as lowering the waste and providing the patients with high-quality care.

However, a lot of Egypt’s public hospitals have issues with inadequate inventory control, including running out of necessary medications and discovering expired medications. The supply of public goods and the rectification of market imperfections, particularly for the most marginalized and vulnerable segments of society, serve as the primary rationale for the public sector’s involvement in the healthcare system. The public sector clearly makes a considerable contribution, but inadequate inventory management plagues many public hospitals in underdeveloped nations, causing misery for the most vulnerable and impoverished patients. Public hospital managers in Egypt place a high premium on the effective and efficient administration of

hospital stocks, which include medications, medical supplies, and medical equipment. Inventory control is critical to patient safety and is necessary for the timely and efficient delivery of healthcare services. Inadequate inventory control results in overstock, stockouts, expiration, and incorrect allocation. It results in both unfavorable reactions to expired medications and likely subtherapeutic pharmacological side effects. Inadequate management of hospital pharmaceutical inventory may raise drug prices and, in turn, lower the amount of money that the underprivileged Use for healthcare, resulting in higher out-of-pocket expenses. Public hospitals serve the impoverished and vulnerable, for whom these expenses represent a great sacrifice.

Egypt’s public hospitals usually have serious challenges with their inventory management systems, which result in problems including shortages of necessary medical supplies, waste from overstocking or expiration, and ineffective use of resources. These challenges raise operating expenses, have a detrimental influence on patient care quality, and impair the healthcare system’s overall efficacy. Therefore, this research aims to identify and prioritize the key challenges of inventory management in public hospitals in Egypt as a developing country. Furthermore, it seeks to develop actionable recommendations and potential solutions to address these challenges and provide enhanced efficiency and effectiveness in inventory management practices in hospitals. In order to achieve this research aim, the following objectives were identified:

- 1- To develop a structure for the identification of the challenges of the inventory management systems of public hospitals from previous literature and experts’ opinions.
- 2- To rank these challenges according to their prioritization, using the Analytical Hierarchical Process (AHP).
- 3- To provide actionable recommendations and potential solutions to the most significant challenges of the inventory management systems of the Public Hospital in Egypt.

The next section will provide a comprehensive overview of existing literature relevant to the challenges of inventory management in healthcare settings. It includes the definition and the importance of inventory management in healthcare, the objectives of effective inventory management in hospitals, challenges identified in healthcare literature, and previous studies in the area of inventory management in hospitals.

- **Inventory management in hospital management:**

The development of effective and efficient healthcare systems has become a critical subject due to the fast expansion in healthcare spending around the world and the corresponding rise in demand for healthcare services, of concern to policymakers in the government and the healthcare industry (Ahmadi-javid et al., 2017). The types of inventories in hospitals involve pharmaceuticals such as pills, capsules, and injections, as well as surgical and medical supplies.

syringes and surgical linen, sterile instruments, and medical equipment (X-ray machine, ECG machine, etc.).

Inventory management in hospitals focuses on efficiently handling supplies to meet both normal and emergency demands. It involves establishing policies for inventory levels, review frequencies, and safety stocks, ensuring quality patient care while minimizing costs and avoiding inflated inventories (Almehwari et al., 2024). It enhances patient care, optimizes resource use, and improves customer relationships through effective logistic management techniques (Al Khatib et al., 2024). Moreover, inventory management in hospitals involves managing warehouses, inventory data, and medications to meet client demand. It requires balancing inventory costs with service expectations, particularly in operating rooms, while ensuring efficient supply chains without compromising quality or wasting resources (Alsuliman et al., 2022).

Efficient inventory management in hospital supply chains is crucial to prevent drug shortages (Zwaida et al., 2021). However, medical inventory management, unlike commercial supply chains, places a higher priority on time than cost due to the critical nature of patients (Aziz et al., 2024). Treatment delays are avoided, and healthcare outcomes are enhanced when necessary medical supplies, drugs, and equipment are readily available when needed, through effective inventory management. Moreover, it minimizes waste, prevents stockouts or overstocking, and maximizes resource use. Efficient inventory management is essential to ensuring the seamless operation of hospitals in a setting where prompt and precise care is essential.

Therefore, the inventory management system is a crucial component that influences the general and hospital systems' managerial and operational performance (Nsawah et al., 2025). Huge sums of money are invested in inventory at hospitals. In the event that supplies for treatments are delayed, cash flow issues could develop. However, an excess of inventory can also result in issues like expiration, deterioration of quality, and obstruction of limited resources. Therefore,

efficient inventory management is essential as it aims to keep inventory levels as high as required to guarantee the quality of medical services, but as low as feasible to reduce the financial expenses related to holding, storing, handling, obsolescence, and damage loss. Because effective inventory management has a direct impact on the caliber of medical services rendered, both scholars and practitioners recognize the significance of this practice in hospitals.

- **Key components of efficient hospital inventory management:**

Hospital inventory management is essential to healthcare operations because it keeps costs down while guaranteeing that the goods are available. Procurement, Stock control, and Use of technology to increase productivity are all components of effective inventory management (Durmuş, 2023; Kartikasari, 2024; and Syahidah et al., 2024). The main efficient components in hospital inventory management are:

A) *Strategies for Procurement:*

- Economic Order Quantity (EOQ): This methodology balances ordering and holding expenses to assist in identifying the ideal order quantity to reduce overall inventory costs.
- ABC Analysis: Hospitals can focus their management efforts on high-value items by using the ABC Analysis approach, which divides inventory into three classifications (A, B, and C) according to importance.

B) *Techniques of Stock Control:*

- Reorder Point (ROP): Setting a cutoff point for when to place new orders guarantees that inventory levels are kept in check without going overboard.
- VEN Analysis: This helps prioritize inventory management according to criticality by classifying things as vital, essential, or non-essential.

C) *Integration of Technology:*

- Predictive analytics and artificial intelligence (AI) improve forecasting accuracy and stock level optimization, which lowers waste and improves service delivery.
- RFID and IoT: These technologies make it easier to track inventories in real time, increasing

visibility and lowering stock management errors.

Even though these procedures greatly increase the effectiveness of inventory management, issues still exist, such as public hospitals' limited funding and the requirement for ongoing staff training to accommodate new technologies (Setiawati et al., 2024).

- **Hospital Inventory Management Challenges:**

Inventory management in hospitals faces several challenges that may affect the quality of patient care, controlling costs, and the effectiveness of operations (Bekele et al., 2022). These challenges involve:

“Lack of automation and technology” indicates ineffectiveness, increased human mistakes, and errors in demand forecasting. This delays timely entrance to medical supplies, eventually affecting patient care and operational cost-effectiveness within healthcare organizations (Al Khatib et al., 2024).

“Lack of communication with vendors” is a problem, as hospital inventory management requires effective vendor communication, but there are several obstacles that prevent operational effectiveness. The absence of real-time data sharing between hospitals and vendors is one of the main problems leading to stockouts. Stockouts or overstock consequences are regularly caused by this restriction, which frequently leads to out-of-date inventory records (Sharma, 2015).

“Insufficient training of staff” in hospital inventory management substantially affects the productivity of healthcare supply management. This implies that ineffective training practices lead to poor inventory management, resulting in stockouts and resource wastage (Krishnakumar et al., 2023). This issue is compounded by a lack of standardized procedures and insufficient knowledge among staff involved in managing the inventory management systems (Rodgers & Desderio, 2020).

“Stockouts” happening is generally identified as one of the most disruptive challenges within healthcare supply chain management, as it has occurred intensively in public sectors of developing economies. It occurs generally when the inventory of a specific medical element is depleted, which leads to a “backorder” setting that hinders the flow of hospital operations. Unlike conventional retail sectors, a stockout in healthcare is not purely a lost sale but a critical risk to patient protection that can lead to increased illness and death rates (Kwon et al., 2020).

“Overstocking” describes having extra medical equipment, supplies, and medicines than is required for

regular operations. The stockout harmfully affects overall patient care, waste minimization, and cost efficiency (Khashu et al., 2025). Not only can overstocking result in financial losses, but it can also result in increased expenses for storage and obsolescence, as well as poorer customer satisfaction (Zwaida et al., 2021).

“Limited warehouse space”: the efficacy of pharmaceutical storage and inventory management is severely hampered by hospitals' limited warehouse space. This limitation may result in inefficiencies, raise the possibility of deterioration of drug quality, and ultimately have an impact on patient care (Al Armoti & Alkabi, 2019). Moreover, insufficient warehouse space might cause drug buildup and complicated logistics, raising the possibility of mistakes and delivery delays.

“Supply Chain Problems” have a major impact on hospital inventory management, which can seriously compromise patient care and operational effectiveness (Zwaida et al., 2021). All the partners of the supply chains of healthcare service, such as managers of healthcare, manufacturers of pharmaceuticals, distributors, information service providers, and even service consumers, are just a few of the many stakeholders that must be coordinated due to the complexity of the healthcare supply chain (Kefale et al., 2019). Variations in demand, supplier constraints, and regulatory obstacles all contribute to the complexity of handling medical supplies, especially medicines. To reduce these problems and guarantee that hospitals can continue to deliver care, effective inventory management techniques are crucial (Bafarat et al., 2025).

“Ineffective procurement process”, as one of the main obstacles to the efficient management of the necessary inventory of medicines, is the procurement process. Delays in the procurement process, mostly locally, result in frequent stockouts of essential medications, especially at the health post level (Id et al., 2024).

As shown in the above exploration of the challenges affecting inventory management in hospital logistics management in the current literature, eight main challenges have been identified. These challenges may hinder the efficacy of the management process of the related inventory of hospitals' logistics management. In the next section, the recent studies in the field of inventory management in the healthcare sector within developing countries will be explained.

- **Previous studies about Hospital Inventory Management:**

A critical review of the current literature regarding

inventory management at public hospitals shows a clear polarization between highly advanced quantitative optimization models and the practical resource limitations of developing countries. On one hand, broad global research focuses on complex algorithmic approaches, such as the Deep Reinforcement Learning (DRL) model for drug refilling decision-making (Zwaida et al., 2021), Statistical Process Control (SPC) methodologies (Eissa & Rashed, 2020), and discrete event reproduction for surgical instruments tracking (Bhosekar et al., 2020; Nallusamy et al., 2018). However, Volland et al. (2017) categorize inventory management as a key research stream in hospital material logistics, emphasizing optimization techniques; it does not specifically address inventory management practices in developing countries, focusing instead on literature from industrialized nations. Moreover, Bialas et al. (2020) implemented empirical testing of a framework for improving hospital inventory management at a large public hospital, demonstrating that the Lack of data availability and unstable infrastructure conditions are rarely present in the public health care sector in developing countries.

While literature explicitly focuses on developing countries, studies have depended on traditional mathematical data segmentations or basic descriptive surveys. For example, several scholars heavily encouraged ABC, VEN, and SDE matrix classifications to manage hospital inventory costs and prevent stockouts (Durmuş, 2023; Ladjama et al., 2024; Legese et al., 2022; Mohammed & Workneh, 2020). While these categorization tools are useful, practical field studies across public sectors in developing countries like Kenya, Namibia, and Ethiopia reveal that root cause inventory management weaknesses are hardly just mathematical; relatively, they are extremely rooted in human and structural shortages, such as budget shortages, insufficient staff capabilities, and a lack of standard computerization (Dikire & Gemed, 2024; Shibabaw et al., 2023; Odanga & Wachiuri, 2022). Furthermore, while Lean thinking (LT) methodology or implementing Vendor-Managed Inventory (VMI) showed successful management results, public hospitals normally neglect these strategies due to systemic risks and a lack of administrative commitment (Krichanchai & McCarthy, 2017; Gurumurthy et al., 2021).

Accordingly, a serious gap remains, as existing scholars either offer high technological solutions that developing countries' public hospitals cannot implement, or scholars who describe systemic failures without a structured and prioritized path. Therefore, this study addresses this gap by contextualizing these intersecting operating and technical inventory management challenges within a public pediatric healthcare system in Egypt as a developing country. By utilizing a multicriteria decision-making approach named AHP, this study moves

beyond simple descriptive summaries to quantitatively prioritize these challenges, developing an actionable and specified roadmap for the public healthcare system for improving inventory management.

2. Methodology of the Study

The methodological process of this study concludes 4 phases. **In phase 1**, a literature review is conducted to identify the challenges of inventory management in hospital management. Therefore, scholarly work, studies, and publications pertaining to inventory management strategies were used to create a preliminary list of 8 challenges. **Phase 2** was focused on validating the practical reality of the proposed list of challenges. Interviews are conducted with inventory management practitioners from the Public Children's Hospital to gather their insights and perspectives. Firstly, the practitioners were asked to rate the proposed list of challenges using a 5-point Likert Scale to confirm which of these challenges they are already facing. Secondly, the practitioners were asked to recommend any additional challenges that were not initially identified in the literature review. In fact, the practitioners recommended 2 challenges to be added to the list; the list was updated to include 10 challenges. **Phase 3** involved prioritizing the barriers. A pairwise comparison questionnaire was conducted with the practitioners of inventory management at the Public Children's Hospital. The participants were asked to compare the significance of the identified 10 challenges against each other. The Analytic Hierarchy Process (AHP) technique was then used to prioritize the challenges based on the responses obtained from the pairwise comparisons. The AHP technique helps assign relative weights or priorities to each challenge. A Pairwise Comparison Matrix was presented for the identified challenges in a series of pairwise comparison matrices. For each pair of challenges, respondents were kindly asked to indicate which challenge was more important and by how much, using Saaty's 9-point fundamental scale of relative importance (1 = equally important, 3 = moderately more important, 5 = strongly more important, 7 = very strongly more important, 9 = extremely more important, with even numbers for intermediate values).

To achieve the aim of this research, the primary case study was conducted at the Public Children's Hospital. The hospital is a specialized public pediatric facility located in Egypt, operated under the jurisdiction of the Egyptian Ministry of Health and Population. The hospital maintains an operational capacity of approximately 50 inpatient beds, a highly specialized 34-cradle Neonatal Intensive Care Units (NICU), Pediatric Intensive Care Units (PICU), and an early intervention and rehabilitation center for special needs children. The selection of

this hospital is greatly appropriate to healthcare logistics management because of its high demand and specialized inventories of medical commodities, pharmaceuticals, and life-support consumables. Furthermore, as it is considered a public institution supplying necessary subsidized healthcare to a large geographic regional demographic, it operated under complicated institutional administrative structures. This makes it an ideal testing ground for evaluating inventory management challenges.

The research design for this study was descriptive and analytical, specifically focusing on a case study approach focused on the Public Children's Hospital. Descriptive, as it describes the challenges of hospital inventory management, and analytical, as it analyzes the prioritization of such challenges using the AHP technique. A purposive sampling technique was utilized to select four key experts (the Inventory Manager, two Hospital Storekeepers, and a Supply Chain Manager) directly handling medical supply chain operations at the Public Children's Hospital. While a sample size of four might appear small for empirical surveys, the AHP is explicitly designed for small, expert-driven groups rather than large representative samples (Nguyen *et al.*, 2022). The AHP relies profoundly on the qualitative depth, specialized domain knowledge, and precise professional judgment of the participants rather than statistical generalizability (Saaty, 1990). Methodological accuracy is instead verified through the mathematical consistency of the aggregated matrix, which in this study yielded a valid Consistency Ratio (CR) of 2.10%, well within the universally accepted threshold of less than 10% (Saaty, 1990).

Their selection was based on their extensive experience and critical roles within the hospital's supply chain and inventory management functions, including an Inventory Manager with 20 years of experience, a Supply Chain Manager with 15 years of experience, two Hospital Storekeepers with 15 and 10 years of experience respectively, and a Supply Chain Officer with 3 years of experience. While the experts had different years of experience, they all met the eligibility criteria of the study, ensuring that every expert had the standard expertise required to evaluate the challenges in the pairwise comparison.

To capture a balanced and comprehensive framework, the pairwise comparison data for AHP were generated in a focus group using the "Consensus-Seeking Approach". In AHP decision-making, following the Consensus-Seeking Approach by engaging an expert panel in a focus group discussion allows participants to debate and reconcile different perspectives openly, making the methodology more robust (Dong and Saaty, 2014). Consequently, all experts' judgments were

equally weighted in the focus group. There are many software packages on AHP; in this study, Expert Choice, which is one of these software packages on AHP, was used. Using Expert Choice, the user can graphically adjust the weights of the decision criteria and see on screen how the alternatives' rankings will change.

3. Study Findings

As stated before, a two-stage survey approach was employed to identify and prioritize the challenges of inventory management in public hospitals. A preliminary list of eight challenges was identified via literature review and validated by four key hospital practitioners using a 5-point Likert scale. All eight challenges were confirmed with mean scores above the average. However, the challenges "Lack of technology and automation" and "Limited warehouse space" had the highest mean score, 5.00.

Additionally, the participants identified two challenges: "Limited Budget and Resources" and "Poor Communication between Departments". They defined them from the operational perspectives as:

- Limited Budget and Resources: The financial and structural constraints that limit capital investment in modernizing supply chain systems, consequently, affect inventory management systems. Moreover, these constraints limit the expansion of physical storage infrastructure.
- Poor Communication between Departments: The fragmentation and delay of critical data flow and operational alignment between independent departments, such as clinical departments, procurement departments, and inventory management, result in a lack of real-time visibility, which affects the overall inventory management process.

Lastly, the practitioners finalized a list of 10 challenges for prioritization using the AHP technique as the last step of the methodological process. The AHP was utilized to prioritize the validated challenges using a pairwise comparison by the same practitioners from the Public Children's Hospital. Geometric means have been used as the aggregation approach to combine the experts' judgments, according to the AHP technique. The results showed that the CR= 2.10 %. This percentage is accepted, as Saaty (1990) has shown that a CR of 10% or less is acceptable to continue the AHP analysis. If the consistency ratio is greater than 10%, it is necessary to revise the judgments to locate the cause of the inconsistency and correct it. Table 1 summarizes the AHP priority, weights, and geometric mean results.

Table 1 Inventory Challenges Priorities:

Challenges	Geometric Mean	Priority	Rank
1. Stockout	3.8967	25.2%	1
2. Overstocking	1.0827	6.9%	5
3. Limited Warehouse Space	2.6288	19.6%	2
4. Lack of Technology and Automation	2.2694	17.4%	3
6. Lack of Communication with Vendors	0.8013	6.8%	6
7. Insufficient Training Staff	1.0827	7.1%	4
8. Poor Communication between Department	0.7618	5.4%	7
10. Ineffective Procurement Process	0.5250	4.6%	8
12. Limited Budget and Resources	0.4138	3.4%	10
13. Supply Chain Problems	0.4137	3.5%	9

Top Priorities:

- **Stockout (25.2%):** This is clearly identified as the most critical challenge, holding the highest priority. This suggests that the inability to meet demand due to a lack of stock is perceived as the most significant problem.
- **Limited warehouse space (19.6%):** Ranked second, this indicates that physical constraints on storage are a major concern, potentially hindering efficient operations and contributing to other issues.
- **Lack of technology and automation (17.4%):** As the third priority, this highlights a recognition of the need for modernization and technological advancements to overcome existing challenges.

Mid-Range Priorities:

- **Insufficient training staff (7.1%) and Overstocking (6.9%)** follow, indicating these are also important, though less so than the top three. The relatively close priority of overstocking to stockout might suggest a perceived challenge in balancing inventory levels.

Lower Priorities:

- Challenges such as Lack of communication with vendors (6.8%), Poor communication between departments (5.4%), Ineffective procurement process (4.6%), Supply chain problems (3.5%), and Limited budget and resources (3.4%) are ranked lower. While still challenges, their perceived impact is considerably less than the top issues. "Limited budget and resources" being the lowest priority is interesting; it might imply that the respondents believe solutions to other problems are achievable even within current financial constraints, or that the other problems have a more direct and immediate impact.

4. Discussion

In this section, some recommendations are presented to overcome the three top-priority challenges found by AHP analysis. These are Stockout, Limited warehouse space, and Lack of technology and automation. Regarding "Stockout", which revealed the top priority in hospital inventory management, it poses a serious problem since they have an immediate effect on the capacity to satisfy patient demand and guarantee the provision of high-quality healthcare. This finding confirmed the results of Jayani & Pudjirahardjo (2014), which identified stockout as a significant issue, with a recorded occurrence of 33.4% in hospital inventory management. Also, the findings reflect a study finding by Kabera & Mukanyangezi (2024), as they mentioned that stockouts that result in an inability to satisfy demand are seen as a serious issue since they can have serious repercussions, including worsened patient care and higher death rates. Inadequate supply chain systems and ineffective inventory management techniques make this problem worse. Recommendations to overcome stockouts: (1) Advanced Inventory Systems: According to Kabera and Mukanyangezi (2024), putting in place advanced inventory management systems, including electronic logistics management information systems, can greatly lower stockout rates and increase stock availability, (2) Effective Supply Chain Management: Stockouts can be avoided and overall inventory efficiency raised by streamlining supply chain procedures, such as sourcing tactics and waste minimisation (Kachwee & Hartmann, 2013), and (3) Emergency Inventory Planning: To ensure preparedness for unforeseen spikes in demand, hospitals should create inventory plans that take into consideration both regular and emergency demand conditions.

Regarding the challenge “Limited warehouse space”, which accounts for 19.6% of issues, it has a big influence on how well inventory is managed. This limitation of the warehouse space may result in operational inefficiencies, higher expenses, and difficulties in satisfying patient requirements. This confirmed the study of Abideen et al. (2024), which mentioned that Space constraints might result in haphazard storage, which makes it challenging to find essential supplies fast, particularly in an emergency. This may lead to drug mistakes, therapy delays, and compromised patient safety. Recommendations to overcome Limited Warehouse Space: (1) Redesigning Layouts: Efficient engineering must re-evaluate the current warehouse layout to improve flow, create dedicated zones (e.g., for sterile vs. non-sterile, high-volume vs. low-volume, cold storage), and potentially narrow aisles with specialized equipment (Automatisés et al., 2023), (2) Warehouse Management System: FEFO/FIFO (First-In, First-Out) rules, put-away and picking optimisation, real-time inventory tracking, and expiration date management are all possible with warehouse management systems (Owino et al., 2013). This significantly improves control and visibility, enabling more accurate stock levels and minimizing the need for more physical space.

About the challenge “Lack of technology and automation,” it ranked as the third top priority of the challenges. The finding reflects a study by Papadopoulos et al. (2021), which mentioned that manual ordering, receiving, and inventory monitoring procedures are labor-intensive, time-consuming, and prone to human mistakes. This led to inaccurate stock levels, lost goods, and delays resulting from this, all of which raise operating expenses and reduce output. Recommendations to overcome “Lack of technology and automation”: (1) Warehouse management system: It is important as it updates receipt and delivery, optimizes storage locations, automates inventory tracking, and facilitates accurate picking procedures. This immediately decreases errors and increases space utilization (Soegoto and Nugraha, 2020). (2) Barcoding and RFID (Radio-Frequency Identification): Real-time tracking from receipt to point-of-use is made possible by the Use of barcode and RFID scanning devices for all medical supplies. This significantly lowers the amount of manual counting, increases inventory accuracy, guards against loss, and makes automatic reordering easier (Papadopoulos et al., 2021). (3) Enterprise Resource Planning (ERP) Systems: By combining a WMS with a more comprehensive ERP system, data can move smoothly between the financial, clinical, procurement, and inventory departments, giving a comprehensive picture of the supply chain and enhancing planning in general (Islam and Shorif, 2025).

According to the study results, it is highly counterintuitive that the expert panel ranked ‘Limited budget and resources’ as the lowest priority challenge (10th, 3.4%).

Far from implying that financial capital is abundant, this significant finding reveals a critical strategic paradigm shift among healthcare practitioners. However, the participants argued that operational challenges, specifically ‘Lack of technology and automation’ (3rd, 17.4%) and ‘Poor communication between departments’ (7th, 5.4%), represent initial deficiencies that severely reduce the return on investment of any subsequent financial investment if mismanagement is left. Accordingly, they placed technological and structural optimization as a fundamental requirement to increase funding. For instance, if the hospital receives a budget increase but at the same time lacks automated inventory tracking or interdepartmental data synchronization, the additional budget will be misallocated. Therefore, the AHP evaluation indicates that prioritizing building robust, visible, and automated inventory management over budget growth is necessary.

5. Theoretical Implications

This study expands the theoretical limitations of healthcare logistics and multicriteria vulnerability assessment in multiple dimensions. Firstly, it addresses a significant gap in the scholarly literature by redirecting the emphasis from generalized, resource-abundant private medical institutions to highly specialized public pediatric facilities situated in developing nations. Secondly, the study results reveal that technological and communication-based challenges are overlooked financial challenges in public health systems. Accordingly, this study improves the Resource-Based View (RBV) within the supply chain concept, particularly inventory management. Rather than inspecting financial investment as the primary driver for organizational resilience, the study’s empirical ranking exposes operational hierarchy where digital structure (Lack of technology and automation) and rational infrastructure (Poor communication between departments) are seen as initial capabilities.

This introduces a novel framework for prioritizing the challenges of inventory management within public sector healthcare facilities, as the augmentation of financial resources does not necessarily enhance operational efficiencies; instead, it is the “preparedness” in operational and technological dimensions that determines the capacity for engagement and the effectiveness of financial resources.

6. Practical Implication

These study findings provide practical implications for the healthcare sector at two levels: the public hospitals and the Health Insurance Organization (HIO). At the

hospital level, the administrators should focus on handling the main challenge of “Stockouts” as they should utilize better communication management between medical departments, procurement departments, and storage departments to predict early demand. Furthermore, the current “Warehouse Space” must be physically rearranged to optimize the “Limited Warehouse Space”.

At the HIO level, it should model a strategic investment. Due to the high rank of “Lack of Technology”, the HIO should implement a gradual technology implementation with barcode tracking or life-saving pediatric goods. This must be supported by “Staff Training” to ensure a successful long-term system.

7. Conclusion and Future Work

This study identified and prioritized the major inventory management challenges of the Public Children Hospital, providing a clear roadmap for public healthcare logistics in developing countries such as Egypt. The findings of the AHP assessment of these challenges

reveal that the operational risks, such as “Stockouts”, “Limited Warehouse Space”, and “Lack of Technology and Automation,” are the true root cause of the logistics weakness, particularly the inventory management. Critically, the lowest ranking of “Limited Budget and Resources” confirms that arranging financial resources at a structurally failed system will not fix it; instead, establishing process visibility and communication must come first. Resolving these logistical challenges will have a direct impact on patient care and the wider Egyptian healthcare system. At the hospital level, reducing medication stockouts ensures successful patient care services without dangerous delays.

This study focused on a specific Public Children's Hospital in Egypt. Future research could expand the scope to include multiple public hospitals across different regions or with varying scales of operation in Egypt. A comparative study would help to identify whether these challenges and their prioritization are consistent across the public healthcare sector in developing countries, or if there are unique challenges or variations based on hospital size, location, or specialization. This could lead to more generalized recommendations and policy interventions.

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