



# Inventory Management Practices and Healthcare Service Efficiency in Primary Health Centres

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## Abstract:

Primary Health Centres (PHCs) are vital to rural healthcare, making the timely availability of medical supplies crucial for effective patient care. This study examines the impact of inventory management practices specifically stock maintenance, procurement processes, and storage techniques on the service efficiency of Primary Health Centres. Adopting a descriptive research design, primary data was collected from medical officers, pharmacists, and administrative staff using a structured questionnaire. Statistical analyses were conducted to evaluate the relationship between inventory control measures (such as stock-out frequency and lead time management) and service quality metrics, including essential drug availability and patient waiting times. The findings reveal a strong positive relationship between efficient inventory management and improved healthcare delivery. Conversely, frequent stock-outs and inadequate demand forecasting directly contribute to extended patient waiting times and service bottlenecks. The study concludes that adopting systematic inventory control techniques, such as robust stock monitoring and accurate demand prediction, is essential to minimize medicine shortages, reduce wastage, and significantly enhance operational efficiency in PHCs.

**Index Terms** - Inventory Management; Primary Health Centres (PHCs); Service Efficiency; Healthcare Supply Chain; Rural Healthcare

## I. INTRODUCTION

Primary Health Centres (PHCs) serve as the foundational "first mile" of India's public healthcare system, providing crucial, affordable care to rural and semi-urban populations. However, a PHC's effectiveness relies heavily on robust inventory management the systematic planning, ordering, and storing of medical supplies. In healthcare, managing inventory is not merely logistical but a critical life-saving function that ensures essential medicines and equipment are consistently available to patients when they need them most.

The quality of inventory control directly impacts a health center's service efficiency. Inefficient practices lead to two major pitfalls: critical stockouts, which force disadvantaged patients to buy expensive medicines from private pharmacies, and overstocking, which wastes limited government funds on expired drugs. Conversely, implementing accurate demand forecasting and proper storage prevents these issues, reduces patient wait times, builds community trust, and ultimately improves healthcare outcomes.

Despite established state-level supply chain models like the Tamil Nadu Medical Services Corporation (TNMSC), localized "last-mile" challenges persist. PHCs serve a diverse population and face distinct operational pressures, including fluctuating seasonal disease outbreaks and logistical hurdles in remote areas. Examining how PHCs manage their stock whether through manual ledgers or digital systems and how they handle emergency procurement is vital for evaluating their true service capability.

## II. RESEARCH OBJECTIVES

Primary objective:

- To analyze the existing inventory control techniques utilized by Primary Health Centres.

Secondary Objectives:

- To evaluate the impact of lead time and stock availability on patient service delivery.
- To assess the efficiency of storage and internal distribution systems within the PHC supply chain.
- To determine the relationship between inventory wastage (expiry/breakage) and operational cost efficiency.
- To formulate strategies for optimizing inventory turnover to minimize service disruptions.

## III. REVIEW OF LITERATURE

**Nsowah, J., Agyenim-Boateng, G., & Anane, A. (2025).** “Effect of Inventory Management Practices on Healthcare Delivery and Operational Performance of Sunyani Regional Hospital”. This study investigated the impact of inventory management practices specifically supplier management, computerization, and communication on healthcare delivery and operational performance at Sunyani Regional Hospital. Addressing the scarcity of empirical research on inventory systems within Ghanaian regional hospitals, the authors surveyed 50 staff members across key departments like pharmacy and procurement.

**Qardawi, Y., & Hastuti, A. S. (2025).** “Inventory Management Optimization and Its Impact on Service Quality in Pharmacy Chains”. This study examined how inventory optimization techniques, specifically ABC-VED analysis and demand forecasting, influence service quality in pharmacy chains. By analysing pre- and post-optimization data from records and surveys, the authors addressed the need to quantify these impacts on patient satisfaction. The findings revealed that optimizing inventory significantly reduced stockouts and holding costs, directly resulting in improved customer satisfaction and service delivery.

**Acquah, S. K. (2024).** “The Role of Effective Inventory Management Practices on Organizational Performance: A Case of Tarkwa Municipal Hospital”. This study investigated the inventory management practices at Tarkwa Municipal Hospital to determine their effect on organizational performance and identify implementation challenges. Addressing the scarcity of research linking inventory practices to performance in municipal hospitals within Ghana's Western Region, the author surveyed 200 respondents. The analysis revealed a significant positive relationship between effective inventory management and organizational performance, emphasizing the need for robust inventory strategies to enhance hospital operations despite existing challenges.

**Bimenyimana, E., & Irechukwu, E. N. (2023).** “Inventory Management Practices and Patient Satisfaction: A Case of Gihundwe District Hospital”. This study investigated the relationship between inventory management practices specifically the acquisition and provision of medical supplies and patient satisfaction at Gihundwe District Hospital. Addressing the scarcity of research connecting technical inventory processes to patient outcomes in the Rwandan context, the authors collected data from both hospital staff and patients. The findings demonstrated a significant positive correlation between effective inventory management and patient satisfaction, suggesting that efficient acquisition and provision mechanisms are fundamental to enhancing the patient experience.

**Singh, A., Rasania, S. K., & Barua, K. (2022).** Inventory control: Its principles and application”. This narrative review examined the fundamental principles of inventory control to demonstrate how applying specific techniques such as ABC, VED, and FSN analysis improves stock availability and efficiency in healthcare facilities. The review highlighted that implementing systematic control techniques, particularly the ABC-VED matrix, leads to significant improvements in cost rationalization and ensures the consistent availability of critical medical supplies compared to ad-hoc methods.

## IV. RESEARCH METHODOLOGY

This study adopts a quantitative, cross-sectional framework utilizing a descriptive and analytical research design to systematically investigate the relationship between inventory management practices and service efficiency at Primary Health Centres (PHCs). To empirically examine how inventory control mechanisms

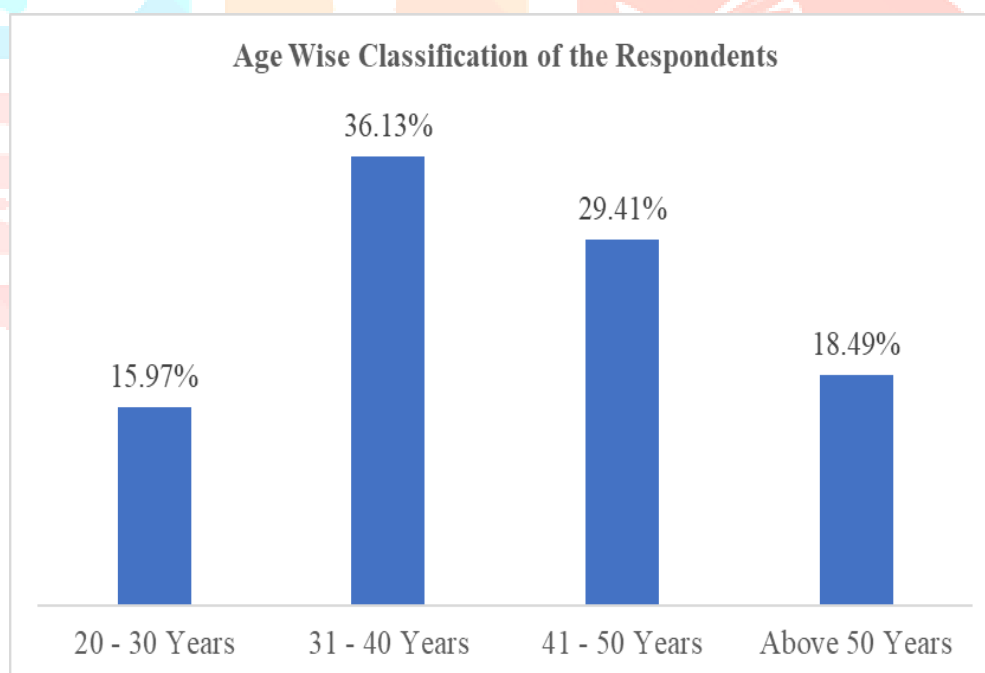
such as stock monitoring and reorder level management directly influence service efficiency metrics like critical medicine availability and patient wait times, the study targets a representative sample of 119 healthcare professionals, including Pharmacists, Medical Officers, Nurses, and Store Administrators. Primary data is collected directly from these handling employees using a structured questionnaire measured on a 5-point Likert scale, which captures demographic profiles alongside operational evaluations of procurement lead times, storage conditions, and stockout frequencies. Concurrently, secondary data is gathered from established literature, peer-reviewed journals, and official government records including reports from the Tamil Nadu Health Systems Project (TNHSP) and the Directorate of Public Health and Preventive Medicine to build a robust theoretical foundation and support the primary empirical findings.

## V. ANALYSIS AND INTERPRETATION

### PERCENTAGE ANALYSIS

**Age Wise Classification of The Respondents**

S. No.	Age Group	No. of Respondents	Percentage
1	20 - 30 Years	19	16
2	31 - 40 Years	43	36.1
3	41 - 50 Years	35	29.4
4	Above 50 Years	22	18.5
TOTAL		119	100.0



#### **Interpretation:**

The age profile of the workforce reveals that the largest segment of respondents falls within the 31 to 40 years category at 36.1%, followed closely by those aged 41 to 50 years at 29.4%. Employees over 50 years account for 18.5%, while the youngest demographic of 20 to 30 years represents the smallest portion at 16%. This indicates a mature and experienced workforce actively participating in the operational processes of the Primary Health Centre (PHC).

## DESCRIPTIVE STATISTICS

Descriptive Statistics for Designation and Years of Experience							
	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Designation	119	1	5	283	2.38	1.127	1.271
Years of experience	119	1	4	349	2.93	1.056	1.114
Valid N (listwis)	119						

### Interpretation:

The descriptive statistics summarize the demographic profile of the 119 respondents from the primary health centres. The data indicates that the "Designation" variable has a mean score of 2.38 and a standard deviation of 1.127, suggesting a moderate spread across different roles within the facilities. Meanwhile, the "Years of experience" variable shows a mean of 2.93 with a standard deviation of 1.056. This indicates that the average respondent possesses a moderate level of experience, with responses clustering relatively closely around the central mean.

### ANALYSIS OF VARIANCE (ANOVA)

		Sum of Squares	df	Mean Square	F	Sig.
Storage and Internal Distribution Efficiency	Between Groups	.563	4	.141	1.430	.228
	Within Groups	11.210	114	.098		
	Total	11.773	118			

### Hypotheses:

- Null Hypothesis ( $H_0$ ): There is no statistically significant difference in the mean scores for Storage and Internal Distribution Efficiency across different designations or roles.
- Alternative Hypothesis ( $H_1$ ): At least one designation or role group has a statistically different mean score for Storage and Internal Distribution Efficiency.

### Interpretation:

The analysis compares the variance between the different designation group means against the variance within those individual groups, producing an F-statistic of 1.430 with a significance p-value of .228. Because the significance level (.228) is greater than the standard 0.05 threshold, the variance between the groups is not significantly larger than the variance within them, meaning we fail to reject the null hypothesis. In direct alignment with your secondary objective to assess storage and internal distribution systems, this statistical consensus indicates that personnel across all organizational roles at the Primary Health Centres share a uniform assessment regarding the current efficiency of internal storage and distribution.

## VI. FINDINGS

- The study surveyed 119 healthcare and administrative personnel involved in inventory management across Primary Health Centres, with a balanced gender composition and a predominantly experienced workforce, where over 71% of respondents had more than six years of service.
- Inventory classification and stock monitoring practices are highly institutionalized, with 95.8% of respondents confirming the use of Vital–Essential–Desirable (VED) analysis and 100% reporting regular monitoring of minimum and maximum stock levels for essential medicines.

- Digital inventory systems and physical stock verification are effectively integrated into routine operations, with more than 97% of respondents affirming that software-based stock tracking and periodic audits ensure high levels of inventory accuracy and operational transparency.
- Existing inventory control techniques significantly reduce overstocking, shorten procurement lead times, and minimize supply delays, while ensuring the uninterrupted availability of critical and life-saving medicines for patient care.
- Storage infrastructure and handling practices are highly efficient, with nearly all respondents confirming adequate warehouse space, reliable cold chain maintenance, and strict adherence to the First-Expiry-First-Out (FEFO) method to prevent wastage and maintain medicine quality.
- Statistical analysis using ANOVA revealed that years of work experience do not significantly influence perceptions of inventory turnover and service efficiency ( $F = 0.788$ ,  $p = 0.503$ ), confirming that effective inventory management consistently enhances healthcare service delivery regardless of staff tenure.

## VII. SUGGESTIONS

- Primary Health Centres should adopt fully digitized and proactive inventory management systems with real-time stock tracking and dashboard-based monitoring to replace manual registers and improve the accuracy, transparency, and efficiency of supply chain operations.
- Systematic inventory control techniques such as ABC analysis, VED analysis, and the integrated ABC-VED matrix should be consistently applied to prioritize critical medicines, optimize stock investment, and ensure uninterrupted availability of essential drugs.
- Demand forecasting should be strengthened using historical consumption patterns, seasonal disease trends, and local healthcare requirements to prevent stock-outs, overstocking, and unnecessary wastage of medicines and medical supplies.
- Regular physical stock verification, strict monitoring of minimum and maximum stock levels, maintenance of buffer stocks, and adherence to the First-Expiry-First-Out (FEFO) method should be continued to enhance inventory accuracy and reduce expiry-related losses.
- Procurement and distribution systems should be streamlined through improved coordination between Primary Health Centres, district drug warehouses, and Tamil Nadu Medical Services Corporation to minimize lead times and ensure timely replenishment of supplies.
- Storage and infrastructure facilities, including adequate warehouse capacity, cold chain equipment, and specialized emergency reserves such as anti-snake venom and trauma kits, should be strengthened to support uninterrupted healthcare delivery across both rural and geographically remote areas.

## VIII. CONCLUSION

Efficient inventory management at Primary Health Centres has a strong positive impact on operational efficiency and patient service delivery. The transition from manual records such as the A-Register to real-time digital inventory systems improves stock accuracy, reduces administrative errors, and enables timely, data-driven replenishment decisions. Effective demand forecasting based on seasonal disease trends, along with streamlined coordination between PHCs, district drug warehouses, and Tamil Nadu Medical Services Corporation, helps reduce procurement lead times and prevents stock-outs during periods of high demand. The use of integrated inventory control techniques such as ABC-VED analysis, FEFO practices, and proper cold chain management ensures optimal prioritization, minimizes wastage, and maintains the quality of essential medicines and vaccines. Localized supply chain strategies are also necessary to address the distinct needs of plains and foothill health centres, including specialized emergency stocks such as anti-snake venom and trauma kits. Overall, uninterrupted availability of medicines improves patient turnaround time, strengthens public confidence in government healthcare services, and reduces out-of-pocket expenses for economically disadvantaged families.

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