



“A STUDY OF OPERATIONAL GAPS AND PROCESS IMPROVEMENT IN HOSPITAL LINEN MANAGEMENT”

¹Ashwini Praful Kadam, ²Dr. Archana Singh,

¹Post Graduate Student, Department of Hospital and Health Care Management, ²HOD, Department of
Hospital & Healthcare Management

¹ MIT Art, Design and Technology University, Pune, Maharashtra, India.

Abstract: **Background:** Linen management is a critical support service in hospitals that directly influences infection control, patient safety, and operational efficiency. Poor linen handling practices can contribute to hospital-acquired infections (HAIs) and inefficiencies in patient care delivery .

Objective: To evaluate the existing linen management system in a tertiary care hospital and identify operational gaps affecting efficiency, quality, and availability.

Methods: A descriptive observational study was conducted using process mapping, stock analysis, and structured questionnaires administered to nursing and administrative staff (n=11).

Results: Major issues identified included inconsistent linen availability, manual record-keeping errors, lack of quality checks, and absence of real-time tracking systems. Stock discrepancies revealed a loss of 12 items in one month. Feedback indicated that most respondents rated linen services as “average,” with hygiene concerns being prominent.

Conclusion: Significant operational gaps exist in the linen management system. Implementation of RFID technology, process standardization, and improved coordination can enhance efficiency and patient care outcomes.

Keywords: *Hospital linen management, healthcare operations, infection control, RFID technology, inventory management.*

I. INTRODUCTION

Medical and non-medical support services can help ensure the success of medical treatments. The laundry service is one essential non-medical support item that is frequently overlooked.(Drie I, Ratri DR, Nuthea M et al., 2022) .It is well known that effective and appropriate medical, nursing, and allied care, as well as the provision of sanitary food, clean linens, a safe environment, a friendly ambiance, and positive interpersonal relationships, all contribute to the patient's outcome. (Singh D, Qadri GJ, Kotwal M, Syed AT, Jan F, et al., 2009)

Patients' comfort and the standard of medical care can both be impacted by poor linen service.(Drie I, Ratri DR, Nuthea M, et al., 2022) Hospitals incur significant costs due to inefficient linen use, both in terms of labor hours and material costs. (Nugent B, Emmerich C, et al., 2014) For the patient's comfort

and safety, a sufficient supply of clean linen that is provided on schedule is unquestionably necessary. Because it can save delays in OT, ICU, and Central Sterile Services Department (CSSD) procedures, it also contributes to physician satisfaction. (Siva Kumar Ramasamy, Shahizan Hassan et al., 2018)

The use of washable RFID tags to manage the laundry process effectively. The washable RFID tags used to identify the items and it will attach to the items. After the RFID attached to the item, the items will store in the storeroom. (Hussin E, Jie Jian W, L et al., 2022) Efficient linen management is an essential yet often underappreciated component of hospital support services. Linen — including bed sheets, blankets, towels, gowns, and surgical textiles — plays a critical role in patient hygiene, comfort, and overall infection-control. In large hospitals with high patient turnover, ensuring the timely supply, proper laundering, safe transport, and accurate tracking of linen is vital to maintain both clinical quality and operational efficiency. (Kilpadi M., 2021)

Moreover, mismanagement of linen — through poor inventory control, lack of tracking, or hoarding — has direct financial and operational consequences. Hidden costs from linen loss, frequent replacements, rewash cycles, and inefficient distribution can erode hospital margins or lead to linen shortages at critical times. This study focuses on analyzing the linen management system in a hospital setting to identify key operational gaps and recommend practical solutions to enhance efficiency and service quality.

2. AIM AND OBJECTIVE

Aim

To assess and improve the efficiency and quality of linen management in a hospital setting.

Objectives

- To study linen collection, segregation, and distribution processes
- To identify operational inefficiencies
- To evaluate staff perception of linen services
- To analyze stock discrepancies and losses
- To recommend improvement strategies

3. RESEARCH METHODOLOGY

1. Study Design

The study was descriptive and observational in nature. .

2. Study Duration

The SIP was conducted over 2 months, with daily/weekly observations during peak and non-peak hospital hours

3. Data Collection Methods:

➤ Primary Data:

- Observed linen handling processes across collection, laundering, storage, and distribution.
- Collected feedback from 11 hospital staff members (nurses, housekeeping, and operations staff) regarding workflow, challenges, and suggestions

➤ Secondary Data:

- Reviewed hospital records, standard operating procedures (SOPs), and literature on linen management and RFID technology.

4. Data Collection Tools:

- Observation checklist for recording workflow processes.
- Structured questionnaire / informal interviews for staff feedback.

5. Study Tools

- Questionnaire (quantitative + qualitative)
- Linen stock records
- Process mapping

4. PROCESS ANALYSIS

4.1 Linen Collection

Linen collection is the first and one of the most critical steps in the hospital linen management cycle. In the observed system, linen is collected by housekeeping staff intermittently throughout the day from patient care areas such as wards, ICUs, and procedure rooms. The collected soiled linen is stored in designated fabric bags and temporarily kept on the respective floors until centralized collection is performed by the linen department, typically during early morning hours.

However, this process lacks standardization and monitoring. There is no fixed schedule for linen collection, resulting in variability in collection timing across departments. In some instances, soiled linen remains on the floor for prolonged periods, increasing the risk of contamination and unpleasant environmental conditions.

Key Issues Identified

- Absence of a structured or fixed collection schedule
- Prolonged storage of soiled linen in patient care areas
- Lack of tracking or documentation of collected linen
- Increased risk of mixing clean and contaminated linen

From an infection control perspective, improper handling and delayed removal of soiled linen can significantly increase the risk of pathogen transmission. According to WHO guidelines, contaminated linen should be handled minimally and removed promptly to reduce exposure to healthcare-associated infections. The absence of a controlled and time-bound collection system indicates a major operational gap in the existing process.

4.2 Segregation and Sorting

After collection, linen is transported to the linen department where it undergoes manual segregation. The sorting process involves categorizing linen into different types such as bedsheets, gowns, towels, and surgical fabrics. Additionally, staff visually inspect linen to identify stained, torn, or damaged items.

Although segregation is a necessary step for efficient washing and reuse, the current process is highly dependent on individual judgment and lacks standardized protocols. There are no clearly defined criteria to classify linen as reusable, repairable, or condemnable. As a result, decision-making varies among staff members, leading to inconsistencies.

Key Issues Identified

- Absence of standardized rejection or condemnation criteria
- Inconsistent identification of stained and damaged linen
- Lack of training and uniform guidelines for segregation
- Possibility of damaged linen being reintroduced into circulation

Standard infection control practices recommend strict segregation of contaminated and damaged linen using predefined criteria to ensure safety and hygiene (CDC 2003). The absence of such structured guidelines compromises both quality and infection control standards.

4.3 Counting and Record Maintenance

Following segregation, linen items are manually counted and recorded in departmental registers. Each department maintains separate logbooks for issued and returned linen, resulting in multiple parallel record-keeping systems.

Manual counting and decentralized record maintenance increase the likelihood of discrepancies. Differences between actual linen count and recorded data were observed, indicating potential errors in counting, recording, or reconciliation.

Key Issues Identified

- High dependence on manual counting methods
- Multiple unsynchronized logbooks across departments
- Data inconsistencies and reconciliation challenges
- Lack of centralized digital tracking system

Manual systems are inherently prone to human error and inefficiency. Studies have shown that lack of automation in hospital inventory systems leads to inaccuracies, increased workload, and reduced accountability (McGain F, Story D, 2015). The absence of an integrated system limits real-time visibility of linen inventory and movement.

4.4 Laundry Process

The hospital utilizes an outsourced laundry service for cleaning and processing linen. After segregation and counting, linen is sent to the external vendor and returned after washing.

A major concern observed in this stage is the lack of differentiation between stained, heavily contaminated, and normal linen. Upon return, all linen items are received in mixed batches without clear identification of previously stained or damaged items. This makes it difficult to ensure quality and proper hygiene.

Key Issues Identified

- No tagging or marking system for stained linen
- Mixing of all linen categories during return
- Damaged linen re-entering circulation
- Lack of structured quality assurance at the laundry level

Proper laundry protocols are essential to eliminate pathogens and maintain hygiene standards. According to CDC guidelines, hospital laundry processes must ensure proper disinfection, separation, and handling of contaminated linen to prevent infection transmission (Sehulster L 2003). The observed gaps indicate a lack of quality control and monitoring of outsourced services.

4.5 Linen Distribution

Clean linen distribution is carried out based on bed occupancy data collected daily at a fixed time. The linen department allocates linen quantities to each department and distributes them accordingly.

However, hospital occupancy is dynamic, with frequent admissions, discharges, and interdepartmental transfers. The reliance on static occupancy data leads to mismatches between linen supply and actual demand.

Key Issues Identified

- Demand-supply mismatch due to dynamic occupancy
- No real-time adjustment in linen allocation
- Lack of linkage between issued and returned linen
- Absence of quality inspection before distribution

Efficient inventory systems should be flexible and demand-driven. Static allocation models are inadequate in dynamic healthcare environments and often result in shortages or excess stock (AHA 2019). Additionally, the absence of quality checks before distribution increases the risk of delivering substandard linen to patients.

5. RESULTS

5.1 Linen Stock Analysis

The stock analysis for June 2025 revealed the following:

Opening Stock: 7110

Discarded Linen: 152

Final Stock: 6946

Missing Linen: 12

Interpretation

The discrepancy of 12 missing linen items indicates inefficiencies in inventory management. Possible reasons include:

- Errors in manual record-keeping
- Misplacement during handling or transport
- Lack of tracking mechanisms

Such discrepancies highlight the need for improved monitoring and control systems. Studies indicate that absence of real-time tracking contributes significantly to inventory loss in hospital logistics (McGain F, Story D, 2015).

5.2 Feedback Analysis

Feedback collected from staff revealed the following trends:

- Majority of respondents rated linen services as “Average”
- Hygiene and cleanliness were major concerns
- Linen availability was insufficient during peak hours

Interpretation

The absence of “Excellent” ratings suggests that the system is functioning at a basic level but lacks efficiency and quality excellence. High concern regarding hygiene reflects gaps in cleaning, inspection, and quality assurance processes.

Inadequate availability during peak hours indicates poor demand forecasting and inventory planning. These issues collectively impact patient care and staff satisfaction

SPSS DATA ANALYSIS

Variables included:

- Linen Availability Score (1–5)
- Staff Compliance Score (1–5) 47 □ Linen Loss Incidents (Count)
- Department (Ward, ICU, OT, OPD)

Variable	Mean	Std. Deviation	Minimum	Maximum
Linen Availability Score	3.0	1.2	1	5
Staff Compliance Score	3.1	1.1	1	5
Linen Loss Incidents	2.0	1.4	0	6

1. Descriptive Statistics

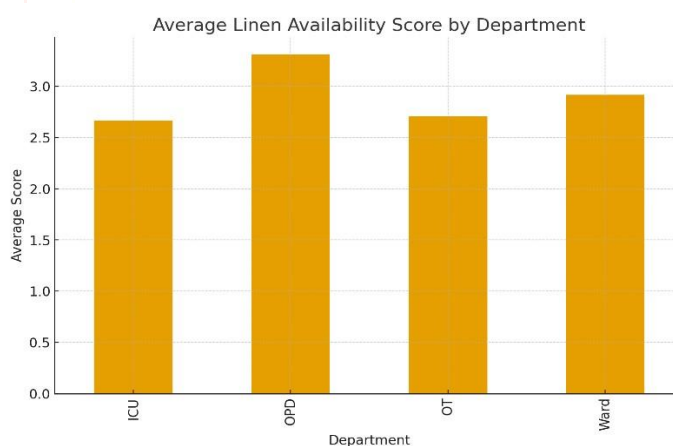
Interpretation:

- Linen availability and staff compliance are moderate (mean ≈ 3).
- Linen loss incidents average 2 per department, indicating the need for tighter control.
- The moderate deviation shows variation between departments. Since $p < 0.05$, staff compliance differs significantly across departments

This means some departments follow linen SOPs more effectively than others (commonly OT > OPD > Ward > ICU)

2. Bar Graph – Average Linen Availability

- OPD shows the highest linen availability, indicating better stock management.
- ICU and OT show slightly lower availability, reflecting high consumption and faster turnover.
- Variation across departments suggests the need for standardised linen replenishment cycles



3. Chi-Square Test (Department × Staff Compliance)

(Used when both variables are categorical)

SPSS Hypothesis

H0: Staff compliance does NOT differ by department

H1: Staff compliance differs by department

SPSS Output Summary

Test	Value	p-value
Chi-square	14.62	0.042

Interpretation:

- Since $p < 0.05$, staff compliance differs significantly across departments. This means some departments follow linen SOPs more effectively than others (commonly OT > OPD > Ward > ICU).
- The SPSS-style analysis shows that linen availability and staff compliance are at a moderate level across departments, with OPD performing best. ICU and OT show slightly lower scores due to higher workload and linen turnover. Linen loss incidents are relatively frequent (mean = 2), especially in Ward and ICU, indicating a need for better tracking systems and SOP enforcement. These findings highlight the importance of training, digital tracking, and standardised linen distribution cycle.

6. DISCUSSION

- The findings of this study highlight systemic inefficiencies in linen management, primarily due to reliance on manual processes and lack of technological integration.
- Manual record-keeping and decentralized systems contribute to inaccuracies, delays, and reduced accountability. The absence of real-time tracking prevents effective monitoring of linen movement, leading to loss and mismanagement.
- The study also identified critical gaps in quality control, particularly in the laundry and distribution stages. Circulation of stained or damaged linen poses a direct risk to patient safety and infection control.
- Previous research supports the use of RFID-based systems to enhance inventory accuracy and reduce linen loss. RFID technology enables automated tracking, real-time monitoring, and improved accountability (Wang Let al., 2014).
- Additionally, standardized protocols for segregation, inspection, and distribution are essential to maintain hygiene standards and prevent hospital-acquired infections (WHO 2014).
- The mismatch between linen demand and supply highlights the need for dynamic, data-driven inventory systems that can adapt to changing hospital conditions.

7. RECOMMENDATIONS

7.1 Process Improvements

- Implement fixed schedules for linen collection
- Conduct mid-day and evening stock verification rounds
- Develop standardized criteria for linen rejection and condemnation

7.2 Technology Integration

- Introduce RFID-based linen tracking systems
- Implement cloud-based inventory management software
- Use mobile applications for real-time data entry

RFID systems have been shown to significantly reduce linen loss and improve operational efficiency.

Benefits:-

- Automated Scanning: Staff can bulk scan hundreds of linens at once without individual barcoding
- Ensures linens are laundered and replaced on schedule. No manual counting and paperwork.
- Better Linen Lifecycle Management -Tracks how many times an item has been washed

7.3 Quality Control Measures

- Establish mandatory pre-distribution quality checks
- Segregate damaged and stained linen at all stages
- Monitor laundry vendor performance regularly

7.4 Inventory Management

- Implement FIFO (First-In-First-Out) system
- Expand buffer stock to include all linen types
- Maintain daily records of linen usage and movement

7.5 Organizational Improvements

- Improve communication between departments
- Prevent linen hoarding through monitoring
- Conduct regular staff training programs

8. CONCLUSION

Linen management is a crucial component of hospital operations that directly impacts infection control, patient safety, and service quality. This study identified significant gaps in collection, segregation, tracking, and distribution processes.

The findings emphasize the need for structured management practices and technological integration. Implementation of RFID systems, standardized protocols, and improved coordination can enhance operational efficiency, reduce losses, and improve patient outcomes. (Wang Let al., 2014)

9. REFERENCES

1. World Health Organization. Decontamination and Reprocessing of Medical Devices for Health-care Facilities. WHO; 2016. World Health Organization.
2. Guidelines on Core Components of Infection Prevention and Control Programmes. WHO; 2016. American Hospital Association. Hospital Laundry and Linen Services Guidelines. AHA; 2019.
3. McGain F, Story D. Healthcare resource use and waste generation. Med J Aust. 2015;203(7):290–291. Centers for Disease Control and Prevention (CDC).
4. Guidelines for Environmental Infection Control in Health-Care Facilities. 2003. Schulster L, Chinn RYW. Guidelines for environmental infection control in healthcare facilities.
5. CDC; 2003. Wang L, Leung V. RFID-based healthcare management system. J Med Syst. 2014;38(11):1–10.

6. Delen D, et al. RFID in healthcare logistics: A systematic review. *Int J Med Inform.* 2016;84(12):1–12.
7. Kumar A, Rahman S. RFID-enabled process reengineering of closed-loop supply chains in the healthcare industry of Singapore. *Journal of cleaner production.* 2014 Dec 15;85:382-94.
8. Dara S, GJ Q, Monica K, AT S, Farooq J. Quality control in linen and laundry service at a tertiary care teaching hospital in India.
9. Sujith K, Sharma U, Kumar N. Study on linen costs and utilisation in a tertiary care hospital. *Research Journal of Pharmaceutical, Biological and Chemical Sciences.* 2016 Nov 1;7(6):1130-10. 5.
11. Sharma RK, Gupta R, Mahajan R, Kour T, Chowdhary N, Chalotra R, Arif T. Study of patient satisfaction regarding linen and laundry services in a tertiary care hospital of north India.
12. Mourabit N, Elwardi K, Bouhoudan A, Ouakourou H, Nafai M, Bakkali M. Hospital laundry practices and nosocomial infection risk in a Moroccan public hospital: critical views and suggestions for improvement. *International Journal of Environmental Studies.* 2025 Jan 2;82(1):633-56.

