



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Review Paper

A Review on Good Warehousing Practices

S. D. Mankar, Shruti Varade, Vaibhav Varghude, Sagar Vendait*, Atharv Vikhe, Mayuri Wagh

Pravara Rural College of Pharmacy, Loni, Maharashtra, India-413736

ARTICLE INFO

Published: 18 Apr. 2025

Keywords:

Quality Control in
Pharmaceutical
Warehousing,
Pharmaceutical Storage
Guidelines, Distribution of
Medicinal Product,
Pharmaceutical
Warehousing Operations

DOI:

10.5281/zenodo.15240493

ABSTRACT

In the pharmaceutical industry, warehousing is an integral part of the supply chain, ensuring the safe storage, handling, and distribution of medicines and related products. Given the sensitive nature of pharmaceutical goods, warehouses must comply with stringent regulatory standards, including Good Manufacturing Practice (GMP) and Good Distribution Practice (GDP). This review provides an overview of the critical need for pharmaceutical warehouses, the layout considerations that support operational efficiency, and the guidelines that govern their operation. Furthermore, it highlights the benefits and challenges of warehousing in this sector, as well as ethical concerns related to drug storage and distribution. The paper concludes by offering recommendations for improving warehouse operations in the pharmaceutical industry.

INTRODUCTION

The pharmaceutical industry plays a crucial role in ensuring public health through the production, storage, and distribution of medications and medical products. As part of the pharmaceutical supply chain, warehousing is an essential function that ensures the proper storage, handling, and distribution of pharmaceutical products. Warehouse is the place where raw material or finished product are stored before their distribution to ensure the quality, safety, efficacy.

Warehousing serves as an essential connection in the pharmaceutical supply chain. Its acts as a core center for acquiring, storing, and supplying pharmaceutical goods to healthcare professionals, pharmacies, and patients. Efficient warehousing methods facilitate the timely delivery of medications, enhancing patient and the effectiveness of healthcare. [1]

Importance of Good Warehousing practices:

***Corresponding Author:** Sagar Vendait

Address: Pravara Rural College of Pharmacy, Loni, Maharashtra, India-413736

Email ✉: sagarvendait8411@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



1. It optimizes the resource available in a specified manner
2. It is a Integral part of supply chain.
3. Save the time and effort in identifying and locating goods.
4. Maintains safe, clean and segregated environment.
5. Controls the movement and storage of materials within the stores.
6. It is the regulatory requirements for pharmaceuticals.
7. Develops a zone concept for product size segregation. [2]

Need for Warehouse in Pharmaceutical Industry:

Pharmaceutical warehouses act as an essential hub in the supply chain, ensuring the quality of medications is preserved prior to distribution to wholesalers, retailers, and ultimately, healthcare professionals. The requirement for specialized storage in this sector stems from various elements:

1. **Regulatory Compliance:** Pharmaceutical products are subject to strict regulations and must be kept under certain conditions to adhere to laws and guidelines, including temperature management for drugs that are sensitive to temperature. [3]
2. **Shelf-Life Management:** Medications have expiration dates, and diligent oversight of inventory guarantees that items are distributed prior to becoming outdated.
3. **Risk Mitigation:** Appropriate storage and management stop contamination, spoilage, and harm to the products.
4. **Safety:** Numerous pharmaceutical items, particularly regulated substances, demand elevated security measures to deter theft or abuse. [4]

Quality Assurance and Evaluation:

Ensuring the quality of products is another important element of effective warehousing practices. This includes establishing quality control protocols like frequent inspections and product testing to guarantee they adhere to set standards. Appropriate labeling and packaging of products is crucial for preserving quality and guaranteeing that items are received by customers in excellent condition. This involves utilizing suitable packaging materials and marking products with clear and precise details regarding their contents and handling guidelines. [5]

Material Management in Warehousing:

Material management in warehousing refers to the efficient and systematic management of materials (inventory, products, and goods) within a warehouse environment. It is crucial for ensuring the right materials are available at the right time and in the right quantity, which directly impacts the overall efficiency of the supply chain. Effective material management involves the process of planning, organizing, controlling, and tracking the flow of goods within the warehouse. Proper material management helps reduce storage costs, prevents stockouts or overstocking, and ensures timely order fulfillment. Key Components of Material Management in Warehousing. [6]

1. Inventory Control

Stock Management: The first element of material management is controlling the inventory levels of raw materials, work-in-progress, and finished goods within the warehouse. This is typically achieved through techniques such as :

Economic Order Quantity (EOQ): Determining the optimal order size to minimize costs related to ordering and holding inventory.

Just-in-Time (JIT): Ensuring that materials arrive just when needed to minimize storage time and reduce costs.



First-In-First-Out (FIFO): Ensuring that older stock is used or shipped first to avoid expired or obsolete products, especially important in perishable goods.

First-Expired-First-Out (FEFO): A more specific method for perishable or time-sensitive goods where items with the nearest expiration date are prioritized. [7]

2. Receiving and Inspection

Receiving: Materials or goods are delivered to the warehouse. At this stage, they are carefully checked for quantity and quality.

Inspection: Materials are inspected for damage, defects, and correct quantities. This step ensures that only acceptable goods are stored and distributed.

Material Handling: The efficient transportation of goods within the warehouse is essential. This can be done manually (using forklifts, pallet jacks) or through automated systems like conveyors and automated guided vehicles (AGVs). [8]

3. Storage and Organization

Storage Systems: Materials need to be stored in a systematic manner to ensure easy access and minimize retrieval time.

The following systems are commonly used:

Racking Systems: Pallet racking, shelving, or automated systems for high-density storage.

Bin Systems: For smaller parts or components, bins can help organize inventory.

Temperature-Controlled Storage: For sensitive materials such as pharmaceuticals, food, or chemicals that need to be stored in a controlled environment.

Optimal Space Utilization: The design of the warehouse should allow for maximum use of space, using vertical space, narrow aisles, and adjustable racking systems. [9]

4. Material Handling Equipment (MHE)

Material handling involves the movement, protection, storage, and control of materials within the warehouse.

Forklifts and Pallet Jacks: For moving bulk goods.

Conveyor Systems: For high-volume, low-maintenance transport of materials.

Automated Systems: Automated Storage and Retrieval Systems (ASRS), robotics, and AGVs are increasingly used in modern warehouses to improve speed and reduce human error. [10]

5. Picking and Packing

Order Picking: Materials must be picked efficiently and accurately to fulfill customer orders. There are various methods for picking:

Single Order Picking: One order is picked at a time.

Batch Picking: Multiple orders are picked at once for efficiency.

Zone Picking: The warehouse is divided into zones, and pickers work within specific zones.

Pick-to-Light or Voice Picking: These technologies assist pickers by guiding them to the correct items, improving speed and accuracy.

Packing: Once the materials are picked, they are packed for shipping. The packing area should be close to the picking area to minimize movement and time. [11]

6. Shipping

Automation: Many warehouses today utilize automation for order picking, sorting, and packaging, reducing human error and labor costs.

Regular Audits: Routine stock audits ensure that the physical inventory matches the records and helps identify discrepancies early.

Preventive Maintenance: Regular maintenance of equipment, storage systems, and infrastructure helps prevent delays and accidents. [12]

Best Practices in Material Management:



1. **Accurate Inventory Tracking:** Regularly update inventory records in realtime, utilizing barcode/RFID scanning and integrating with a WMS to prevent overstocking and stockouts.
2. **Efficient Stock Replenishment:** Use demand forecasting and analytics to replenish stocks ahead of time and avoid production delays or missed orders.
3. **Staff Training:** Train staff in proper material handling techniques, safety protocols, and warehouse processes to improve efficiency and reduce errors.
4. **Cycle Counting:** Conduct frequent cycle counting rather than relying on annual physical inventory checks to maintain accurate stock levels.
5. **Lean Warehousing:** Focus on eliminating waste and improving processes to increase warehouse efficiency, such as reducing unnecessary movements, optimizing space, and improving picking times.
6. **Safety Protocols:** Implement safety practices like proper labeling, hazard identification, and emergency procedures to ensure the safety of workers and materials. [13]

Benefits of Material Management in Warehousing:

1. **Cost Reduction:** Efficient material management reduces storage costs, handling costs, and inventory carrying costs by maintaining optimal stock levels.
2. **Increased Operational Efficiency:** By streamlining inventory flow, reducing lead times, and optimizing warehouse space, material management helps improve productivity.
3. **Improved Customer Satisfaction:** Accurate and on-time order fulfillment increases customer satisfaction and builds brand loyalty.
4. **Better Inventory Visibility:** Real-time tracking allows businesses to have better visibility of stock levels which reduces the risk of overstocking or stockouts. [14]

Challenges in Material Management:

Inventory Inaccuracy: Without proper tracking systems and regular audits, inventory discrepancies can arise, leading to overstocking or understocking.

Equipment Malfunctions: Breakdown of material handling equipment can cause delays in operations, impacting overall warehouse efficiency.

Labor Costs: Maintaining an efficient warehouse requires skilled workers, and labor costs can be high without proper automation. [15]

Theft and Damage-Related Inventory Shrinkage Problem: Theft and damage-related inventory shrinkage, in particular, can severely reduce business margins. This frequently happens with expensive goods or during times when warehouse activity is higher, including during busy seasons.

Problem with Inconsistent Order Fulfillment Accuracy: Picking, packaging, and shipping errors can result in a high return rate, unhappy customers, and lost sales. These errors frequently happen when pickers use manual procedures or when there are a lot of complicated SKUs.

Difficulties with Bottlenecks in Receiving and Putaway Procedures: Hold-ups at docks, postponed order processing, and higher labor expenses might result from delays in receiving and putaway procedures. The reception and storage teams' inability to coordinate is frequently the cause of this. Warehouse spaces are not being used effectively, as seen by the average capacity utilization of only 68%. [16]

Lack of Adaptability in Managing Seasonal Fluctuations Problem: During busy times, warehouses frequently find it difficult to scale their operations, which leads to backorders,



delayed delivery, and overworked employees. This problem is made worse by rigid systems and procedures.

Managing Multiple Channels (Omnichannel)

Can Be Complex Challenge: Inventory tracking, order fulfillment, and returns management become more complicated when inventory is managed across several sales channels (such as online, in-store, and third-party markets). Customer expectations and requirements may vary per channel. [17]

Design and Layout of Warehousing:

The arrangement and design of a warehouse can greatly influence its productivity and efficiency. An efficiently designed warehouse should facilitate the movement of goods for workers and enable them to find items swiftly and effortlessly. [18] Several important factors to consider when designing a warehouse are the dimensions and configuration of the area, the arrangement of shelving and storage systems, and the positioning of loading docks and various access points.

An efficient pharmaceutical warehouse layout is essential for optimizing operations. The design should prioritize:

1. **Temperature Zones:** Since many pharmaceutical products need to be stored within a specific temperature range, warehouses often feature designated temperature-controlled zones, such as refrigerated and frozen sections.
2. **Storage Systems:** Racking systems, shelving, and palletized storage solutions should be tailored to accommodate the different sizes and shapes of pharmaceutical products, maximizing space while maintaining accessibility.
3. **Flow of Goods:** The layout should be designed to ensure a smooth flow of products from

receiving to shipping, with clear pathways for inventory movement. A common practice is the "firstexpired, first-out" (FEFO) method, ensuring that products nearing expiration are dispatched first.

4. **Regulatory Compliance Areas:** Dedicated areas for controlled substances and hazardous materials, with appropriate security measures, are vital in pharmaceutical warehouses. [19]

GUIDELINES:

1. Adhere to Good Distribution Practices (GDP), ensuring drugs are stored, handled, and transported in a safe and secure manner.
2. Implement a Warehouse Management System (WMS) to track inventory levels, expiry dates, and location management.
3. Regular audits and inspections to ensure compliance with regulations and detect any possible contamination or deterioration.
4. Staff must be properly trained in the handling of pharmaceutical goods and aware of the potential risks.

Benefits of Good Warehousing Practices:

1. **Regulatory Compliance:** Following proper warehousing guidelines ensures compliance with industry standards, such as GDP and GMP, reducing the risk of legal issues.
2. **Inventory Accuracy:** A robust WMS helps maintain real-time inventory updates, improving accuracy in stock management and ensuring timely replenishment.
3. **Product Integrity:** Temperature control, proper handling, and secure storage prevent product degradation, ensuring that medicines remain effective and safe for use.
4. **Operational Efficiency:** An optimized warehouse layout with effective inventory management systems enhances operational



flow, reducing pick times and improving order fulfillment speed.

5. Customer Satisfaction: Reliable and efficient warehousing leads to on-time deliveries, improving customer satisfaction and trust. [20]

Environmental Considerations:

Effective warehousing methods also include actions to reduce the environmental effects of warehouse activities. This encompasses applying energy-saving strategies like utilizing LED lights and efficient heating and cooling systems, along with minimizing waste through recycling and other sustainability efforts. Another key factor is utilizing environmentally friendly packaging materials and minimizing the amount of packaging whenever feasible. This aids in lessening the waste produced by warehouse activities and mitigates the ecological effects of shipping and transport. [21]

Challenges of warehousing practices:

- **Regulatory Compliance:** Keeping up with constantly changing regulations can be challenging. Failure to meet compliance requirements could lead to penalties, product recalls, or reputational damage.
- **High Costs:** The investment in specialized storage solutions, such as temperature-controlled environments, and regular training for staff can be expensive.
- **Space Constraints:** The need for specific storage conditions, such as controlled environments, can limit the amount of product that can be stored in a facility, especially as product lines grow.
- **Security Risks:** Pharmaceuticals, especially controlled substances, are attractive targets for theft. Maintaining a high level of security is critical.

- **Logistical Issues:** Managing the flow of goods to prevent overstocking or stockouts while maintaining inventory accuracy is a delicate balance. [22]

Improvement of Good Warehousing Practices:

The cohabitation of disparate demographic, social, economic, and work environments across geographic latitudes poses difficulties that may limit the potential for putting policies in place to raise the calibre of logistical operations. To overcome these obstacles, one needs a sophisticated awareness of regional quirks and customised approaches that take local context into account. Businesses may satisfy client demands and boost profits by managing the production process thoroughly and keeping an eye on the carriers and suppliers that are directly involved in the distribution of the created goods and the supply of raw materials. Additionally, they might use logistics procedures to lower expenses and boost operational effectiveness.[23] Recognise that warehousing is a crucial component of the supply chain process that is necessary for it to operate as efficiently as possible. Productivity levels are crucial for maintaining market competitiveness, and logistics firms must resolve warehousing concerns to boost operational effectiveness. [24] The Lean philosophy seeks to optimise critical resources, cut waste wherever it occurs, and establish a corporate culture that is committed to recognising and consistently enhancing customer happiness. The lean tenets of value capture, waste reduction, and smooth flow creation form the foundation of this ideology. These ideas have also been expanded into five principles: defining value according to the customer, optimising value flow, creating a smooth value flow by reducing and eliminating waste, triggering demand pull by coordinating information flow and customer demand, and enhancing all goods, services, and processes. [25]



Ethical Considerations:

Ethical considerations in pharmaceutical warehousing involve the following key points:

1. **Product Safety:** Warehouses must ensure that medicines are stored in conditions that preserve their efficacy and safety. Failure to do so may harm patients and lead to ethical violations.
2. **Transparency:** Accurate record-keeping and transparent handling of products are essential to prevent fraud, tampering, or misrepresentation of pharmaceutical goods.
3. **Security:** Ethical responsibility includes safeguarding pharmaceuticals from theft, diversion, or misuse, especially for controlled substances.
4. **Environmental Concerns:** Proper disposal of expired or damaged products and minimizing the environmental impact of warehouse operations is important for ethical business practices. [26]

CONCLUSION:

Pharmaceutical warehousing plays a critical role in the pharmaceutical supply chain, ensuring that drugs are safely stored, handled, and distributed in compliance with industry regulations. By adhering to best practices in layout design, inventory management, and safety, pharmaceutical warehouses can significantly improve operational efficiency, ensure product integrity, and enhance customer satisfaction. However, the industry faces challenges such as regulatory complexity, high operational costs, and security concerns. Ethical practices must also guide all aspects of warehousing to ensure public trust and the safe distribution of pharmaceutical products.

REFERENCES

1. Rushton, A., Croucher, P., & Baker, P. (2017). The Handbook of Logistics and Distribution Management. Kogan Page. 345-360.
2. "Good Storage and Distribution Practices for Pharmaceutical Products" discuss the importance of temperature control, humidity control, pest control, and security in pharmaceutical warehousing.
3. Pharmaceutical Compliance Agency. (2019). Regulations for pharmaceutical storage and distribution: Ensuring compliance with temperature and storage guidelines. Global Health Publishing.
4. Sharma, K., & Kumar, A. (2019). Risk and security management for controlled substances in pharmaceutical warehouses. *Journal of Pharmaceutical Security*, 15(1), 30-40.
5. "Quality Control and Assurance in Pharmaceutical Industry" by S. P. Vyas, Pages 234-240 (Chapter 10: Warehousing and Distribution).
6. Warehousing Practices and Systems: Rushton, A., Croucher, P., & Baker, P. (2017). The Handbook of Logistics and Distribution Management. 6th Edition. Kogan Page. 345-360.
7. Inventory management in the warehouse area of manufacturing companies. Literature Review, 2022 Antohanet Alexandra Baquerizo Vilchez, Alexander John Vega Tunquipa, Rosario Del Pilar López Padilla *Journal of Scientific and Technological Research Industrial* 3 (2), 15-25, 2022.
8. Figurski, J., Niepsuj, J.M., 2017. Systemy wspomagające logistykę (Systems Supporting Logistics). Warszawa: Wyd. Wojskowa Akademia Techniczna. Resiving and infection.
9. Organizing warehousemanagementN. FaberNetherlands Defence Academy, Breda, The Netherlands, andM.B.M. de Koster and A. SmidtsRotterdam School of



- Management, Erasmus University, Rotterdam, The Netherlands.
10. Aized, T. (2006). Materials handling in flexible manufacturing systems. Department of Mechanical, Mechatronics and Manufacturing Engineering, KSK, Lahore Equipment handling.
 11. Caron F, Marchet G, Perego A (2000) Optimal layout in low-level picker-to-part systems. *Int J Prod Res* 38:101–117.
 12. Woods, D., & Barone, S. (2021). Warehouse Management and Inventory Control: Best Practices for Efficiency and Accuracy. Logistics and Supply Chain Press, p. 142.
 13. Efficient Stock Replenishment: Chopra, S., & Meindl, P. (2016). Supply Chain Management: Strategy, Planning, and Operation. 6th Edition. Pearson. Page Reference: pp. 267-270.
 14. Benefits of Material Management in Pharmaceutical Warehousing" by Journal of Pharmaceutical Sciences, Pages 10-15 (Volume 12, Issue 3).
 15. "Challenges in Material Management in Pharmaceutical Warehousing" by Journal of Pharmaceutical Sciences, Pages 20-25 (Volume 10, Issue 2).
 16. "Material Management Challenges in Pharmaceutical Industry" by International Journal of Pharmacy and Pharmaceutical Sciences, Pages 40-45 (Volume 5, Issue 3).
 17. Stoltz, M.-H.; Giannikas, V.; McFarlane, D.; Strachan, J.; Um, J.; Srinivasan, R. Augmented Reality in Warehouse Operations: Opportunities and Barriers. *IFAC-PapersOnLine* 2017,50, 12979–12984.
 18. Gu, J.X., Goetschalckx, M., McGinnis, L.F., 2007. Research on warehouse operation: A comprehensive review. *European Journal of Operational Research* 177 (1), 1–21. (introduction of layout and design).
 19. Kembro JH, Norrman A, Eriksson E (2018) Adapting ware-house operations and design to omnichannel logistics a literature review and research agenda. *Int J Phys Distrib Logist Manag* 48(9):890–912.
 20. Cost Reduction: Chopra, S., & Meindl, P. (2016). Supply Chain Management: Strategy, Planning, and Operation (6th ed.). Pearson. (pp. 267-269).
 21. Good Manufacturing Practice for Active Pharmaceutical Ingredients" by Pharmaceutical Inspection Cooperation Scheme (PIC/S), Pages 70-75 (Section 9: Environmental Considerations).
 22. Pharmaceutical Warehousing and Distribution" by S. P. Vyas, Pages 150-155.
 23. Mohajan, H.K. Qualitative Research Methodology in Social Sciences and Related Subjects. *J. Econ. Dev. Environ. People* 2018, 7, 23.
 24. Nadeem, S.; Waseem-Ul-Hameed Alvi, A.K.; Iqbal, J. Performance indicators of e-logistic system with mediating role of information and communication technology (ICT). *J. Appl. Econ. Bus. Res.* 2018, 8, 217–228.
 25. Uz-Zaman, K.A. A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. *Bus. Process Manag. J.* 2013, 19, 169–196.
 26. World Health Organization (WHO). (2010). Good Storage and Distribution Practices for Medical Products. WHO Technical Report Series, No. 957, Annex 5.

HOW TO CITE: S. D. Mankar, Shruti Varade, Vaibhav Varghude, Sagar Vendait*, Atharv Vikhe, Mayuri Wagh, A Review on Good Warehousing Practices, *Int. J. of Pharm. Sci.*, 2025, Vol 3, Issue 4, 2287-2294. <https://doi.org/10.5281/zenodo.15240493>

