
African Journal of Pharmaceutical Research and Development

Available online at <https://ajopred.com>

Vol. 17 No.2; pp. 214-220 (2025)



Review Article

NARRATIVE REVIEW OF SUPPLY CHAIN MANAGEMENT STRATEGIES FOR IMPROVING DRUG DISTRIBUTION EFFICIENCY IN NIGERIA

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ABSTRACT

This review examined the existing literatures on the supply chain management strategies highlighting the challenges and providing actionable insights to improving drug distribution efficiency in Nigeria. PubMed, Google scholar, Scopus and Web of science were searched for articles published between 2015 and 2025 using defined keywords such as supply chain, strategies, efficiency, drug and Boolean operators. The inclusion criteria for the review were articles published in English language and studies that focused on challenges and ways of improving drug distribution efficiency in Nigeria. The selection process involved multiple steps by three researchers. A structured data extraction frame work was developed to ensure consistency and accuracy in the review process. Two independent reviewers were involved in the data extraction process to minimize bias and improve accuracy. Any discrepancies were resolved through discussion or consultation with a third reviewer. A thematic analysis was used to identify patterns and trends across the selected studies. This analysis facilitated the identification of recurring themes and also identified the various gaps in the literatures. The key themes were structural and systemic challenges, strategic interventions, human resources and capacity development. Technology and public private partnership programs enhance supply chain management. However, rural disparities, counterfeit drugs and other challenges persist thereby necessitating targeted interventions.

ARTICLE INFO

Received 15 August 2025
Accepted 05 September 2025
Published 26 September 2025

KEYWORDS

Supply chain,
management,
strategies,
distribution,
efficiency

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INTRODUCTION

The Nigerian health care system is grappling with persistent challenges in drug distribution which have far reaching implications for public health and the attainment of universal health coverage. Some of the key challenges includes frequent stock out of essential medicine, the proliferation of counterfeit medicine and in efficiencies in supply chain management [1]. These problems disproportionately affect the rural and underserved communities where access to health care services is already limited [2] Supply chain management encompasses a range of processes involving

procurement, inventory management, warehousing, transportation and distribution all of which must be seamlessly integrated to achieve optimal outcomes [3] Globally advancement in supply chain management such as the adoption of digital technologies, centralized procurement system and cold chain logistics have significantly improved drug availability in many countries [4]. However, Nigeria lags behind in implementing these strategies due to a combination of infrastructural deficits, weak regulatory frame works and shortage of skilled personnel.³ Moreover, the Nigerian pharmaceutical sector is plagued by systemic issues such as

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<https://doi.org/10.59493/ajopred/2025.2.10>

ISSN: 0794-800X (print); 1596-2431 (online)

inadequate funding for health logistics, poor coordination between federal and state governments and limited private sector involvement in drug distribution [5].

The World Health Organization (WHO) has emphasized that strengthening SCM systems in low- and middle-income countries (LMICs) like Nigeria is essential for achieving Sustainable Development Goal (SDG) which focuses on ensuring healthy living and promoting wellbeing for all [6]. Also, the pharmaceutical supply chain in Nigeria plays a vital role in the healthcare systems by ensuring that essential medicines are available to millions of citizens [7]. Despite its importance, the system encounters several challenges that hinder its efficiency and effectiveness, creating significant obstacles to the assessment of quality medicines. These issues are severe in rural and undeserved areas where logistical and Infrastructural gaps further widen inequalities in healthcare delivery [1,8]. This review evaluated the effectiveness of SCM strategies in Improving drug distribution in Nigeria, with a focus on identifying scalable solution that can address the unique challenges faced by the country.

MATERIALS AND METHODS

This review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines to ensure transparency and replicability [9].

Searching strategy

A search of four academic databases (Pubmed, Google scholar, Scopus and web of science) was conducted to identify relevance studies between 2015 and 2025. R.U.O, A.I, C.A and I.C.I carried out the database search using the keywords “supply chain” or “strategies” or “efficiency” and “drug”. Additional articles from the official website of Nigerian government agencies such as the Federal Ministry of Health and National Agency for Food and Drug Administration and Control (NAFDAC) were also explored. International organizations websites such as the World Health Organization was also searched.

Inclusion and exclusion criteria

Studies that were to be considered for the review were expected to focus on strategies for improving drug distribution efficiency in Nigeria. The inclusion criteria for the study include peer reviewed articles between 2015 and 2025, studies published in English language, researches that focused on pharmaceutical supply chain in Nigeria or other sub-Saharan African countries with comparable healthcare system, studies evaluating the effectiveness of supply chain management strategies and researches addressing challenges such as counterfeit drugs, last mile delivery, infrastructural limitation and regulatory frameworks. The exclusion criteria were studies that focused on non-pharmaceutical supply chain researchers conducted outside Nigeria or sub-Sahara Africa without contextual relevance, articles with insufficient methodological details and opinion pieces, editorials and unpublished dissertations.

Data synthesis

All the articles identified were screened independently by A.I, C.A and I.C.I. The selection process involved multiple steps by the three researchers. The collected articles were managed by using the Zotero reference manager after a prior review of the titles and abstracts. Two independent reviewers were involved in the data extraction process to minimize bias and improve accuracy. Any discrepancies in data extraction were resolved through discussion or consultation with a third reviewer. The extracted data were discussed under suitable headings and entered into a Microsoft Excel spreadsheet for easy analysis and organization. This is to explore the aim of the review.

RESULTS

The search process initially generated 231 results. After removing 17 duplicates, 214 unique articles remained. These articles were then screened based on their titles and abstract, resulting in 97 articles considered for further evaluation. Full text access was obtained for the 97 articles and their eligibility was accessed which removed 63 articles leading to the inclusion of 34 articles for the study. To ensure consistency and accuracy in the selection process the authors engage in discussions and researched a unanimous agreement on the eligibility of the 34 articles. Ultimately, the 34 articles were included in the systematic review. Figure 1 provides a visual representation of the selection process.

Thematic analysis identified three primary themes and several sub themes related to supply chain management strategies, challenges and outcomes in Nigeria's drugs distribution system.

Theme 1: Structural and systematic challenge in drug supply chain management.

Sub Theme 1:Infrastructural Deficiency: The findings reveal that poor road network and transportation issues significantly hinder last mile drug delivery [1,7]. Also, limited cold chain storage affect vaccine and temperature sensitive medicine distribution [8].

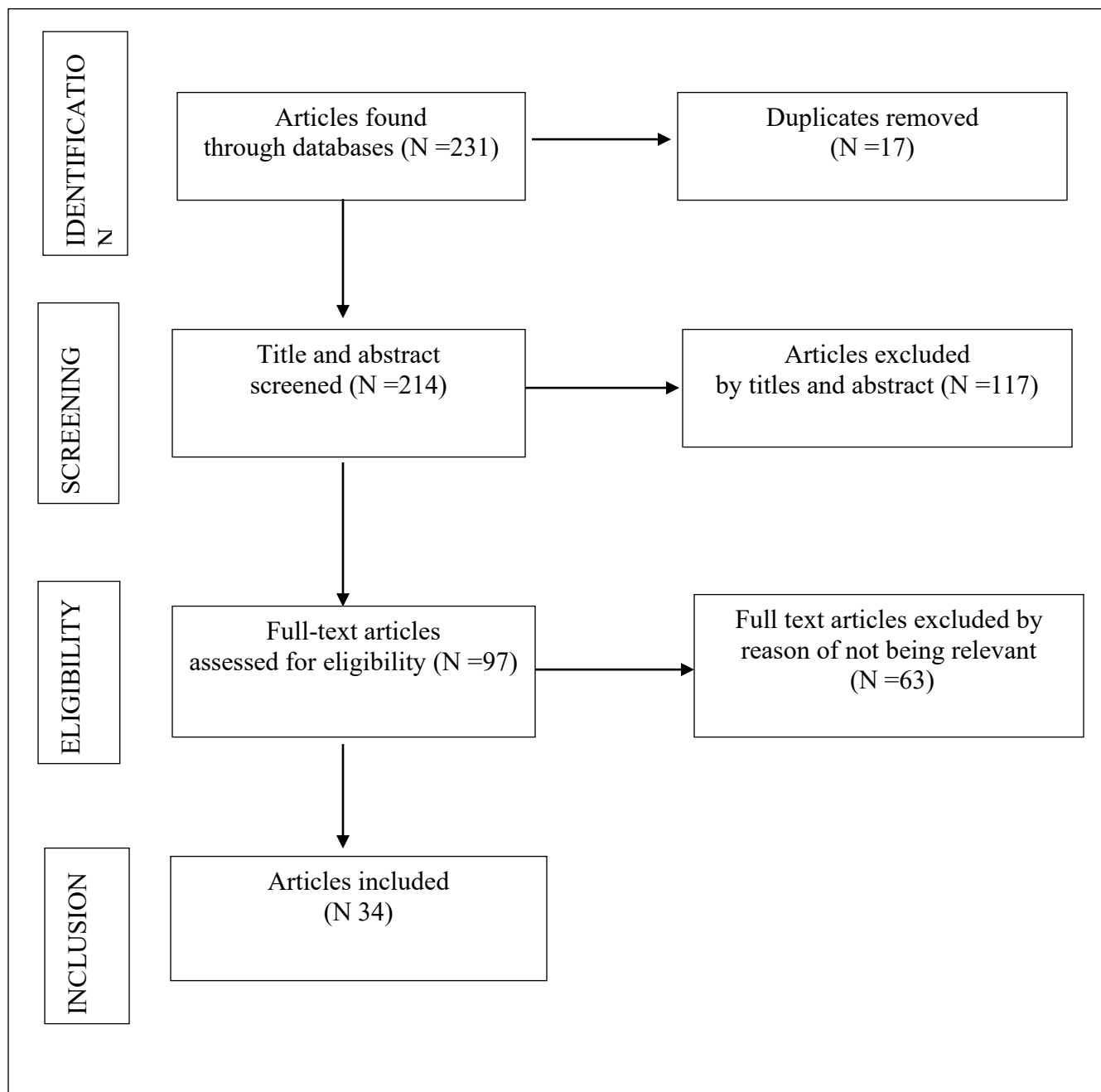


Figure 1: Study selection process according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) flowchart.

The findings also indicate that insufficient warehouse capacity leads to drug stock out and wastage [10].

Sub Theme 1; 2 Supply chain fragmentation and regulatory weaknesses

The findings revealed that unregulated parallel market lead to the proliferation of counterfeit drugs [11]. Also, inefficiencies of the Federal Ministry of Health Central Medical Stores affect nationwide drug distribution [12,13].

The findings also revealed that weak enforcement of supply chain guidelines exacerbated distribution challenges [12].

Sub Theme 1; 3 Logistics and procurement inefficiencies

The findings revealed that stock out in public hospitals are frequent due to delayed procurement processes [14]. Also, poor forecasting methods which results in over stocking or understocking of essential medicines were identified [15]. The lack of real time inventory tracking systems also affects supply chain visibility [15].

Theme 2; Strategic inventions for supply chain improvement

Sub Theme 2; 1 Public-private partnerships (PPPs) in drug distribution.

The findings revealed that collaboration with private logistics company improves last mile delivery efficiency [16]. Also, third party logistics outsourcing reduces operational costs for government facilities [10]. In addition, public private partnerships facilitate investments in storage and transportation infrastructure [17].

Sub Theme 2; 2 Digital Innovations and supply chain visibility

The findings revealed that blockchain technology adoption improves traceability and reduces the circulation of counterfeit drugs [11]. In addition, introduction to mobile based stock tracking systems enhances real time monitoring [18] while data driven analytics help in predictive demand forecasting and inventory management.

Sub Theme 2; 3 Decentralization of supply chain systems.

Decentralized vaccine supply chains reduce bottle necks in emergency response [20,21]. State managed procurements reduce delays associated with federal level bureaucracy [16], while community-based drug distribution models improve access in rural areas [20].

Theme 3 Human resource and capacity building in pharmaceutical supply chain.

Sub Theme 3;1 Training and capacity development of supply chain personnel.

The findings revealed that many pharmacists lack formal training in supplying chain management¹[13,14,23]. Also work force shortages in logistics and distribution developments

hinder efficiency [5,14] while training programs for supply chain managers improve drug availability and forecasting accuracy [5,23,24]

Sub Theme 3;2 Governance and policy reform.

The findings revealed that the national drug distribution guidelines (2012) remain poorly implemented [12], while the policy on essential medicine procurement need to be reviewed to include the use of emerging technologies [11]. In addition, strengthening the role of regulatory agencies improves supply chain accountability [15,16]

Sub Theme 3; 3 Role of pharmacists and healthcare workers in drug distribution.

The findings reveal that the involvement of pharmacists in logistics planning enhances medicine safety and quality [24]. while pharmacists led interventions improve stock monitoring and reduce drug expiration rates [17]. In addition, empowering healthcare workers with supply chain knowledge strengthens distribution efficiency [23].

DISCUSSION

Structural and systematic challenges in Drug supply chain management

Infrastructural deficiencies: Infrastructural challenges such as poor road network and inadequate storage facilities significantly impede the efficiency of Nigerian's drug supply chain [1,7,8]. In addition, lack of investment in health commodities and inefficient supply chain systems often leads to high expiry rate and limited drug availability in primary and secondary health facilities. Such deficiencies result in frequent stock out and wastages undermining the reliability of drug distribution systems [10].

Supply chain fragmentation and regulatory weaknesses: The fragmentation of supply chains and weak regulatory frameworks contributes to the proliferation of counterfeit drugs and inefficiency in drug distribution [11]. More so unregulated parallel markets thrive due to inadequate enforcement of supply chain guidelines exacerbating distribution challenges. This situation is further compounded by inefficiencies in central medical stores affecting nationwide drug distribution [12,13,16].

Logistical and Procurement inefficiencies: logistical challenges including delayed procurement processes and poor forecasting methods leads to frequent stock out in public hospitals [14]. In addition, the absence of real-time inventory tracking systems hampers supply chain visibility, resulting in overstocking or understocking of essential medicines [15]. These inefficiencies highlight the need for improved procurement strategies and inventory management system.

Strategies interventions for supply chain improvement;
Public-Private Partnership (PPPs) in Drug Distribution: Partnerships with private logistics companies have improved

last mile delivery efficiency and reduced operational costs for government facilities [10,16,17]. These PPPs also facilitate investments in storage and transportation infrastructure thereby ameliorating some of the infrastructural deficiencies.

Digital innovations and supply chain visibility: The traceability and real-time monitoring of the inventories of drugs has been improved by the adoption of the digital technologies such as block chain and mobile based stock tracking system [11]. Also, data driven analytics aid in predictive demands forecasting and inventory management thereby enhancing the overall efficiency of the supply chain [18,19]. These innovations are critical in addressing logistical and procurement inefficiencies.

Decentralization of supply chain systems: State managed procurement processes have shown to reduce delays associated with federal levels bureaucracy while community-based drug distribution models enhance accessibility to the hinterland or remote areas [15].

Human resource and capacity building in pharmaceutical supply chain:

Training and capacity development of supply chain personnel: A significant number of pharmacists are not knowledgeable in supply chain management leading to work force shortages in logistics and distribution department [13,14]. In addition, implementing training programs for supply chain managers has been shown to improve drug availability and forecasting accuracy [5,23,24]. Also investing in human resource development is essential for strengthening the pharmaceutical supply chain.

Governance and policy reforms: The National Drug Distribution Guidelines (2012) remain poorly implemented and policies on essential medicine procurement require revision to incorporate new technologies [10]. Also strengthening the role of regulatory agencies can improve supply chain accountability and ensure the effective enforcement of guidelines [25,26].

Role of pharmacist and healthcare workers in distribution: Pharmacists lead interventions have been shown to improve stock monitoring and reduce drug expiration rates [27]. In addition, empowering healthcare workers with supply chain knowledge strengthens distribution efficiency and ensures the reliability of drug system of drug supply system [23].

Interconnectedness Of Themes

The themes identified in this review are closely interconnected reflecting the multifaceted nature of supply chain management in Nigeria's pharmaceutical sector. Structural and systemic challenges such as regulatory inefficiencies, infrastructural gaps and prevalence of counterfeit drugs which creates the fundamental weaknesses that hinder efficient drug distribution. These challenges not only expose the fragility of the existing supply chain system but also highlight the urgent need for

strategic interventions. In response, various public private partnerships, digital innovation and collaborative models have emerged as key strategies aimed at addressing these systemic inefficiencies. However, the success of such intervention is often contingent upon the availability of a skilled and adequately resourced workforce. The third theme which focused on human resource and capacity building revealed how workforce shortages and skill gaps can undermine the most innovative supply chain solution. Ultimately, these themes are deeply intertwined, systemic issues necessitate strategic responses and the effectiveness of those responses is shape by the strength of the human infrastructure Supporting them. These interconnectedness underscores the need for an integrated approach to improving drug distribution, one that simultaneously addresses systemic reform strategic innovation and workforce development.

Strengths and limitations of the study

This study provided useful insights into how drug distribution in Nigeria can be improved by highlighting key challenges and strategies. One major strength is that it's harmonized findings from different studies to give a broad picture of the current situation. It also used clear themes to organize the information making it easier to understand the connection between problem, solution and workforce needs.

However, the study has some limitations.

There were not many research papers that focused on only on Nigeria, so some findings from other African countries where included which may not fully reflect Nigeria's unique context. Only English language studies were reviewed which could mean that other useful information might have been missed. Also, since the studies reviewed hard different methods and quality levels it was hard to compare them directly. Finally, the analysis involved some interpretation which could instigate researcher bias, effort we are made to be objective.

Future Recommendations

To improve drug distribution in Nigeria more research is needed that focuses directly on the country's supply chain system especially in rural and remote areas. Further studies should also focus on current strategies such as public private partnerships and scaling up digital tools.

There should be more focus on policies that support long-term improvement and fix gaps in regulation and enforcement. In addition, building the skills of the pharmaceutical workforce through training and education is vital for sustaining supply chain improvements. Overall, future efforts should connect policy, technology, infrastructure and human resources to create a stronger and more reliable drug distribution system.

CONCLUSION

In this study, poor infrastructure, weak regulation and counterfeit drugs were identified as the major problems

affecting efficiency of supply chain management. To address this challenge, several solutions such as public private partnership, digital tools and training programs have been introduced. However, these strategies can only succeed if supported by a skilled and well equipped workforce. The findings highlight the need for a coordinated approach that tackles both the system wide problems and the human resource gaps. Finally, improving drug distribution in Nigeria requires a mix of strong policies innovations and investment in human resource development.

ACKNOWLEDGMENT

The author would like to acknowledge the staff of the Department of clinical Pharmacy and Pharmacy Management, University of Nigeria, Nsukka for the support in developing early career pharmacy researchers, students and professionals.

AUTHORS' CONTRIBUTION

ROO synthesized the literature from the data sources. **AI** and **MOA** analyzed and reviewed the synthesized articles. **CA** reviewed the manuscript. **ICI** conceived, synthesized, analyzed the selected articles, and reviewed the manuscript. All the authors read and approved the final manuscript.

CONFLICT OF INTEREST

The author(s) declared no potential conflict of interest with respect to the research authorship and/or publication of this article.

FUNDING

The author(s) received no financial support for the research, authorship and publication of this article.

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