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The Impact of Supply Chain Management Practices on Service Delivery: A Case of the Public Health Sector in Zambia

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Abstract

This study explores the influence of supply chain management (SCM) practices on service delivery in Zambia's public health sector. Using a quantitative descriptive approach, data were collected from 49 respondents across public health facilities regarded as Level 1 or Mini Hospitals in Zambia. Key SCM practices such as procurement planning, supplier relationship management, and inventory management were assessed for their impact on equity, cost-effectiveness, and availability of medical supplies. Findings show that these practices significantly influence service delivery, accounting for 54% of its variability. The study recommends enhancing information sharing, formalizing supplier relationships, and optimizing inventory management to address gaps in service delivery.

Keywords: Supply Chain Management, Service Delivery, Public Health Sector, Zambia, Inventory Management, Healthcare Logistics

1. Introduction

Public health service delivery in Zambia continues to face persistent challenges, with inefficiencies in supply chain management (SCM) being a significant contributing factor. These inefficiencies manifest in recurring stockouts of essential medicines, delayed procurement processes, and weak logistics networks, which hinder the effective distribution of medical supplies. The shortage of medicines in public healthcare facilities in the past few years has led to ineffective delivery of quality healthcare services worldwide and Zambia is no exception (Yadav, 2015). Such issues negatively impact patient satisfaction and compromise equity in access to healthcare, particularly in underserved and remote areas. The frequent unavailability of critical medical resources disrupts service delivery, undermines healthcare outcomes, and increases patient dissatisfaction.

Healthcare facilities often grapple with poor coordination among stakeholders, inadequate communication systems, and a lack of robust inventory management practices. These gaps are compounded by resource constraints, including insufficient funding, unreliable transportation infrastructure, and capacity issues within the procurement and logistics systems. Despite ongoing reforms in Zambia's healthcare sector, public health facilities still struggle to maintain consistent access to essential medical supplies. Studies by (Acosta, 2019), (Tomasz Bochenek, 2019) concluded that some of the contributing factors to the shortage of medicines include manufacturing and quality problems, shortage of raw materials, political instability, and profitability issues. Other factors include long lead times, delays in awarding tenders, absence of national contracts on the regional code lists of medicines, the failure of suppliers to meet demand, and the failure to pay suppliers with the last two bordering on supply chain management practices.

This study aims to investigate the influence of SCM practices on service delivery outcomes in Zambia's public health sector, focusing on facilities in Lusaka and surrounding districts. The research specifically examines key SCM practices such as procurement planning, inventory management, supplier relationship management, and information sharing, and how these practices affect healthcare equity, cost-effectiveness, and availability of supplies. By identifying gaps and proposing actionable recommendations, the study seeks to contribute to improving healthcare delivery in resource-constrained settings.

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2. Literature Review

Effective SCM practices contribute to better resource utilization, timely delivery of medical supplies, and improved patient outcomes. Key SCM components such as procurement planning, inventory management, supplier relationship management, and information sharing have emerged as pivotal elements in enhancing healthcare performance.

For instance, Shah (2016) explored the role of SCM practices in India's public health sector and demonstrated that robust inventory management systems significantly reduced stockouts and improved the availability of essential medicines. The study revealed that hospitals with effective stock monitoring and replenishment systems were better equipped to meet patient needs, reducing delays in care. Similarly, Govindarajan and Ramamurti (2018) emphasized the importance of information sharing among supply chain stakeholders. They found that facilities with integrated communication systems achieved better resource allocation and reduced lead times, leading to higher levels of patient satisfaction and operational efficiency.

In the African context, studies have highlighted similar SCM challenges and opportunities. Njuguna and Moronge (2017) examined SCM practices in Kenya's public hospitals and found that strong supplier relationships were critical for ensuring the timely delivery of medical supplies. The study identified inadequate demand forecasting and poor logistics as barriers to effective service delivery, particularly in rural areas. These findings were further corroborated by Muturi et al. (2020), who demonstrated that well-structured supplier relationships and effective logistics management led to improved healthcare outcomes. The study noted that hospitals with collaborative supplier partnerships experienced fewer disruptions in supply chains and better stock availability.

In Zambia, the public health sector faces significant SCM-related challenges. Monique (2019) documented persistent stockouts of critical drugs, such as antibiotics and malaria treatments, in rural and urban health facilities. The study attributed these shortages to weak procurement planning and inadequate logistics infrastructure, which often left facilities unable to meet patient demands. Additionally, Chileshe (2022) examined the impact of SCM practices on the performance of SMEs in Zambia's agro-industry, demonstrating how effective SCM practices, including supplier relationship management and inventory control, improved operational outcomes.

Table 1 Summary of Literature Review

Author/Year	Focus of Study	Key Findings	Relevance to Current Study
Chileshe, 2022	The impact of supply chain management practices on performance of small and medium enterprises. a case of Agro-dealers in Lusaka	Effective inventory management reduces stockouts and improves resource availability.	Highlights the importance of inventory management in ensuring consistent availability of medical supplies.
Monique (2019)	Bottlenecks in Zambia's public health SCM	Inadequate logistics, poor demand forecasting, and stockouts hinder effective service delivery.	Highlights challenges specific to Zambia's public health SCM, forming a baseline for this study.
Njuguna & Moronge (2017)	SCM practices in Kenya's public hospitals	Strong supplier relationships and accurate demand forecasting enhance healthcare service delivery.	Provides insights on the role of supplier relationships in mitigating stockouts and improving efficiency.
Muturi et al. (2020)	Impact of supplier relationships on healthcare outcomes in African hospitals	Collaborative supplier partnerships reduce disruptions and improve the availability of essential drugs.	Supports the need for formalized supplier relationships to enhance service delivery in Zambia.

2.1. Research Theories

Systems Theory: This theory underscores the interdependence of components within a system, highlighting how SCM practices such as procurement, inventory management, and supplier relationships collectively influence service delivery outcomes.

Contingency Theory: This theory emphasizes that SCM strategies must be tailored to specific organizational and environmental contexts. For instance, facilities in remote areas may require customized logistics solutions to address transportation challenges.

Resource-Based View (RBV): The RBV theory focuses on the unique resources and capabilities of an organization, such as strong supplier relationships and skilled personnel, as critical factors in achieving competitive advantage and improving service delivery.

2.2. Conceptual Framework

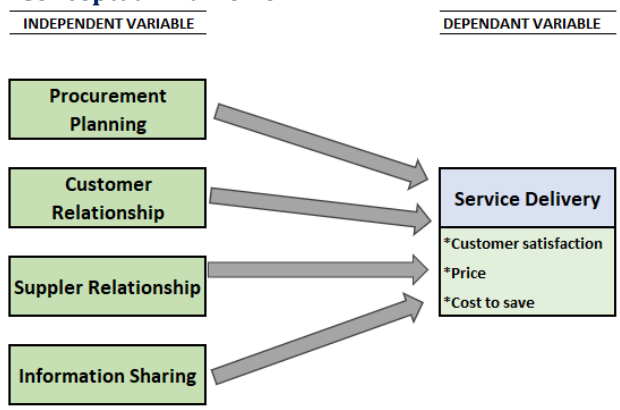

Figure 1 Conceptual Framework of the Study; Source: Authors (2024)

The study adopts the conceptual framework above which shows the relationship between Supply chain management practices and service delivery. The independent variable is the Supply chain management practices which include the supplier relationship, customer relationship information sharing and logistics while the dependent variable is the service delivery.

3. Research Methodology

3.1. Design

The study adopts a quantitative descriptive research design to systematically analyze and describe the relationship between SCM practices and service delivery outcomes in Zambia's public health sector. This design allows for a clear examination of existing SCM practices, their prevalence, and their direct impact on key healthcare delivery metrics such as equity, cost-effectiveness, and resource availability.

Table 2 Research Design Matrix of the Study

Research question	Research objective	Population and sampling	Data collection tool	Data analysis
What supply chain management practices are being used in Zambia's public health sector?	To establish the effective supply chain Management practices employed in Zambia's public health sector.	Level 1 Hospitals and Health Centres in Lusaka, Mazabuka & Chisamba Districts: Total Population Sampling	In- depth Questionnaire	Quantitative Analysis
Which public health services are affected by supply chain management practices?	To establish the public health services affected by supply chain management practices.	Level 1 Hospitals and Health Centres in Lusaka, Mazabuka & Chisamba Districts: Total Population Sampling	In- depth Questionnaire	Quantitative Analysis
How do supply chain management practices influence service delivery in Zambia's public health facilities?	To evaluate the impact of supply chain management practices on service delivery outcomes in Zambia's public health facilities.	Level 1 Hospitals and Health Centres in Lusaka, Mazabuka & Chisamba Districts: Total Population Sampling	In- depth Questionnaire	Quantitative Analysis

3.2. Philosophies

This research is grounded in the positivist philosophy, which emphasizes the collection and interpretation of objective data. The positivist approach ensures that the researcher remains neutral, focusing on measurable evidence obtained through structured data collection tools such as questionnaires. This philosophy is particularly suited to assessing the quantifiable impact of SCM practices on healthcare service delivery.

3.3. Study Population

The study targeted 85 public health facilities, classified as Level 1 hospitals and mini-hospitals, within Lusaka and nearby districts. These facilities were selected because they provide critical healthcare services and rely heavily on SCM processes for the availability of essential supplies. The respondents included clinicians, pharmacists, and procurement officers,

whose roles are directly linked to the implementation and outcomes of SCM practices.

3.4. Study Sample

From the target population, a sample of 50 respondents was selected to represent the perspectives of key stakeholders in public health facilities. This sample size was determined based on accessibility, relevance to the study objectives, and the time constraints of the research.

According to Ministry of Health, there are 85 public health facilities classified as either 1st Level Hospital or Mini Hospital in Zambia. The population size of this study is relatively small and to get meaningful findings, the study opted to employ total population sampling. The Sample size per facility was 3 comprising of 1 Clinician, 1 Pharmacists and 1 Procurement official.

Determining a representative survey sample size for 3 representatives in each of the 85 Level 1 health facilities was calculated using the formular:

$$n = \frac{N}{1+\frac{N-1}{X}}$$

Where:

N is the known population size.

X is the desired ratio of the sample size to the population size.

So, the sample size (n) required for a population size (N) of 255 with a desired ratio (X) of 60 is approximately 50 respondents.

3.5. Sampling Techniques

A Total Population Sampling method was employed due to logistical challenges and resource limitations. This approach enabled the researcher to collect data from accessible facilities and respondents, ensuring that insights could be gathered within the study's timeframe while maintaining relevance to the research objectives.

3.6. Data Collection

Primary data were collected using structured questionnaires, designed to capture information on the implementation and effectiveness of SCM practices. The questionnaires included closed-ended questions to standardize responses and facilitate quantitative analysis. Secondary data were gathered from journal articles, books, and reports to provide context and support the interpretation of findings.

3.7. Data Analysis

Data were analyzed using SPSS and Microsoft Excel, employing both descriptive and inferential statistical techniques. Descriptive statistics such as frequencies and means identified trends in SCM practices, while regression analysis explored the relationship between SCM practices and service delivery outcomes. Tables, graphs, and charts were used to visually present the findings, ensuring clarity and accessibility.

4. Findings

The findings of this study highlight the pivotal role of Supply Chain Management (SCM) practices in enhancing service delivery within Zambia's public health sector. By examining key SCM variables, such as procurement planning, supplier relationship management, inventory management, and information sharing, the study provides empirical evidence supporting the effectiveness of these strategies in improving healthcare outcomes. The positive results observed in this research align with global studies, further underscoring the universality of efficient SCM practices in advancing public health services.

The study found that procurement planning emerged as one of the most widely adopted SCM practices in public health facilities, contributing significantly to better forecasting, reduced stockouts, and more efficient allocation of medical resources. These findings resonate with the research by (Ruth Mwikali, 2012) which demonstrated that well-structured procurement processes were instrumental in enhancing the overall performance of healthcare supply chains. This suggests that public health facilities in Zambia must continue to strengthen their procurement planning efforts, as it forms the foundation for ensuring the consistent availability of essential medical supplies.

4.1. Stakeholder Engagement

The study found that 77.6% of respondents emphasized the importance of supplier relationship management as a critical SCM practice. While many facilities demonstrated some level of collaboration with suppliers, inconsistencies in formalizing these partnerships limited the potential benefits. Facilities that engaged in extensive collaboration with suppliers reported fewer stockouts and better resource availability.

4.2. Data Quality and Reporting

Information sharing emerged as the most significant factor influencing service delivery outcomes (B = 0.360, p = 0.005).

However, the low adoption of IT systems for real-time data sharing (mean = 2.54) highlighted a critical gap in data quality and reporting. This deficiency limits the ability of facilities to forecast demand accurately and coordinate effectively with supply chain partners.

4.3. M&E Framework Adoption

While inventory management (71.4%) and procurement planning (81.6%) were widely adopted, the study identified a lack of robust monitoring and evaluation (M&E) frameworks to track the performance of these practices. Without effective M&E systems, facilities struggled to optimize supply chain processes and address inefficiencies proactively.

4.4. Geographic and Sectoral Insights

Facilities in remote areas faced unique challenges, including inadequate transportation infrastructure and limited supplier engagement. These issues were exacerbated during rainy seasons, when poor road conditions disrupted the delivery of medical supplies. Urban facilities, on the other hand, benefited from better infrastructure and supplier networks, but still reported inefficiencies in procurement processes and inventory management.

5. Conclusion and Implications

This study has revealed that the implementation of supply chain management (SCM) practices significantly impacts service delivery in Zambia's public health sector. In addressing the first objective, the research established that procurement planning, supplier relationship management, and inventory management are the most commonly implemented practices. Procurement planning, in particular, emerged as a cornerstone for ensuring the continuous availability of medical supplies, while supplier relationship management and inventory control were found to be critical for maintaining sustainable supply chains. These findings underscore the importance of robust SCM systems in facilitating equitable and efficient distribution of resources, even in low-resource settings.

Regarding the second objective, the study examined the public health service deliveries most affected by SCM practices, including equity of access, cost-effectiveness, and availability of essential medical supplies. The findings demonstrated that strong SCM practices improve equity by reducing disparities in resource allocation across facilities, particularly those serving underserved populations. Enhanced inventory management ensures the timely availability of critical medical supplies, while efficient supplier collaboration reduces costs associated with stockouts and emergency procurements. These outcomes highlight the strategic role SCM plays in addressing systemic challenges in Zambia's healthcare sector.

Finally, in relation to the third objective, the study found a robust relationship between SCM practices and service delivery outcomes, with an R-squared value of 0.540 indicating that SCM practices account for more than half of the variance in service delivery performance. The significant F-value ($p = 0.000$) further validated this relationship, emphasizing the predictive power of SCM in determining healthcare efficiency. These findings align with global research, affirming the universal applicability of SCM principles in improving healthcare outcomes. The study concludes that public health facilities in Zambia can achieve significant improvements in service delivery by adopting integrated, strategic SCM practices and fostering collaborative frameworks across all supply chain actors.

Recommendations

Based on the findings of this study, several recommendations are proposed for public health facilities, policymakers, and stakeholders involved in healthcare supply chains in Zambia:

Strengthen Procurement Planning

Procurement planning has emerged as a critical driver of supply chain efficiency. It is recommended that public health facilities in Zambia enhance their procurement planning processes by incorporating data-driven demand forecasting, strategic supplier selection, and long-term purchasing agreements. These measures can help ensure the timely and cost-effective acquisition of essential medical supplies, reduce stockouts, and improve healthcare delivery.

Improve Demand Forecasting: Predicting customer demand and managing inventory to ensure the right products are available at the right time. Impact on Service Delivery: Proper forecasting and inventory management help prevent stockouts, reduce excess inventory, and ensure timely delivery to customers.

Enhance Supplier Relationship Management

The study found that deeper collaboration with suppliers leads to more reliable service delivery. Therefore, public health facilities should formalize and institutionalize their supplier partnerships through contracts, service-level agreements (SLAs), and joint performance reviews. Investing in supplier development and capacity-building initiatives will also foster trust and improve supplier responsiveness, thereby reducing lead times and ensuring a steady flow of medical supplies.

Improve Inventory Management Systems

Effective inventory management is essential for avoiding both overstocking and stockouts, which can lead to wastage and inefficiencies. It is recommended that public health facilities adopt modern inventory management technologies such as Enterprise Resource Planning (ERP) systems or Warehouse Management Systems (WMS). These tools can enable real-time tracking of inventory levels, automate reordering processes, and optimize stock control, ensuring that critical supplies are always available when needed.

Leverage Technology for SCM Optimization

The adoption of digital health technologies, including e-procurement platforms, data analytics, and blockchain for supply chain transparency, should be a priority for public health institutions. Technology-driven SCM processes can enhance accuracy, reduce procurement lead times, and ensure accountability across the supply chain.
Invest in the use of technology such as Enterprise Resource Planning (ERP), Internet of Things (IoT), Artificial Intelligence (AI), and Big Data to optimize operations. Impact on Service Delivery: Enhances visibility, tracking, decision-making, and responsiveness to customer needs, improving the efficiency and accuracy of service delivery.

Strengthen the Distribution Management systems.

The movement of goods from manufacturers to customers, including transportation, warehousing, and last-mile delivery. Impact on Service Delivery: Ensures that products are delivered on time, in the right condition, and at the correct location, which is crucial for customer satisfaction.

Policy Interventions

At the policy level, the Zambian government should establish national SCM guidelines for public health facilities, outlining best practices in procurement planning, supplier management, and inventory control. Additionally, there is a need for regulatory frameworks that support public-private partnerships (PPPs) in the healthcare supply chain, encouraging private sector participation and investment in critical supply chain infrastructure.

Conflict of Interest

The authors declare that they have no conflicting interests

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Data Availability statement

The data used to support the findings of this study are available from the corresponding author upon request.

Ethical considerations

The article followed all ethical standards appropriate for this kind of research.

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