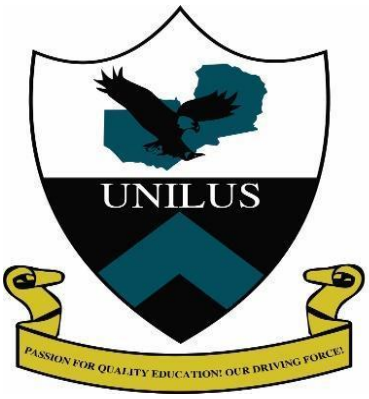

UNIVERSITY OF LUSAKA

SCHOOL OF POSTGRADUATE STUDIES

ASSESSING FACTORS AFFECTING SUPPLY CHAIN PERFORMANCE OF TRACER DRUGS IN PUBLIC HEALTH FACILITIES IN ZAMBIA: A CASE OF LUSAKA.

A Dissertation Submitted in Partial Fulfillment of the Requirements of the University of Lusaka for the Award of the Master of Science in Procurement, Logistics, and Supply Chain Management

BY

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MSCPLSM 22213578

SEPTEMBER, 2024

SIGNED DECLARATION IN A POSTGRADUATE RESEARCH THESIS

I am aware of and understand the university's policy on plagiarism and I certify that this thesis submitted to the University of Lusaka in partial fulfillment for the award of Degree of Masters of Science in Procurement, Logistics, and Supply Chain Management has

i. Been solely composed by myself
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Name of Supervisor **Signature:** **Date**

Dr Shem Sikombe  15/01/25

Name of student

Name: Violet Kabonde 15/01/25

DEDICATION

This study is wholeheartedly dedicated to my father, my Husband and my four daughters who have been my source of encouragement and gave me strength, spiritual and moral support and indeed Jehovah my God for his wisdom, guidance and support to finish this program.

ACKNOWLEDGEMENT

I would like to thank all those who have taken the time off their busy schedule to make their various helpful contributions and help towards the completion of my course in general and in particular this project.

To my Principal and supervisor Mr Shem Sikombe, for his patience, tolerance, constructive and negative feedback, and very helpful advice, even in the shortest possible time.

Others include Mr Jacob Habanji, Perfect Moment Pharmacy General Director for his, consistent support, encouragement and financial assistance, reducing the pressure, for without his assistance I would not have done it. May the Almighty God reward you as only my words can describe how grateful I am?

More appreciation goes to the management of the University Teaching Hospital

For allowing me to conduct this research.

Special appreciation goes also to all the people whom I did not notice but played a part in compiling this work

Lastly but not least, I would like to thank all the participants for their participation in the data collection and their maximum cooperation. This study would not have been possible without them

ABSTRACT

This study uses a mixed-methods approach to investigate the factors influencing the supply chain performance of tracer drugs in public health facilities in Lusaka, Zambia. Quantitative data were collected through a structured questionnaire from 100 pharmacy personnel, while qualitative data were gathered via semi-structured interviews with 10 key informants and observational checklists. Purposive sampling ensured the inclusion of participants with relevant expertise.

Quantitative analysis, conducted using regression and correlation analysis in SPSS version 23, identified logistics activities, particularly warehousing, transportation and distribution, as significant predictors of supply chain performance ($\beta = 0.55$, $p < 0.001$). Conversely, the level of technology ($\beta = 0.008$, $p = 0.946$) and staff competency ($\beta = 0.002$, $p = 0.983$) did not show significant relationships, potentially due to systemic issues such as inadequate infrastructure and resource constraints.

Qualitative findings revealed operational inefficiencies at ZAMMSA, weak internal inventory controls, and poor stakeholder communication. The absence of computerized inventory systems led to inaccuracies, difficulty tracking expiration dates, and increased staff workload. Thematic analysis highlighted proactive procurement practices, local supplier engagement, and alternative funding as strategies to mitigate supply limitations.

The study emphasizes the critical role of robust logistics activities in ensuring an efficient pharmaceutical supply chain. It identifies significant challenges, including poor resource management and operational issues at both ZAMMSA and facility levels. Enhanced coordination, technology integration, and resource management are essential for improving supply chain performance and drug availability in Lusaka's public health facilities.

Keywords: Level of Technology, Logistics Activities, Supply chain Performance

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LIST OF ACRONYMS AND ABBREVIATIONS

SC: Supply Chain

SCM: Supply Chain Management

SOP: Standard Operating Procedures

KPI: Key performance Indicators

ZAMMSA: Zambia Medicines and Medical supply Agency

LMIS: Logistics management information system

SPSS: Statistical Packages for Social Sciences

KII: Key Informant Interview

PHCU: Primary Health care unit

UNILUS: University of Lusaka

ICT: Information Communication and Technology

EDI: Electronic Data Interchange

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CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.0 Introduction

Efficient supply chain management of essential medicines is a cornerstone of effective healthcare delivery in Zambia (Enoos, 2023). Despite increased investments in procurement, medicine availability in many low- and middle-income countries (LMICs) remains critically low. This shortfall is largely attributed to weak and poorly functioning supply chains.

Tracer drugs, a subset of essential medicines, are pivotal in meeting primary healthcare needs and must always be available in a well-functioning healthcare system (Munga et al., 2021). These medicines are carefully selected based on priority health needs and are expected to be consistently accessible in appropriate dosages, sufficient quantities, assured quality, and at an affordable price (Umer et al., 2023). Their availability is a key indicator of supply chain performance and a proxy for a health program's capacity to meet client needs with the required products and services.

Globally, the World Health Organization (WHO) recommends at least 80% availability of tracer commodities in health facilities to ensure quality care. The consistent presence of these medicines is vital, and their availability is directly linked to how efficiently the supply chain functions. Improving supply chain performance first requires understanding of its current status measured through various parameters such as net profit margin, days of supply, inventory turnover, and overall operational efficiency (Galankashi & Rafiei, 2022).

This study assessed factors influencing the performance of the tracer drug supply chain in Lusaka's public health facilities. It examined key dimensions such as staff competence, logistics, technology adoption, and inventory management. Findings highlighted challenges such as data inaccuracies, absence of computerized systems, and stock record errors all of which forced patients to seek more costly private-sector alternatives. Identifying these gaps informs a targeted approach to enhance the efficiency, accuracy, and reliability of medicine delivery in public health institutions.

1.1 Background of Study

The performance of supply chains for tracer drugs in public health facilities has evolved amid persistent challenges and emerging innovations. Historically, LMICs, particularly rural areas, struggled with consistent availability of essential medicines—hindering access to critical treatments like antiretroviral drugs for HIV/AIDS (Sheshe, 2018; Atiga et al., 2023). These challenges underscored the urgent need for strategic interventions to strengthen pharmaceutical logistics.

Zambia's distribution costs are estimated to be 4.5% lower than those in the U.S. pharmaceutical sector, indicating relatively efficient logistics (Friedman et al., 2012). Still, room for improvement remains. A notable intervention involved implementing a direct distribution system, allowing clinics to order directly from the central supply agency. This resulted in significant reductions in stock-outs from 47.9% to 13.3% and a decline in stock-out duration from 18.2 days to 4.1 days (Vledder et al., 2019). This approach also improved supply chain responsiveness by reducing information asymmetry between health facilities and central suppliers.

However, improving supply chain systems is not solely a technical endeavor. It often involves navigating complex political and institutional landscapes. Effective interventions must therefore consider technical, social, and political dynamics. Strengthening communication and data exchange between health facilities and the Zambia Medicines and Medical Supplies Agency (ZAMMSA), along with distribution system enhancements, could significantly improve pharmaceutical supply chain performance.

Performance-Based Financing (PBF) has also been introduced to boost medicine availability, including tracer drugs (Lohmann et al., 2022). While PBF aims to enhance motivation and care quality, it faces challenges such as persistent stock-outs, financial constraints, and implementation barriers (Zitti et al., 2019). These factors highlight the need for comprehensive approaches that integrate logistics improvements with broader systemic reforms.

In Uganda, Lugada et al. (2022) found that supply chain performance had improved across technical areas, yet challenges persisted such as inadequate planning, staff shortages, limited funding, and weak regulatory structures. Similar issues were reported

in other LMICs, including Liberia, where efforts to promote rational medicine use reflected post-conflict health system rebuilding priorities (Lewycka et al., 2021; Søvold et al., 2021).

Moreover, the COVID-19 pandemic revealed the vulnerability of supply chain systems. Studies emphasized the importance of resilient logistics, timely data sharing, and proactive communication to ensure uninterrupted medicine access (Gizaw et al., 2022; Kuo, Ou & Wang, 2021). These lessons underline the importance of a robust supply chain infrastructure capable not only of meeting routine demands but also of withstanding public health emergencies.

Consequently, the problem statement for this study was derived from the evident gaps in essential medicine supply chains, highlighting the urgent need for a more reliable, efficient, and resilient system in Zambia's public health sector.

1.2 Problem Statement

The efficient management of tracer drugs within the supply chain was crucial for ensuring the availability of essential medicines in public health facilities (Ayako et al., 2023). However, in Zambia, as in many other low- and middle-income countries, particularly in Lusaka, challenges persisted in maintaining optimal supply chain performance for tracer drugs (Vledder et al., 2019). The Ministry of Health (MOH) of Zambia and its development assistance partners had invested substantial amounts of money in the public-sector drug procurement and distribution system in recent years. Despite these efforts, public health facilities across Zambia continued to face difficulties accessing drugs and medical supplies in appropriate quantities. For instance, ampicillin, an antibiotic, was out of stock in 86% of urban health clinics for an average duration of 7.4 weeks (Friedman et al., 2019).

Factors such as the level of technology, logistics activity, inventory management, and staff competency significantly affected the supply chain's effectiveness. Understanding these factors and their influence on supply chain performance was vital for enhancing the availability and accessibility of tracer drugs in public health facilities in Lusaka.

While the effect of technology, logistics activity, inventory management, and staff competency on supply chain performance was recognized, there was limited

comprehensive research focusing on these factors, specifically for tracer drugs in Lusaka's public health facilities. For example, existing studies such as those by Chandani et al. (2012) often generalized findings across different pharmaceutical medicines or healthcare settings, overlooking the unique challenges faced by tracer drugs. Furthermore, most research studies, such as the one conducted by Alemu et al. (2022), had not focused on the topic in the local context of Zambia, creating a contextual gap in research. Therefore, there was a gap in understanding the specific relationship between these factors and the supply chain performance of tracer drugs in public health facilities in Lusaka.

This research aimed to address the gap in knowledge by investigating the factors affecting the supply chain performance of tracer drugs in public health facilities in Lusaka, Zambia. Specifically, the study assessed the influence of the level of technology, logistics activity, staff competency, and inventory management on the availability and accessibility of tracer drugs. By identifying the key drivers of supply chain performance, this research sought to provide recommendations for improving the efficiency and effectiveness of tracer drug management in public health facilities, ultimately contributing to enhanced healthcare service delivery in Lusaka.

The research objectives for this study are divided into two parts: the general objective and the specific objectives.

1.3 General Objective

To assess the factors affecting supply chain performance of tracer drugs in public health facilities in Zambia: A case of Lusaka.

1.3.1 Specific Objectives

1. To explore the effects of the level of technology on supply chain performance.
2. To determine the effect of logistics activity on supply chain performance.
3. To assess the effects of staff competency on supply chain performance.
4. To assess challenges in inventory management on supply chain performance (using qualitative analysis)

1.4 Research Questions

1. What effects does the level of technology have on supply chain performance?
2. How does logistics activity influence supply chain performance?
3. In what ways does staff competency affect supply chain performance?
4. What are the challenges in inventory management on supply chain performance?

1.5 Research Hypotheses

1. Level of Technology:

   (H_0): There is no significant relationship between level of technology and supply chain performance.

   (H_1): There is a significant positive relationship between level of technology and supply chain performance.
2. Logistics activity:

   (H_0): There is no significant relationship between logistics activity and supply chain performance.

   (H_2): There is a significant positive relationship between logistics activity and supply chain performance.
3. Staff Competency:

   (H_0): There is no significant relationship between staff competency and supply chain performance.

   (H_3): There is a significant positive relationship between staff competency and supply chain performance.

1.6 Significance of Study

This study aimed to improve essential medicine availability, ensuring consistent access for patients. Understanding supply chain dynamics was expected to enhance healthcare delivery by streamlining medication distribution and improving care quality. Additionally, the study aimed to help optimize resource allocation, guiding effective resource distribution for a reliable medicine supply. Focusing on tracer drugs addressed critical public health challenges, potentially mitigating stock-outs and enhancing healthcare system effectiveness.

Furthermore, insights from the study were intended to guide policymakers and stakeholders in crafting tailored strategies to fortify the pharmaceutical supply chain, fostering collaboration and tangible improvements in healthcare accessibility, affordability, and quality. Ultimately, the study sought to advance equitable health outcomes for all segments of society and contribute to the empirical evidence and valuable insights for academics and practitioners to fortify the pharmaceutical supply chain, fostering collaboration and tangible improvements in healthcare accessibility, affordability, and quality, ultimately advancing equitable health outcomes for all segments of society and lastly, the study will contribute to the empirical evidence and valuable insights for academics and practitioners.

1.7 Scope of the Study

This research aimed to analyse the factors affecting the supply chain performance of tracer drugs in public health facilities in Lusaka, Zambia, focusing on the level of technology, inventory management, logistics activity, and staff competency. It sought to offer localized insights into challenges and successful practices, with the goal of enhancing healthcare delivery within the capital city's public health facilities. The study's independent variables included the level of technology, logistics activity, inventory management, and staff competency, while supply chain performance was the dependent variable.

1.8 Definition of key Terms

Technology: Technology refers to the application of scientific knowledge, methods, and tools to solve practical problems or achieve specific objectives (Jimoyiannis, 2010). In the context of business and industry, technology often involves the use of machinery, equipment, computer systems, software, and processes to enhance efficiency, productivity, and innovation in various operations.

Procurement: Procurement is the process of obtaining goods, services, or resources from external sources to fulfil the needs of an organization. (Rajagopal, 1993) It involves activities such as identifying suppliers, negotiating contracts, purchasing goods or services, and managing supplier relationships.

Distribution: Distribution refers to the process of moving goods or products from manufacturers or suppliers to end-users or consumers. It encompasses activities such as warehousing, transportation, inventory management, and order fulfillment. Effective distribution ensures that products are delivered to the right place, at the right time, and in the right condition to meet customer demand and maximize customer satisfaction (Kapoor, 2003).

Competency: Competency refers to the knowledge, skills, abilities, and characteristics that enable individuals or organization to perform tasks, solve problems, and achieve desired outcomes effectively. (Sanghi, 2003) In a business context, competencies may include technical skills, interpersonal skills, leadership abilities, and domain expertise.

Supply Chain: A supply chain refers to the network of organizations, resources, activities, and processes involved in the creation and delivery of goods or services to customers. Effective supply chain management aims to optimize the flow of materials, information, and resources to meet customer demands efficiently while minimizing costs and maximizing value creation. (Shukla, 2011)

Logistics management information system (LMIS): A LMIS is the system of physical- and technology-based records and reports that supply chain workers and managers use to collect, organize, present *and* use logistics data gathered across all levels of the system. An effective LMIS depends on the right combination of *people*, *processes*, and *technology*. Skilled *people* must record, analyse, manage, and use supply chain data at every level. forecasting, inventory management, distribution planning, reporting and ordering, order fulfillment, temperature monitoring, equipment maintenance, performance monitoring, etc.—and incorporate routine data management processes.

Inventory management: refers to the process of ordering, storing, using, and selling a company's inventory. This includes the management of raw materials, components, and finished products, as well as warehousing and processing of such items.

1.9 Organization of the Dissertation

CHAPTER ONE: Chapter one introduces the study's focus on assessing factors influencing the supply chain performance of tracer drugs in public health facilities in

Zambia, particularly in Lusaka. It emphasizes the critical role of efficient supply chain management in ensuring uninterrupted access to essential medicines, highlighting the significance of tracer drugs in addressing primary healthcare needs. The chapter presents background information, the research problem, objectives, hypotheses, and the scope. The research aims to scrutinize factors affecting tracer drugs availability and distribution to fortify healthcare infrastructure against disruptions, setting the stage for subsequent chapters.

CHAPTER TWO: Chapter two offers a comprehensive exploration of literature relevant to the research topic, establishing the theoretical foundation for the study. It concluded by introducing the conceptual framework, which serves as a road-map guiding the research methodology and analysis.

CHAPTER THREE: Chapter three outlines the methodology that will be employed in the study, encompassing various aspects such as the research approach, study design, and specific analysis techniques. The methodology provides a detailed framework for collecting, processing, and interpreting data to effectively address the research objectives.

CHAPTER FOUR: Results of the analysis

The chapter employs various research methodologies, including quantitative approaches, to present the results of the field research that was conducted. The data collection process involved the use of different methodologies. The implementation of this measure aims to maximize the accuracy of the provided findings within practical limitations. In addition, the chapter involved analyzing and discussing the results, effectively placing the findings within the framework of the study's goals, questions.

CHAPTER FIVE: Discussion of findings

This chapter provided the discussions of the research findings from the previous chapter. The discussions mainly centred on how the findings of this study align with the findings of other studies conducted in relation to the research topic.

CHAPTER SIX: Conclusion and recommendations

In the final section of this chapter, thorough conclusions and recommendations was provided, emphasizing the particular aspects of the study's results that require additional investigation. Conducting further investigation is crucial in order to provide evidence and support for the derived conclusions.

1.10 Chapter Summary

This chapter initiated an introduction to the study, focusing on evaluating the factors affecting the supply chain performance of tracer drugs in Zambian public health facilities, particularly in Lusaka. It was followed by a background section that offered a historical perspective on pharmaceutical supply chain management challenges, emphasizing the importance of efficient management for ensuring medicine access. The statement of the problem identified persistent gaps in the pharmaceutical supply chain, advocating for comprehensive research. Research objectives were then outlined, aiming to explore the effect of technology, logistics activity, inventory management, and staff competency on tracer drug supply chain performance, guiding subsequent investigation. The significance of the study was emphasized for its potential to enhance healthcare delivery and public health outcomes in Zambia. Lastly, the scope of the study delineated geographical and investigatory parameters, concluding with key term definitions for conceptual clarity throughout the study.

CHAPTER TWO:

LITERATURE REVIEW

2.0 Introduction

This chapter presents a literature review aiming to explore supply chain management in healthcare, illuminating various theories, conceptual frameworks, and empirical studies that have investigated this connection. The Supply Chain Operations Model (SCOR) provides a widely accepted frame work to help with planning, sourcing, making, delivering and returning products to customers. Through an examination of existing research, this review offers valuable insights into the theoretical underpinning of comprehending the distribution of tracer drugs. It explores the intricate network of activities such as Logistics Management Information System (LMIS) a software that supports logistics operations such as transportation, warehousing, inventory management system and supply chain visibility system involved in the supply chain process, highlighting key concepts and principles governing the efficient movement of pharmaceuticals within healthcare systems. By synthesizing insights from existing literature, this study aims to provide a comprehensive understanding of the complexities surrounding tracer drug supply chains in public health facilities. Through this thorough review, valuable insights will be generated, facilitating the identification of areas for improvement and the development of targeted interventions to enhance healthcare delivery and patient outcomes in Zambia.

2.1 Empirical Review

An empirical review is a literature review that concentrates on summarizing and synthesizing previously conducted research studies, experiments, or observations that have gathered empirical data. (Hennink, 2022.)

2.1.1 Global Perspective

At a global level, a study conducted by Maingi (2022) investigated the influence of integrating supply chain systems on healthcare performance in Migori County. With an aim to address the challenges faced by public hospitals due to disruptions in the supply chain, the research focused on four key aspects: integration of Inventory Management

Systems, Quantification Systems, Logistics Management Information Systems, and Human Resource Management Systems. Using a descriptive survey design, data was collected from 23 hospitals, involving 275 respondents, including supply chain managers and key interview informants. The findings revealed that while integration of all four systems positively impacted healthcare performance, significant effects were observed primarily with Logistics Management Information Systems and Human Resource Management Systems, emphasizing the importance of these components in enhancing healthcare delivery.

The study highlighted several challenges faced by public hospitals, including high stock-out rates, uncoordinated procurement of health commodities, poor data quality, and inadequate staff training in supply chain management. These challenges underscored the need for improved integration of supply chain systems to ensure commodity security and enhance healthcare performance. Despite positive effects observed with certain integrated systems, such as Logistics Management Information Systems and Human Resource Management Systems, there remained gaps in the integration of Inventory Management Systems and Quantification Systems, suggesting areas for further improvement.

The study shed light on the critical role of integrated supply chain systems in improving healthcare performance in Migori County. By addressing the gaps identified and implementing recommendations for enhanced integration, such as investing in staff training and improving data management practices, public hospitals can mitigate supply chain disruptions and ultimately enhance healthcare service delivery and patient outcomes.

A study by Bahadori, et al., (2024) aimed to identify and categorize key variables associated with the pharmaceutical supply chain. They conducted a systematic review of all studies on drug supply chain management, adhering to the PRISMA guidelines. The search was carried out in both international and national databases from January 30, 2000, to March 30, 2023. We used specific keywords related to the drug supply chain for this search. We excluded articles, letters to the editor, and editorials from the review and ultimately qualitatively examined 34 studies. The quality of these articles was assessed

using the CASP checklist. We identified key variables and classified them into five categories: Monitoring and control (16 variables), information technology and intelligence (4 variables), human capital (10 variables), physical and financial resources (16 variables), and suppliers (4 variables). It is imperative for health policymakers to develop effective strategies in monitoring and control, information technology and intelligence, human capital, physical and financial resources, and management of drug suppliers. These strategies are essential for the efficient supply and distribution of drugs within the supply chain.

2.1.2 Regional Perspective

Tracer drugs play a pivotal role in assessing the overall availability and performance of pharmaceutical supply chains, serving as indicators for essential medicines within healthcare systems. Particularly in addressing prevalent health conditions, such as HIV/AIDS, these medications are crucial, according to WHO (2010). Despite efforts to improve availability, HIV/AIDS commodity stock-outs remain a significant issue in many African countries, leading to treatment interruptions, antiretroviral resistance, treatment failure, and adverse health outcomes.

To address this concern, a study was conducted by Lule et al. (2024) in Wakiso District, Uganda, aiming to assess the determinants of HIV Tracer Commodities' availability in health facilities. Employing a descriptive cross-sectional design, data was collected from 42 health facilities offering HIV/AIDS services using semi-structured questionnaires adapted from the ART SPARS tool. The findings revealed that 67% of the visited health facilities had all HIV Tracer commodities available on the day of the visit. It was observed that computerized ART commodity management systems and timely ordering were associated with higher availability, while reliance solely on manual LMIS was linked to lower availability. These results underscore the importance of implementing efficient inventory management systems and ensuring timely procurement to enhance the availability of essential medicines like HIV Tracer Commodities in healthcare facilities. (Lule, 2024.)

Another study done in Ethiopia by Addisu (2021) which aimed to assess the performance of the Integrated Pharmaceuticals Logistics System (IPLS) in selected health centres of

Awi zone, Amhara region, Ethiopia. Tracer drugs, emblematic of essential medicines, serve as indicators for the overall availability and performance of pharmaceutical supply chains, reflecting the effectiveness of the health logistics system. Employing a descriptive cross-sectional study design and quantitative methods of data collection, data were gathered from 33 health centres in the first and second phases of IPLS implementation. Structured questionnaires adapted from standard logistics indicators assessment tools and IPLS implementation supportive supervision tools were utilized. Findings revealed that all pharmaceutical programs, except vaccines, had been integrated into IPLS, with a predominantly pull system for supply, except for maternal, neonatal, and child health programs.

Despite overall good availability of tracer pharmaceuticals, challenges persisted in reducing pharmaceutical wastage rates. Notably, IPLS-affiliated pharmaceuticals were priced relatively lower, with fixed rates for determining selling prices across health centres. Recommendations included integrating vaccines into IPLS, improving pharmaceutical availability and storage conditions, shortening delivery lead times, and implementing mechanisms for emergency pharmaceutical delivery to service delivery points. This study underscores the importance of evaluating pharmaceutical logistics systems to enhance supply chain performance and ensure consistent access to essential medicines within healthcare facilities.

Another study by Goyit, et al. (2016) aimed at assessing the current status of the drug supply chain in Nigeria with respect to the capacity and practices of storage, distribution and transportation. A cross-sectional descriptive survey was conducted to assess the various parameters, through the use of structured questionnaires administered to officers handling drugs supply system in selected sites in FCT Abuja and Plateau state. The study showed that 68% of the stores assessed had a defined quality assurance policy in place. 68% indicated availability of written information and documentation of storage activities. However, only 39% of respondent indicated availability of temperature charts, while 61% reported having in place a functional distribution and transportation mechanism. Conclusion: Despite observed lapses, this assessment revealed enough strengths and

good infrastructural presence to indicate that the drug supply chain is sufficiently effective and efficient to receive and manage medicines that pass through it.

2.1.3 Local Perspective

Studies addressing the problem of assessing factors affecting the supply chain performance of tracer drugs in public health facilities in Zambia are relatively limited, necessitating further research on the topic. In low- and middle-income countries like Zambia, the irrational use of medicines, particularly antimicrobial misuse, presents a significant health challenge. Moreover, the distribution dynamics of essential medicines within healthcare systems are influenced by various factors, including technological advancements, procurement processes, distribution channels, and staff competency. For instance, a study conducted by Jeremie et al. (2021) investigated inventory policies for pharmaceutical distribution in Zambia, aiming to improve availability and access equity. The findings suggested that improved inventory control policies could enhance patient access to drugs in Zambia, with broader relevance beyond the country. The study highlighted the inadequacies of the current inventory policy recommended by the multi-country USAID-funded DELIVER project, which is widely used throughout sub-Saharan Africa and other low- and middle-income countries. Specifically, the study revealed that the optimization-based policy proposed in the research outperformed existing policies in terms of equity, particularly in scenarios where inventory in the central warehouse is scarce.

Additionally, empirical results from the study shed light on broader observations regarding distribution equity within pharmaceutical supply chains. The study highlighted the potential disparities in service levels between facilities, especially when proportional inventory rationing rules are applied. These observations underscore the importance of considering factors such as access lead times and timing heterogeneity between facilities to ensure equitable distribution of medicines. Overall, the study emphasized the need for robust inventory policies and equitable distribution strategies to enhance the supply chain performance of essential medicines, including tracer drugs, in public health facilities in Zambia. Further research in this area is essential to develop evidence-based

interventions that address existing gaps and optimize pharmaceutical supply chain management practices to improve patient outcomes.

A study by Phiri, (2016) aimed to evaluate the rational use and availability of antimicrobials at primary level health facilities within the Lusaka district community health office. Employing a cross-sectional descriptive design with both prospective and retrospective components, the study utilized standardized research methodologies adapted from the World Health Organization (WHO). The study population encompassed 30 government primary-level health facilities in Lusaka District, from which 20 were sampled using a combination of purposive and random sampling techniques. Data collection involved the assessment of 800 patient encounters, 520 medicines inventory records, and other baseline data using various tools, including the Prescribing Indicator Form, Patient Care (Pharmacy) Form, and Antimicrobial Availability Form. Third-year Pharmacy Technology students were trained for data collection, which included observations, interviews, and pre-tested tools.

The study's findings revealed significant insights into antimicrobial prescribing and dispensing practices at primary health facilities. Clinical Officers predominated as prescribers, with Pharmacy Technologists as the main dispensers, highlighting the scarcity of Pharmacists in these facilities. The study observed a high proportion of paediatrics patients, low rates of generic drug prescribing, and frequent prescription of antibiotics and injectable drugs, indicating potential irrational prescribing decisions. Moreover, commonly prescribed antimicrobials such as Amoxicillin and Metronidazole were identified, alongside deficiencies in medicines labelling and short consultation and dispensing times. Despite the availability of essential drugs lists in most facilities, the study noted inadequate access to first-line antimicrobials and low availability of second-line substitutes. These findings underscored the prevalence of antimicrobial overuse and irrational prescribing practices, highlighting the urgent need for interventions to improve medicines management and therapeutic outcomes.

These insights contribute to addressing the broader challenge of optimizing pharmaceutical supply chain performance and ensuring rational use of medicines in public health facilities in Zambia.

2.2 Theoretical Review

2.2.1 Supply Chain Network Theory

Supply Chain Network Theory represents a fundamental shift in how supply chains are conceptualized and managed. It moves away from the traditional linear model of supply chains towards a more holistic understanding of the interconnectedness and complexity inherent in modern supply chain systems. At its core, this theory recognizes supply chains as intricate networks comprising various entities, including suppliers, manufacturers, distributors, and customers. These entities are interconnected through direct and indirect relationships, forming a web of interactions that influence the flow of information, goods, and resources throughout the supply chain. By leveraging concepts from network theory, such as graph theory and network analysis, Supply Chain Network Theory provides a framework for analyzing and understanding the structure, dynamics, and behaviour of supply chain networks (Harland, 1996).

In this study, the Supply Chain Network Theory is crucial for understanding the factors influencing the performance of tracer drugs in Zambian public health facilities. By conceptualizing the supply chain as a complex network, researchers can analyse relationships and interactions among stakeholders involved in procurement, distribution, and management processes. This approach facilitates a comprehensive assessment of goods, information, and resource flow, revealing bottlenecks, inefficiencies, and improvement opportunities. Through a deeper understanding of network dynamics and structural characteristics, policymakers and managers can design targeted interventions to enhance tracer drug availability, accessibility, and effectiveness, thus improving healthcare outcomes for the population.

2.2.2 Resource-Based View Theory

The Resource-Based View (RBV) theory provides a strategic management perspective by portraying firms as repositories of unique resources and capabilities. It asserts that

sustainable competitive advantage stems from possessing resources that are valuable, rare, costly to imitate, and non-substitutable—framework. RBV emphasizes internal analysis, urging firms to identify and leverage resources that differentiate them from competitors, including both tangible and intangible assets like brand reputation and intellectual property. Additionally, RBV highlights resource heterogeneity and immobility, suggesting that resources must not only vary among companies but also be difficult to transfer to enable firms to execute distinctive strategies and outperform rivals.

The Resource-Based View (RBV) theory offers a valuable framework for analyzing the performance of tracer drugs in Zambian public health facilities by examining their internal resources and capabilities. Through RBV principles, the researcher aims to uncover the unique competencies and assets that contribute to effective tracer drug management, providing insights into why certain facilities outperform others. This understanding can inform policymakers and healthcare managers in directing investments and development efforts towards enhancing the overall performance of public health facilities, ultimately leading to improved healthcare delivery and patient outcomes in Zambia.

2.2.3 Institutional Theory

Institutional Theory, rooted in sociology and organizational studies, delves into the foundational aspects of social structure, examining how norms, rules, and routines become ingrained as authoritative guidelines for social behaviour (Hatch, 2018). William Richard Scott conceptualizes institutions as crucial social structures that imbue social life with stability and significance, comprising cultural-cognitive, normative, and regulative elements. Central to Institutional Theory is the notion of institutional isomorphism, whereby organizations must adhere to prevailing rules and belief systems within their environment to garner legitimacy. This theory underscores the profound impact of the institutional environment on organizational behaviour and structure, shaping their formal arrangements and practices.

Institutional Theory offers a crucial framework for studying the supply chain performance of tracer drugs in Zambian public health facilities by examining how organizations adhere to norms and regulations. The researcher aims to uncover the factors driving institutional conformity within the healthcare sector, shedding light on why certain facilities adopt

specific strategies. This understanding enables policymakers and healthcare managers to evaluate regulatory frameworks and norms, aligning supply chain practices to improve access to essential medicines and healthcare outcomes in Zambia.

2.3 Conceptual Framework

Figure 1.

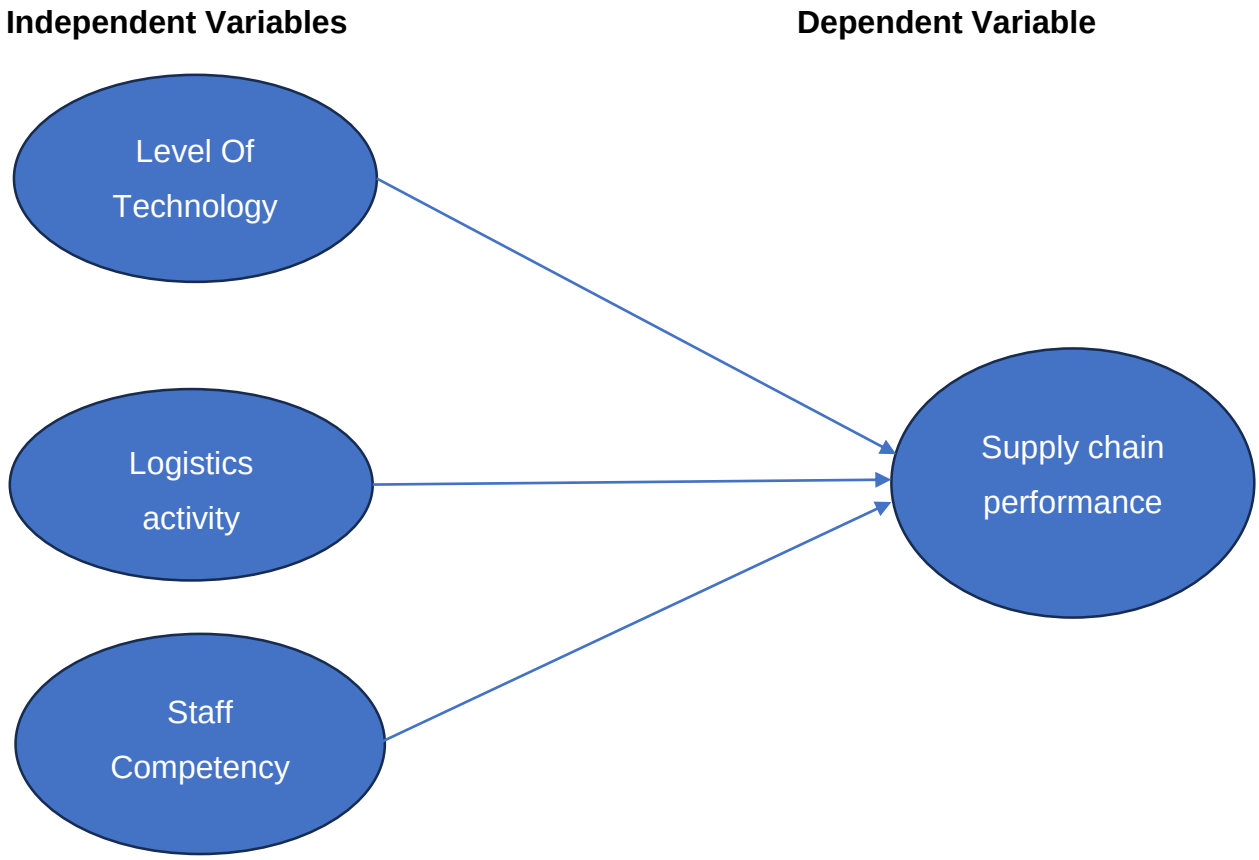


Figure 2.1 *Conceptual Framework* (Source: Developed by Author)

2.4 Conceptualization of the Conceptual Framework

Level of Technology

The level of technology within a supply chain is a critical factor influencing performance, with advancements in technology enhancing efficiency, accuracy, and responsiveness.

The conceptualization of technology in supply chains encompasses various dimensions, including automation, data analytic, and digital integration. According to (2018), high levels of technological adoption enable organizations to optimize their supply chain processes by improving data visibility, enhancing decision-making capabilities, and reducing operational costs. Technologies such as Enterprise Resource Planning (ERP) systems, Internet of Things (IoT) devices, and Artificial Intelligence (AI) are instrumental in streamlining operations, managing inventory, and forecasting demand, which collectively contribute to superior supply chain performance.

In the context of Zambia, the level of technology presents both opportunities and challenges for supply chain performance. Research by Ngoma and Simatele (2021) indicated that while technological advancements have the potential to significantly enhance supply chain efficiency in Zambia, there are notable gaps in technology adoption due to infrastructural limitations and limited access to advanced technologies. For example, the use of sophisticated data analytic and automated systems is often constrained by inadequate IT infrastructure and high costs associated with technology investments. Ngoma and Simatele emphasize that addressing these technological challenges is crucial for improving supply chain performance, suggesting that increased investment in technology and infrastructure could drive more effective and efficient supply chain operations in Zambia.

Recent studies have further highlighted the impact of technology on supply chain performance, particularly in emerging markets like Zambia. For instance, the study by Mumba et al. (2023) explores how technology-driven solutions, such as block-chain and cloud computing, can enhance transparency and collaboration within supply chains. They argue that while these technologies offer significant benefits, their adoption in Zambia is hindered by factors such as limited technical expertise and the high cost of implementation. However, the potential for technology to transform supply chain operations is substantial, and initiatives aimed at improving technological literacy and reducing implementation costs could have a profound impact on supply chain performance in the region. This aligns with global findings by Ahi and Searcy (2018), who stress that technological innovation is key to achieving competitive advantage and improving supply chain resilience

Sousa and Rodrigues (2022), investigated how digital technologies affect supply chain efficiency by comparing case studies from the European Union and Brazil. The study findings were that digital tools, such as cloud computing and real-time data analytic, significantly improve supply chain performance by enhancing coordination and reducing operational costs. The research highlighted that while European firms exhibit higher levels of digital technology integration, Brazilian firms are making significant strides in adopting these technologies, leading to improved supply chain outcomes. Another study done by Lee and Morales (2018) examined he role of technology in optimizing supply chains, with a focus on Asia and Latin America. It shows that technologies such as predictive analytics and automation systems enhance supply chain performance by improving forecasting accuracy and operational efficiency. The findings indicate that while Asia has seen rapid technological advancements, Latin American countries are gradually integrating these technologies, resulting in improved supply chain effectiveness and resilience.

Logistics Activity

The conceptualization of logistics activity as a critical component of supply chain performance has garnered substantial attention in recent research. Logistics activities, encompassing transportation, warehousing, inventory management, and order fulfillment, play a pivotal role in enhancing the efficiency and responsiveness of supply chains. According to Sheffi and Brau (2019), logistics is integral to achieving competitive advantage through cost reduction, improved service levels, and enhanced customer satisfaction. They argue that robust logistics operations enable firms to streamline their supply chains, thus achieving better coordination and timely delivery of products. This view is reinforced by the work of Christopher (2016), who emphasizes that effective logistics management is essential for optimizing supply chain performance by ensuring the seamless flow of goods and information across the supply chain network. Electronic Logistics Management Information System (ELMIS) are key platforms supporting supply chain functions of the health system

In the context of Zambia, logistics activities face unique challenges that impact overall supply chain performance. The study by Mweemba and Kamwendo (2022) highlights that Zambia's infrastructure limitations, such as inadequate road networks and unreliable

transportation services, significantly affect logistics efficiency. These challenges lead to increased transit times and higher costs, thereby impeding the performance of supply chains within the country. Moreover, logistical inefficiencies in Zambia are exacerbated by the country's reliance on cross-border trade with neighbouring nations, which further complicates supply chain operations. This situation underscores the importance of addressing logistical constraints to improve supply chain performance in the Zambian context.

Recent research has also identified several strategies to enhance logistics activities and, by extension, supply chain performance in Zambia. A study by Mwanza et al. (2023) proposes the adoption of technology-driven solutions, such as advanced tracking systems and digital platforms, to improve logistics efficiency. They argue that integrating technology into logistics operations can mitigate some of the infrastructure-related challenges faced in Zambia. Additionally, the research advocates for collaborative approaches between the public and private sectors to develop infrastructure and streamline logistics processes. This approach aligns with global best practices, as noted by Kache and Cegarra-Navarro (2021), who emphasize that strategic logistics management and infrastructure development are crucial for achieving sustainable supply chain performance.

Staff Competency

Staff competency is increasingly recognized as a crucial determinant of supply chain performance, as it directly influences various operational outcomes, including efficiency, effectiveness, and adaptability. The conceptualization of staff competency in supply chains involves the skills, knowledge, and abilities of employees that enable them to perform their roles effectively and contribute to the overall performance of the supply chain. According to Wagner and Bode (2018), staff competency encompasses both technical skills and soft skills, such as problem-solving and communication, which are essential for managing complex supply chain processes. Their research underscores that well-trained and knowledgeable staff are better equipped to handle disruptions, optimize processes, and drive continuous improvement, ultimately leading to enhanced supply chain performance.

In the context of Zambia, the significance of staff competency is particularly pronounced due to the country's evolving economic landscape and the need for effective supply chain management in a developing environment. A study by Chitondo and Mumba (2021) highlights that the Zambian supply chain sector often faces inadequate staff training and skill development challenges. This deficiency can lead to inefficiencies, such as poor inventory management and ineffective procurement practices. Chitondo and Mumba's research emphasizes that addressing these gaps through targeted training programs and professional development initiatives is crucial for improving supply chain performance in Zambia. The findings align with the broader literature suggesting that investing in staff competency can significantly enhance operational capabilities and contribute to achieving competitive advantage (Klaus, et al., 2019).

Recent advancements in research further corroborate the importance of staff competency for supply chain performance. For instance, Zhang et al. (2023) demonstrate that organizations with a focus on continuous learning and skill enhancement achieve better supply chain outcomes, including faster response times and higher service levels. They argue that a strategic approach to employee development, encompassing both technical and managerial skills, can lead to more resilient and agile supply chains. This perspective is relevant to Zambia, where the integration of modern supply chain practices and technology requires a workforce that is adept in these areas. As noted by Nkhoma et al. (2022), developing a skilled workforce in Zambia through partnerships between educational institutions and industry can bridge the competency gap and support the growth of a more efficient and competitive supply chain sector.

2.5 Chapter Summary

This chapter provides a comprehensive review of the literature relevant to the research topic, establishing the theoretical foundation for the study. It concluded by presenting the conceptual framework, which serves as a road-map guiding the research methodology and analysis.

CHAPTER THREE:

METHODOLOGY

3.0 Introduction

Chapter three outlines the methodology adopted for the study, covering various aspects such as the research approach, design, population/sample size determination, data collection methods, instruments, instrument reliability assessment, data analysis procedures, and ethical considerations.

3.1 Research Approach

There are three types of research approaches; Qualitative, Quantitative and mixed-methods approaches (Creswell, 2014). According to Creswell (2014) the mixed-method approach combines both qualitative and quantitative research methods to provide a comprehensive understanding of the research problem.

Firstly, qualitative methods were used to gather in-depth insights into the experiences and perspectives of key stakeholders in the global supply chain industry. This involved conducting interviews, focus groups, and case studies to explore the various factors influencing the digital transformation of supply chains. Secondly, quantitative methods were used to collect and analyse numerical data related to digitalization and supply chain performance.

Structured questionnaires were administered to a sample of supply chain professionals and managers to gather data on the adoption of digital technologies, supply chain integration, and performance metrics. The integration of qualitative and quantitative data allowed for a more holistic and nuanced analysis of the role of digitalization in transforming global supply chains. By combining these methods, the study was able to provide a comprehensive understanding of the complex relationships between digitalization, supply chain dynamics, and performance outcomes

3.2 Study units

The study units are selected public health facilities, selected health professionals, selected key informative, selected tracer drugs and selected logistics reporting and recording tool.

3.3 Research Design

Public health supply chain performance indicator drugs were selected from a national list of tracer drugs. Given that the primary aim of the study is to evaluate the determinants influencing the supply chain performance of tracer drugs within public health facilities, a descriptive research design is deemed most suitable. This design facilitates a comprehensive examination of the various factors impacting the efficiency and effectiveness of the supply chain processes. By employing a descriptive approach, the study can systematically gather, organize, and analyse data to provide a detailed account of the current state of the supply chain for tracer drugs.

3.3 Study Population

All pharmacy in-charges and pharmacy staffs in all the selected facilities were the target population. According to the Health care seeking in modern urban LMIC settings: evidence from Lusaka Clarke-Deelder, et al., (2022), revealed a total of 88 facilities operating in the Lusaka district with a population size of 26,000 employees working teaching hospitals, general hospitals, private facilities, and smaller health centres, health posts, or mission facilities. Therefore, study targeted pharmacy staffs in the selected health facilities in Lusaka population size 26,000 employees.

3.4 Sample Size and Sampling Procedure

Sample size for personnel

Theoretical saturation is a method used to determine sample size in qualitative research, focusing on the point where no new information or themes emerge from additional data collection. In this study, the researcher applied this principle to estimate the sample size. With a total of 88 facilities in Lusaka district, the population size would be 26,000 employees.

The sample size of the study is arrived at using the modified Taro Yamane's (1973). The sample size is calculated as follows:

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{26,000}{1 + 26{,}000(0.06)^2}$$

$$n = \frac{26{,}000}{94.6}$$

$n = 275$ Health workers

The research encompassed two primary cohorts of participants: survey participants comprising a target sample of 275 health professionals (pharmacy personnel) and interview participants ranging from 10 to 30 key informants and observational checklist (facility-level). A sample size of 10-30 respondents was commonly sampled due to the nature of qualitative data collection and analysis. The survey focused on health professionals who are directly engaged in the tracer drug supply chain, encompassing pharmacy professionals, store managers, and supply chain coordinators from a range of public health institutions throughout Zambia. This yielded extensive, quantitative insights into matters such as stock outs, delays, and logistical complexities. In the qualitative phase, comprehensive interviews was undertaken with pharmacy heads, store managers, and supply chain managers at primary health care units (PHCUs) and higher-level health facilities to elicit profound, nuanced insights into the systemic and operational challenges encountered within the drug supply chain. The integration of an extensive sample for the survey alongside a more focused, targeted sample for interviews facilitates both comprehensive statistical analysis and an in-depth, context-specific comprehension of the elements influencing supply chain performance. Creswell (2013) emphasizes that qualitative research often involves smaller samples to gain a deeper understanding of participants' perspectives and experiences.

3.5 Sampling Technique

Purposive sampling and stratified random sampling were used since these are the people with first-hand knowledge about the availability of tracer drugs medicines in public health and factors that affect supply chain performance of medicines and medical supplies. The study employed a combination of purposive and stratified random sampling techniques to select participants. Purposive sampling was utilized to deliberately select specific individuals or groups based on their relevance to the research objectives. This approach ensured that participants with valuable insights into the factors affecting supply chain performance of tracer drugs in public health facilities are included in the study. All staffs handling pharmacy in each selected facility were sampled. Hence, the PHCUs were stratified as selected primary level one hospitals and tertiary Hospitals, the tracer medications being managed; and the storage capacity. The public health supply chain performance indicator drugs are selected from a Zambia national list of tracer drugs.

For the qualitative part, key informants were select purposely from Public Health care units: primary from Lusaka district level one Hospitals and tertiary Hospitals, (Pharmacy head, pharmacists and store manager). This was based on rich information and pharmaceutical delivery services.

3.6 Data Collection

The research utilized both primary and secondary data sources. Primary data was collected through a structured self-administered questionnaire and the interview guide, whereas secondary data was obtained from published books, articles, and reports relevant to the study's topic. All the selected public health facilities and stores were approached on the day of the visit.

Quantitative data collection involved administration of a structured self-administered questionnaire and observations to the pharmacy personnel to confirm factors affecting supply chain performance of tracer drugs in selected public facilities. The data collected by reviewing tracer drugs logistic formats and conducting physical inventory. These medicines are the one that treat most common diseases in the area and are to be used at the level of primary health care centre.

This questionnaire was used to collect data on the main issues about logistics activities, staff competency, and technology and their effect on the supply chain performance of tracer drugs.

Qualitative data collection entails conducting key informant interviews with the pharmacy in-charges who have first-hand knowledge about the available tracer essential medicines in their facilities, challenges of inventory management of tracer drugs, and assessing factors that would affect the supply chain performance of tracer drugs. Qualitative data concerning public health supply chain performance were collected from key informants using a semi-structured interview guide. These entail conducting key informant interviews with the pharmacy in-charges who have first-hand knowledge about the available tracer drugs and assessing factors that would affect the supply chain performance of tracer drugs.

3.7 Reliability of Instruments

In the study by Kaluai & Muathe (2020), evaluating the instrument's reliability entails verifying if the study's results can be reproduced. The Cronbach alpha coefficient was utilised in this research to measure the internal consistency between the items and the variables they signify.

Table 3.1 Reliability Statistics

Variable	N of Items	Cronbach's Alpha
Supply Chain Performance	3	.651
Level of Technology	3	.691
Logistics Activities	3	.865
Staff Competency	3	.627

3.8 Data Analysis Techniques

The data collected for this investigation was analyzed using a combination of quantitative and qualitative methods. Regression and correlation analysis, implemented through the SPSS tool, was employed to analyse the quantitative data, while Thematic Analysis was utilized for the qualitative data using the SPSS tool.

3.9 Demographic Characteristics

A total of 100 respondents participated in the study, with slightly more females (55%) than males (45%). Participants were drawn from various professional roles, with the majority being pharmacists (68%), followed by pharmacy technologists (18%). Other roles included supply chain managers (4%), healthcare administrators (4%), logistics coordinators (3%), and a small proportion in other roles (3%).

Regarding years of professional experience, a significant proportion of respondents reported more than 7 years of experience (27%), while 21% had 4 to 7 years, 18% had 1 to 3 years, and 34% had less than 1 year of experience. This indicates a balanced mix of seasoned professionals and those relatively new to the field.

Respondents were primarily affiliated with central or tertiary hospitals (66%), with smaller proportions working in district hospitals (14%), regional hospitals (10%), and primary healthcare centres (6%). A small percentage indicated affiliation with other types of health facilities (4%).

In terms of educational qualifications, the majority of respondents (69%) held a bachelor's degree, while 20% had a certificate or diploma, and 11% had a master's degree. This reflects a workforce with a strong foundation in higher education, particularly at the undergraduate level.

Table 3.2 Sample Characteristics

Variable	Description	Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	45	45.0	45.5	45.5
	Female	54	54.0	54.5	100.0
Role	Supply Chain Manager	4	4.0	4.0	4.0
	Pharmacist	68	68.0	68.0	72.0
	Logistics Coordinator	3	3.0	3.0	75.0
	Healthcare Administrator	4	4.0	4.0	79.0
	Pharmacy Technologist	18	18.0	18.0	97.0
	Other	3	3.0	3.0	100.0
Years of experience	Less than 1 year	34	34.0	34.0	34.0
	1 to 3 years	18	18.0	18.0	52.0
	4 to 7 years	21	21.0	21.0	73.0
	More than 7 years	27	27.0	27.0	100.0
Type of public health facility	Distric Hospital	14	14.0	14.0	14.0
	Central or Tertiary Hospital	66	66.0	66.0	80.0
	Regional Hospital	10	10.0	10.0	90.0

	Primary Healthcare Centre	6	6.0	6.0	96.0
	Other	4	4.0	4.0	100.0
Highest level of education	Certificate or Diploma	20	20.0	20.0	20.0
	Bachelor's Degree	69	69.0	69.0	89.0
	Master's Degree	11	11.0	11.0	100.0

3.9 Ethical Consideration

To uphold ethical standards, this study prioritized voluntary participation, anonymity, and confidentiality. Participants were assured that their involvement is voluntary, and their responses would remain anonymous. They were informed that their contributions would be used solely for academic research purposes, and no personal details, including names, contact information, or addresses, would be solicited to safeguard their privacy.

3.10 Chapter Summary

Chapter three details the methodology employed in this study, which investigated the determinants of public health supply chain performance, focusing on tracer drugs. A mixed-methods approach was utilized, combining both qualitative and quantitative methods to provide a comprehensive understanding. Data collection involved surveys, interviews, and observations, with primary data collected through questionnaires and interviews, and secondary data from existing literature. The reliability of instruments was assessed using Cronbach's alpha, with acceptable results. This detailed methodology provides a robust foundation for the findings presented in the subsequent chapter.

CHAPTER FOUR:

RESEARCH FINDINGS

4.0 Introduction

This chapter presents the findings from the analysis of the data collected for this study. The aim is to address the research objectives and hypotheses through a systematic examination of the data using appropriate statistical techniques. The chapter begins with an overview of the demographic characteristics of the respondents, which provides a contextual understanding of the study population. This is followed by an assessment of the data quality, including checks for missing data, outliers, and assumptions of normality, linearity, and multicollinearity.

Subsequently, the chapter delves into descriptive statistics to summarize the key variables, highlighting their central tendencies, dispersions, and distributions. Correlation analysis is then performed to explore the relationships between the independent and dependent variables, laying the groundwork for subsequent regression analysis. Finally, multiple regression models are presented to identify the most significant predictors of the dependent variable, with a detailed interpretation of their contributions to the explained variance.

The findings from this chapter form the basis for discussions in the next chapter, where the implications of these results will be linked to the theoretical framework and practical recommendations. Each section in this chapter is organized to ensure clarity and coherence, with a focus on addressing the study's key objectives.

4.1 Preliminary Statistical Analyses

This section includes an examination of missing data, the identification of outliers, and an assessment of the normality of the data distribution, all of which are crucial for the validity of the results. Additionally, correlation analysis is conducted to explore the relationships between key variables, providing a foundation for the regression analysis that follows.

Missing Data, Outliers and Normality

4.1.1 Missing Data

The dataset showed minimal missing data, with "Level of Technology" having 1% missing values and all other variables reporting no missing data. According to Schafer and Graham (2002), a missing data percentage below 5% is generally considered negligible and unlikely to affect the validity of the analysis.

4.1.2 Outliers

Outliers were assessed using the interquartile range (IQR) method, where values outside Q1−1.5 × IQR and Q3+1.5 × IQR were flagged as potential outliers (Tukey, 1977). The IQR values ranged from 1.33 for "Staff Competency" to 2.00 for "Logistics Activities." The absence of extreme outliers suggests that the dataset is relatively clean and free from undue influence by extreme values, as supported by similar findings in robust statistical practices (Leys et al., 2013).

4.1.3 Normality

Normality was evaluated primarily through skewness and kurtosis values, which are key indicators of the shape and peakedness of distributions (West et al., 1995). Supply Chain Performance exhibited near-symmetric distribution (skewness = -0.22) and a slightly flatter distribution than normal (kurtosis = -0.75). Level of Technology showed moderate positive skewness (0.52) and a mildly flattened distribution (-0.38). Logistics Activities displayed near symmetry (-0.12) but a significantly flatter distribution (-1.20). Staff Competency presented a moderate positive skew (0.70) and a distribution close to normal in peakedness (0.04). Values of skewness between −1 to 1 and kurtosis between −2 to 2 are typically considered within the acceptable range of normality and threshold for most statistical analyses (Kim, 2013).

4.1.4 Correlation Analysis

Pearson’s correlation coefficient was computed to examine the strength and direction of the relationships between the independent variables (Role, Years of Experience, Level of Technology, and Logistics Activities) and the dependent variable, Supply Chain Performance. The results are summarized in the table below.

Role: The correlation between Role and Supply Chain Performance was r=.114, indicating a very weak positive relationship that was not statistically significant. This suggests that differences in roles do not meaningfully influence supply chain performance.

Years of Experience: The correlation coefficient for Years of Experience and Supply Chain Performance was r=.085, demonstrating an extremely weak positive relationship. This was also not statistically significant, implying that the years of experience of respondents do not significantly affect perceptions of supply chain performance.

Level of Technology: A moderate positive correlation was observed between Level of Technology and Supply Chain Performance (r=.391, p<.01). This indicates that improvements in the level of technology are moderately associated with better supply chain performance. The statistical significance underscores the importance of technological factors in enhancing supply chain effectiveness.

Logistics Activities: A strong positive correlation was found between Logistics Activities and Supply Chain Performance (r=.593, p<.01). This demonstrates that well-coordinated logistics activities are strongly associated with enhanced supply chain performance. The statistical significance highlights logistics as a critical driver of supply chain efficiency.

Staff competency: A very weak positive correlation was found between staff competency and supply Chain Performance (r=0.084). This indicates that staff competency has a negligible impact on Supply chain performance of tracer drugs.

The results suggest that technological capabilities and logistics activities have a strong positive relationship with supply chain performance, as evidenced by their strong correlations. On the other hand, organizational role and years of experience seem to have minimal impact.

Table 4.1 Correlation Analysis

Variable	Mean	Std. Deviation	N	1	2	3	4	5
Supply Chain Performance	2.8833	1.08181	100	1				
Role	2.73	1.347	100	.114	1			
Years of experience	2.41	1.215	100	.085	-.259**	1		
Level of Technology	2.5387	1.01877	99	.391**	-.015	-.137	1	
Logistics Activities	2.9683	1.25768	100	.593**	-.070	.173	.654**	1

Staff Competency	1.9767	.79597	100	.084	.016	.069	.180	.129

** Correlation is significant at the 0.01 level (2-tailed).

4.2 Regression Analysis

The regression analysis was conducted to explore the factors influencing supply chain performance, using an ordinary least squares (OLS) regression approach.

Table 4.2 Regression Analysis

Variables	Standardised Coefficients (β)	Std. Error	Sig.	VIF
Control Variables				
Role	.163	.068	.059	1.077
Years of Experience	.026	.082	.779	1.255
Independent Variables				
Level of Technology	.008	.124	.946	2.021
Logistics Activities	.594	.099	.000	1.992
Staff Competency	.002	.114	.983	1.046
F	11.226		.000	
F Change	11.226		.000	
R	0.614			
R Square	.376			
R Square Adjusted	.343			
R Square Change	.376			

The regression analysis revealed a statistically significant model, as indicated by an F-value of 11.226 ($p < 0.05$). This suggests that the predictors collectively explain a meaningful portion of the variance in supply chain performance. The R-square value of 0.376 indicates that 37.6% of the variability in the dependent variable is accounted for by the model, while the adjusted R-square of 0.343 confirms the model's explanatory power after adjusting for the number of predictors. The R-square change of 0.376, alongside an F-change value of 11.226 ($p < 0.05$), further validates the significant contribution of the included variables.

Among the control variables, "Role" yields a standardized coefficient (β) of -0.163 with a p-value of 0.059. As this exceeds the 0.05 threshold, the effect of role on supply chain

performance is not statistically significant, suggesting that an individual's position within the supply chain does not reliably predict performance outcomes in this sample. Similarly, "Years of Experience" shows a standardized coefficient of 0.026 ($p = 0.779$), well above the 0.05 threshold, indicating no significant association with supply chain performance. The variance inflation factors (VIF) for these variables are low (1.077 for Role and 1.255 for Years of Experience), confirming the absence of multicollinearity and supporting the reliability of these non-significant findings.

For the independent variables, "Logistics Activities" demonstrates a strong and statistically significant effect, with a standardized coefficient of 0.594 ($p < 0.05$) and a VIF of 1.992. This indicates that logistics activities—such as inventory management, transportation, and distribution—are a critical determinant of supply chain performance. In contrast, "Level of Technology" ($\beta = 0.008$, $p = 0.946$, VIF = 2.021) and "Staff Competency" ($\beta = 0.002$, $p = 0.983$, VIF = 1.046) both have p-values far exceeding 0.05, confirming that neither variable significantly influences supply chain performance in this context. The VIF values for all independent variables remain below 3, suggesting that multicollinearity does not substantially affect the model's estimates.

4.3 Thematic Analysis of Challenges in Inventory Management

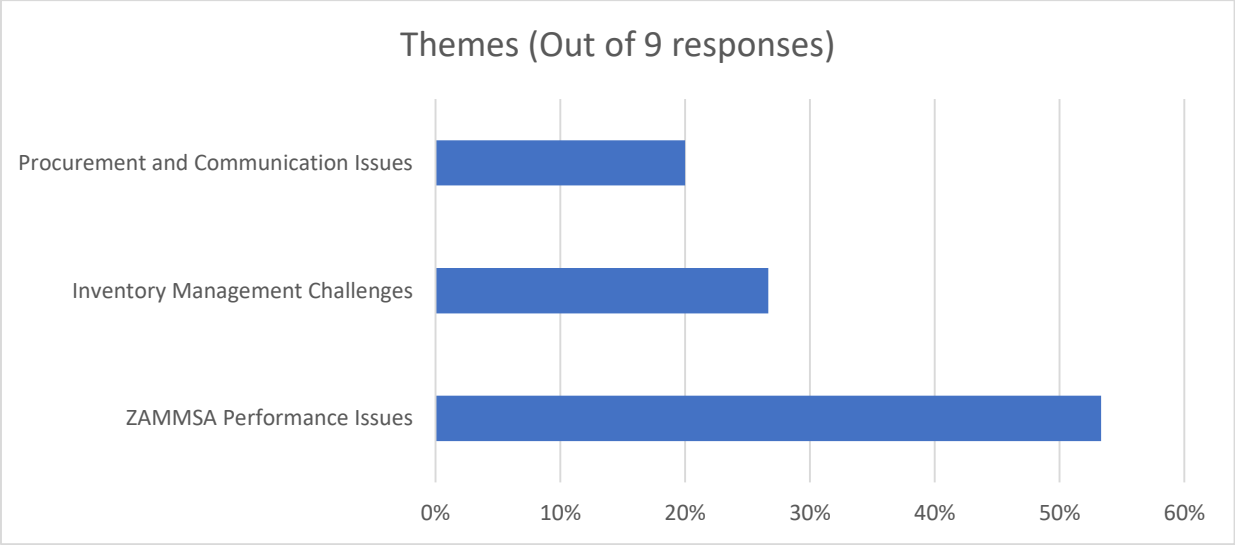
The thematic analysis presented in this section aims to provide a detailed understanding of the challenges and factors influencing inventory management and the supply chain performance of tracer drugs in public hospitals in Lusaka. The analysis was conducted using responses from key informants across various facilities, identifying recurring themes and patterns that illustrate the underlying issues. 10 respondents were approached, and 9 responses were captured, representing a total response rate of 90%. Key concepts, ideas, or issues arising from the responses to each question were coded and grouped into broader themes which represent the main narratives and patterns in the data. The findings from the thematic analysis are presented below:

Question 1. What are the main reasons why some medicines are missing or in too much supply in Lusaka's public hospitals?

The thematic analysis of interview responses regarding the reasons for medication shortages and overstocks in Lusaka's public hospitals identified three key themes. The most prominent theme was ZAMMSA inefficient supply chain management which leads to stock outs and overstocking of essential medcines such as delayed delivery and reduced fill rate. For example, one respondent reported "Delayed delivery from ZAMMSA, ZAMMSA doesn't fulfil our orders and their fill rate is less than to our expectations".

The second theme, Inventory Management Challenges, highlighted issues related to stock imbalances and the need for redistribution at the facility level with one respondent reporting “Yes we do experience overstock and shortages. Overstock- we redistribute them to other facilities and also give Provincial Health office for redistribution” (R1). Finally, Procurement and Communication Issues also emerged as a theme with mention of emergency procurement, poor collaboration and poor communication between different stakeholders, as evidenced by respondent 10 stating a “Barrier in communication between supply chain managers and suppliers”. These themes collectively illustrate how systemic issues at the supplier level, internal challenges with inventory management and fragmented communication contribute to drug availability problems in Lusaka.

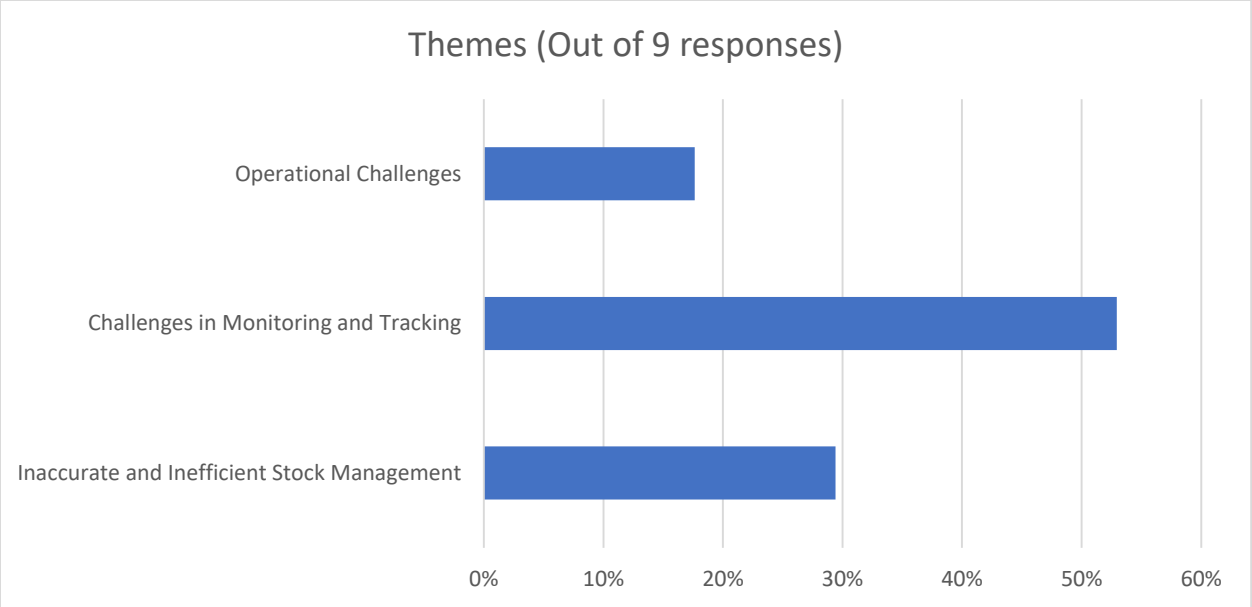
Figure 4.1 Reasons for Medication Shortages and Overstocks in Lusaka's Public Hospitals



Question 2. How does not using computers to track medicines make it difficult for hospitals in Lusaka to manage and provide the essential drugs?

The most prominent theme from the analysis responses on the impact of not using computers to track medicines was Challenges in Monitoring and Tracking. One respondent noted that “It makes it difficult to know which items are about to expire and therefore leading to losses. It is difficult to accurately monitor consumption patterns and hence poor ordering of drugs." The theme Inaccurate and Inefficient Stock Management, focused on the challenges related to relying on manual systems. For instance, one respondent stated, “When there is no computer system, we use manual cards that are not very accurate and hence you find a lot of mistakes and data not correct”. Finally, Operational Challenges further showed how the lack of computerised systems create an increased workload, difficulties in producing reports and more errors. As one respondent said, “It makes it hard to keep track of quantities on hand.

Figure 4.2The Impact of Not Using Computers to Track Medicines

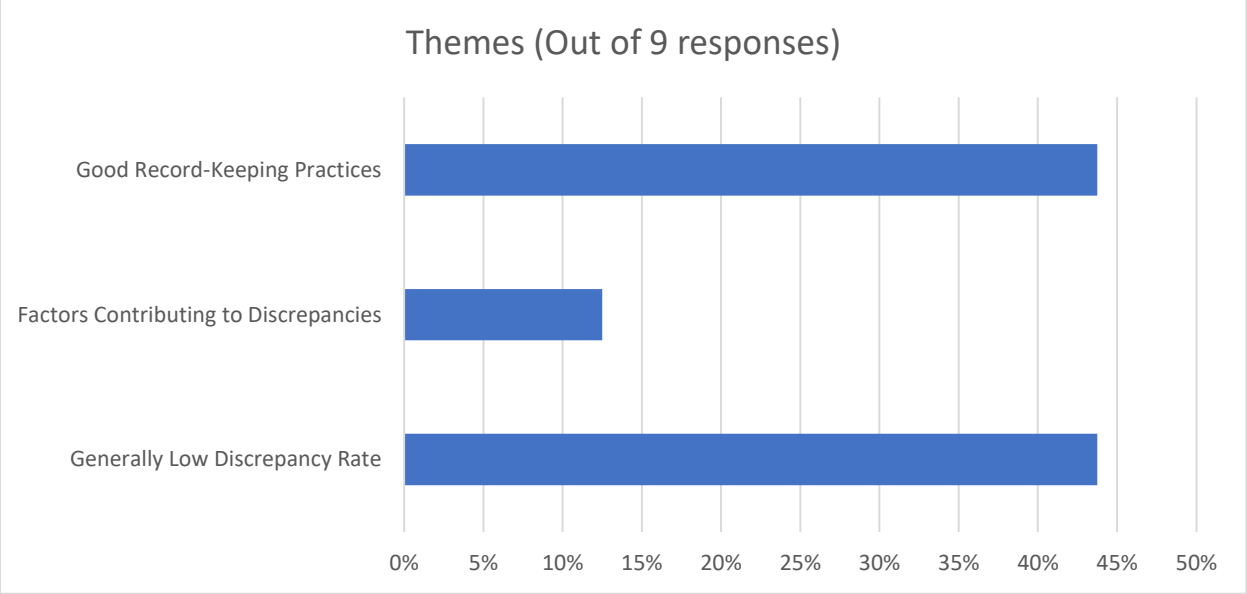


Question 3. How often do hospitals in Lusaka find that their records of medicine stock don’t match the actual amount they have?

Three themes were identified from the thematic analysis of responses regarding how often hospitals in Lusaka find discrepancies between their records and actual stock. Low

Discrepancy Rate was the most dominant theme indicating rare mismatches between stock records and physical stock. However, some respondents identified Factors Contributing to Discrepancies. For example, one respondent stated that mismatches “often” occurred due to “stock control cards not updated because of renovation undergoing at our main facility” and another respondent reported "Often drugs like ARVs they alot and move at the fast rate and hence difficult to track all the drugs which are dispensed". The final theme, Good Record-Keeping Practices, showed that facilities had a number of methods they used to maintain accurate records, with the most common method being the use of timely updates in stock cards and the use of multiple records such as ELMIS and Goods Received Notes, as evidenced by one respondent, who stated, “… mostly we ensure all the products ordered and received are entered on time on the stock control cards, the ELMIS system and the GRN”.

Figure 4.3 How Often Hospitals in Lusaka Find Discrepancies between Their Records and Actual Stock



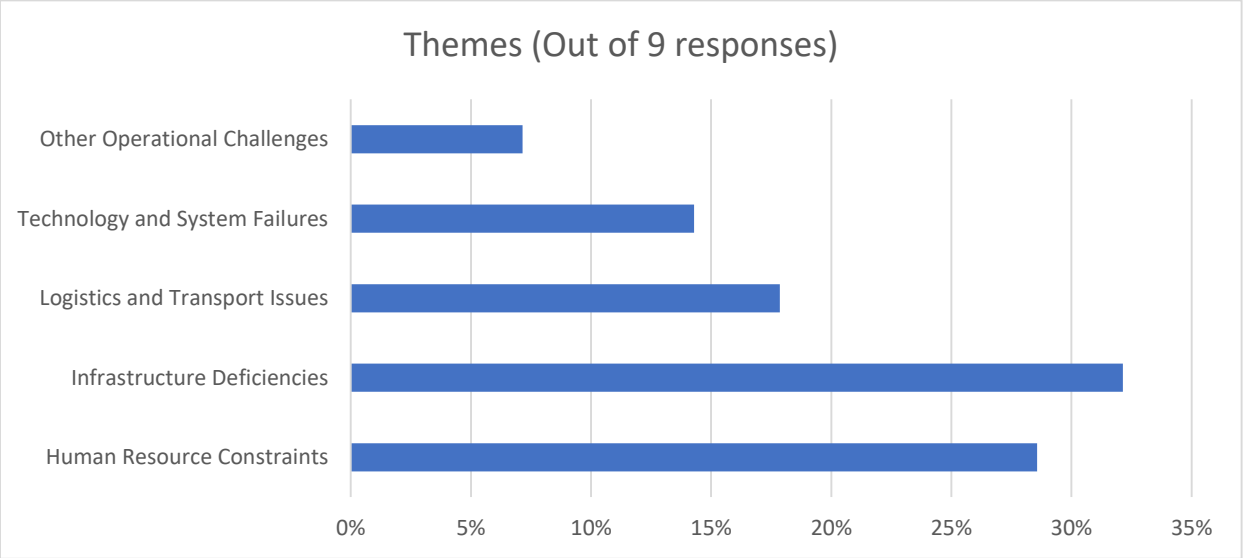
Question 4. What are the main challenges that your facility face in keeping accurate record of stock and inventory management?

Of the five key themes identified regarding the main challenges in keeping accurate stock records, the most prevalent was Infrastructure deficiencies which included poor storage

of essential drugs due to inadequate space and limited shelving. One respondent stated "... most stocks are kept in other offices and corridors and … result in high risk of pilferage". And on the point of visit a lot of intravenous fluids were seen kept in corridors and some in registry which risk product to be hazardous for consumption due to unfavourable temperature. Several other responses focused on Human Resource Constraints (e.g., one respondent claimed "Human resource constraint is the major challenge and we become overwhelmed with work").

Logistics and Transport Issues also emerged, with concerns about difficulties collecting medicines and redistributing between facilities. As stated by a respondent "Transport - difficult to get some orders from other facilities and from ZAMMSA especially if we have an emergency order and we want to do self-collection". Technology and System Failures were also identified as challenges. One respondent reported "Technology - intermittent internet connectivity and currently the facility edition is non-functional". Finally, there were also Other Operational Challenges such as inadequate training and the impact of non-functional air conditioning.

Figure 4.4 Main Challenges Facilities Face in Keeping Accurate Stock Records

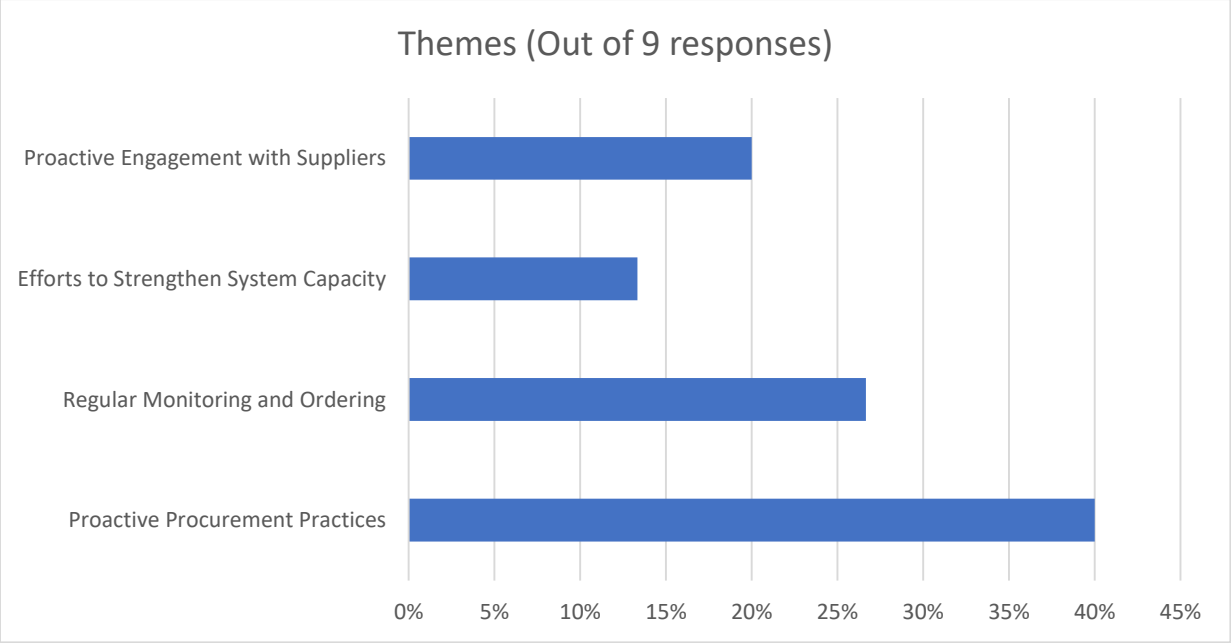


Question 5. What measures have you put in place to ensure timely delivery of essential medicines and medical supplies?

The thematic analysis of the responses regarding measures put in place to ensure timely delivery of essential medicines revealed four key themes. A prominent theme was Proactive Procurement Practices, with respondents citing self-procurement of specific drugs, use of alternative funding sources and use of emergency orders to ensure supply. As one respondent stated, “We procure especially tracer drugs not supplied from ZAMMSA and do emergency orders” and we also send weekly report of tracer drugs to the provincial health office for review of tracer drugs availability and action”. Several responses highlighted the theme regular monitoring and ordering with one respondent noting “Daily assessment of fast moving products ensuring they are available all the time”.

Proactive Engagement with Suppliers also emerged as a strategy with respondents reporting using memorandum of understanding (MOU), direct supplier engagement and use of alternative suppliers. One respondent reported: “We have a memorandum of understanding with our supplier and In case of any shortage we just engage the supplier on the list to deliver”. The final theme, Efforts to Strengthen System Capacity showed how facilities had requested for additional human resources and IT equipment as one respondent noted, "We have requested for more personnel through PHO to cover up human resource challenges, we have also requested the purchase of 2 laptops in order to manage our stock efficiently.”

Figure 4.5 Measures put in place to ensure timely delivery of essential medicines

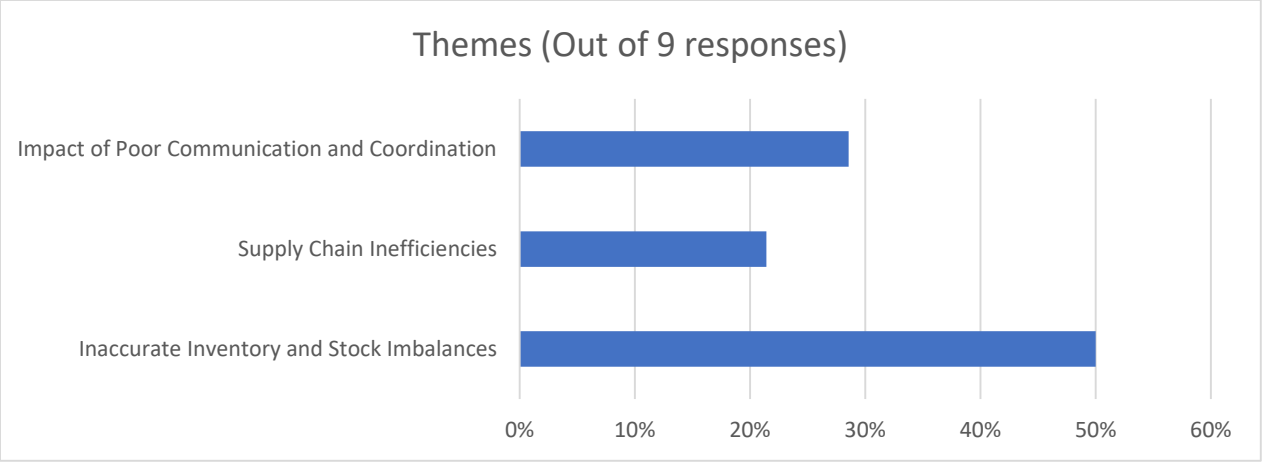


Question 6. How do problems with coordination and communication between departments like procurement, logistics, and inventory management affect the performance of the tracer drug supply chain?

Thematic analysis revealed three key themes regarding the impact of poor coordination and communication on the tracer drug supply chain. The primary theme, Inaccurate Inventory and Stock Imbalances was repeatedly cited, with respondents noting inaccurate inventory management, overstocking, understocking, and discrepancies (e.g., "This results in inaccurate management of inventory...overstock and shortages," Supply Chain Inefficiencies, the second theme, included reduced fill rates, increased lead times, and insufficient supply (e.g., one respondent noted "Results in reduced Fill rate...and increased lead time,").

Finally, the Impact of Poor Communication and Coordination highlighted how this lack of communication negatively affects drug supply, leading to unmet demand and patient impact as one respondent stated "Lack of coordination mostly result in insufficient supply...we just order not knowing which commodities ZAMMSA has…"

Figure 4.6 Impact of Poor Coordination and Communication on the Tracer Drug Supply Chain



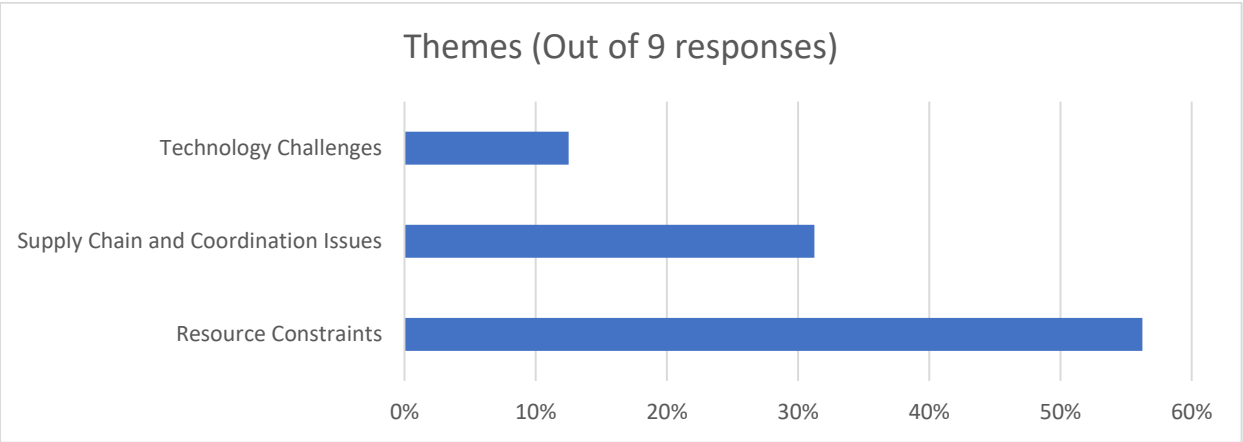
Question 7. What specific issues are encountered in inventory management for tracer drugs at your facility, and how do these issues affect drug availability?

The thematic analysis of responses regarding specific issues encountered in inventory management of tracer drugs and their impact on drug availability revealed three key themes. The dominant theme was Resource Constraints, with responses highlighting issues related to inadequate human resources, lack of storage space and poor infrastructure. As one respondent stated, “Inadequate human resources, infrastructure constraints...result in inadequate supply of essential medicines and medical supplies”, and another highlighting the direct consequences of this when they stated “Inadequate storage space, human resources constraints and this result either in overstocking or shortages”.

The theme, Supply Chain and Coordination Issues covered issues related to supplier performance (ZAMMSA) lack of coordination and transport, for example when a respondent noted "Lack of coordination between ZAMMSA and facility leads to inadequate supply of essential medicines and medical supplies”.

Finally the theme, Technology Challenges, related to issues with systems that support inventory management, for example as stated by one respondent "Technology challenges as the system is down most of the time". These themes highlight the wide range of challenges that facilities are facing when it comes to supply chain performance of tracer drugs.

Figure 4.7 Specific Issues Encountered In Inventory Management of Tracer Drugs and Their Impact on Drug Availability

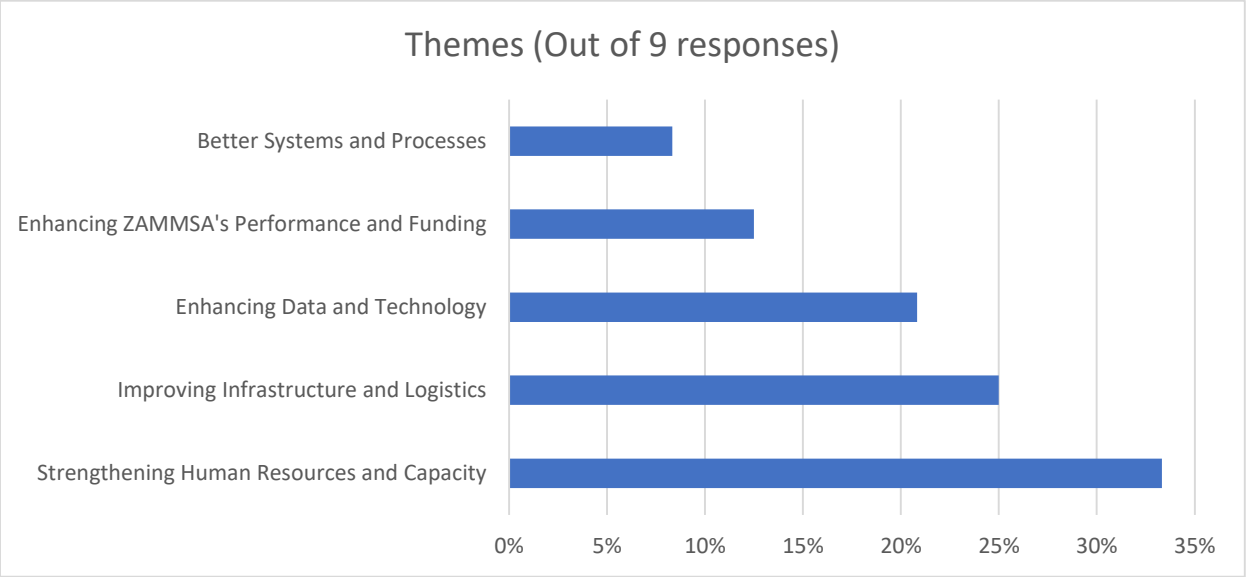


Question 8. What improvements or changes would you suggest to better handle inventory management and improve the supply chain performance for tracer drugs in your facility?

Five key themes were revealed after the thematic analysis of suggested improvements for tracer drug inventory management and supply chain performance. Strengthening Human Resources and Capacity was prominent, with frequent calls for more staff, trained supply chain managers, and increased personnel with respondents stating “MOH to employ more personnel,” and “MOH to employ more supply chain managers…”

Another theme, Improving Infrastructure and Logistics emphasized the need for more storage space and transport for collection and distribution. According to one respondent “Govt...to improvise storage conditions and transport.” Enhancing Data and Technology included suggestions for bar codes, improved internet connectivity, and ELMIS system improvements (e.g., "IT also needs to be improved by improvising bar codes," R13). The fourth theme, Enhancing ZAMMSA's Performance and Funding focused on improved service, higher fill rates, order fulfilment, and increased funding (e.g., one respondent said “ZAMMSA must fulfil all the orders and increase the fill rate,”). Lastly the theme Better Systems and Processes focused on the need to improve the systems used for receiving and issuing drugs as well as managing stock.

Figure 4.8 Suggested Improvements for Tracer Drug Inventory Management and Supply Chain Performance



4.4 Chapter Summary

This chapter analysed the factors influencing supply chain performance in Lusaka's public hospitals using both quantitative and qualitative methods. Key findings revealed that Level of Technology and Logistics Activities significantly impact supply chain performance, emphasizing the importance of technological integration and efficient logistics processes. While Staff Competency was not statistically significant, its role may be influenced by other factors. Preliminary checks confirmed the robustness of the data, and thematic insights highlighted operational challenges like delayed deliveries, low order fulfillment, and communication barriers. Together, these findings offer a comprehensive understanding of the challenges and opportunities in optimizing supply chain performance. The next chapter constitutes the discussion of the findings.

CHAPTER FIVE:

DISCUSSION

5.0 Introduction

This section discusses the findings from the regression analysis, focusing on the relationships between key variables and their implications for supply chain performance in Lusaka's public hospitals. The analysis aimed to identify the factors significantly influencing supply chain performance of Tracer drugs, with a specific focus on the roles of technology, logistics activities, and staff competency and challenges of inventory management on tracer drugs.

5.1 Effects of Level of Technology, Logistics Activities, and Staff Competency

This study aimed to assess the factors influencing the supply chain performance of tracer drugs in public health facilities in Lusaka, Zambia, using an ordinary least squares (OLS) regression analysis. The model examined the impact of control variables (Role and Years of Experience) and independent variables (Level of Technology, Logistics Activities, and Staff Competency) on supply chain performance. The results indicate that Logistics Activities is the only significant predictor of supply chain performance ($\beta = 0.594$, $p < 0.001$), while Level of Technology, Staff Competency, and the control variables do not significantly contribute to explaining variance in the dependent variable at the 0.05 significance threshold.

The overall OLS regression model was statistically significant ($F = 11.226$, $p < 0.001$), with an R-square value of 0.376, indicating that 37.6% of the variance in supply chain performance is explained by the predictors. The adjusted R-square of 0.343 confirms the model's explanatory power after accounting for the number of variables. The control variables, Role ($\beta = -0.163$, $p = 0.059$) and Years of Experience ($\beta = 0.026$, $p = 0.779$), both yielded p-values above the 0.05 threshold, suggesting that neither variable significantly impacts supply chain performance. This finding implies that individual-level characteristics, such as position within the organization or tenure, may not be critical

determinants of performance in this context. It is possible that roles within the supply chain are not sufficiently specialized to influence outcomes, or that experience does not translate into improved performance if systemic constraints, such as inefficient processes or inadequate infrastructure, limit individual contributions (Bowersox et al., 2019).

Among the independent variables, Logistics Activities emerged as the strongest and only significant predictor of supply chain performance ($\beta = 0.594$, $p < 0.001$). This finding underscores the critical role of effective logistics operations, encompassing transportation, warehousing, inventory management, and distribution, in ensuring the timely availability of tracer drugs. The result aligns with Lambert's (2014) assertion that logistics management is fundamental to achieving optimal supply chain outcomes, particularly in resource-constrained settings like Zambia's public health sector. Efficient logistics practices, such as streamlined distribution protocols and optimized inventory systems, appear to be indispensable for improving supply chain performance. This suggests that interventions targeting logistics infrastructure, such as improving transportation networks or enhancing inventory tracking, could yield substantial benefits in reducing stockouts and ensuring access to essential medications.

In contrast, Level of Technology ($\beta = 0.008$, $p = 0.946$) did not significantly influence supply chain performance, a finding that deviates from prior literature emphasizing the role of technology in enhancing supply chain efficiency (Chopra & Meindl, 2016). This lack of significance may reflect limited adoption or inconsistent implementation of technologies, such as electronic inventory systems or real-time tracking, across the studied facilities. Alternatively, the technologies in use may not be well-suited to the specific challenges of managing tracer drugs, or their impact may be overshadowed by more pressing logistical constraints. The relatively higher VIF for Level of Technology (2.021) also suggests potential overlap with other predictors, such as Logistics Activities, which may incorporate technological elements, potentially diluting its distinct effect in this model.

Similarly, Staff Competency ($\beta = 0.002$, $p = 0.983$) showed no significant relationship with supply chain performance. This unexpected outcome suggests that the current level of

staff skills, as measured in this study, does not meaningfully contribute to supply chain outcomes. Several factors may explain this finding. First, systemic issues, such as inadequate infrastructure, inefficient processes, or resource constraints, may limit the ability of competent staff to impact performance effectively. Second, the measure of staff competency may not have captured the specific skills most relevant to supply chain management, such as expertise in logistics or technology integration (Taylor & Pearson, 2017). Finally, the dominant effect of logistics activities may mask the contributions of staff competency, particularly if logistical challenges are the primary bottleneck in the supply chain.

The moderate R-square value of 0.376 indicates that while Logistics Activities is a key driver, other unexamined factors, such as funding constraints, policy frameworks, or external supply chain disruptions likely influence supply chain performance. This suggests the need for a more comprehensive model in future research to capture the full spectrum of determinants. The findings advocate for targeted interventions to strengthen logistics operations, such as developing standardized protocols for transportation and storage, while also highlighting the need to investigate why technology and staff competency did not yield significant effects. Qualitative studies exploring the barriers to effective technology adoption and the relevance of staff training programs could provide deeper insights into these non-significant findings, informing more holistic strategies to enhance supply chain performance in Zambia’s public health facilities.

5.2 The Effect of Inventory management on Supply Chain Performance

Qualitative data were collected through interviews to gain in-depth insights into various aspects of the supply chain, encompassing inventory management, ordering processes, communication channels, and the impact of these factors on drug availability. A thematic analysis approach was used to explore the respondents' experiences and perspectives, identify recurring themes, and understand the nuances within the data.

5.2.1 Reasons for Medicine Shortages and Overstocking

The analysis of interview responses identified three main themes that contribute to medication shortages and overstocks in Lusaka's public hospitals. Firstly, ZAMMSA plays a key role in ensuring the availability of medicines and medical supplies in Zambia,

however the research reviewed so many operational issues affecting supply chain performance of tracer drugs in public health facilities of Lusaka, as seen in the majority of the responses relating to the institution. The recurrent issues with delivery timeliness and order accuracy suggest potential problems with logistics, forecasting, or resource capacity within ZAMMSA. The data further reveals challenges at the facility level, as they must grapple with stock imbalances and implement reactive redistribution strategies. This demonstrates a lack of efficient internal inventory control and highlights how the facilities are managing the impact of ZAMMSA's performance on the hospitals. The presence of emergency procurement indicates a lack of reliable, consistent supply systems and adds a layer of complexity to the supply chain. Furthermore, issues with poor collaboration and communication with key stakeholders reveals a fragmented approach to the drug supply chain. This suggests the necessity for better communication strategies across the entire drug supply chain. These findings align with existing literature on health supply chains that emphasize the importance of effective supplier performance, accurate inventory management and open lines of communication in ensuring reliable drug availability (e.g., Leung, et al., 2016; Kalungia et al., 2017 and Modisakeng, 2019). The key area of focus for improvement should be on improving the capacity and reliability of the national supplier as well as addressing internal inventory challenges and improve communication across the drug supply chain to ensure an adequate and reliable supply of drugs.

5.2.2 Impact of Not Using Computers in Inventory Management

A range of issues on the question of the lack of computerised systems for tracking medications in public hospitals in Lusaka were revealed through thematic analysis. The main problem mentioned in most of the responses appeared to be difficulties in monitoring and tracking different important parameters of the drug supply. The lack of digital record-keeping severely limits the hospitals' ability to manage their stock effectively and this may lead to incorrect unit of measurement, incorrect data entry, incorrect location and human error during stocktake process. The reliance on manual processes leads to problems of inaccuracy, errors in records and a lack of visibility into stock levels, all of which greatly affects the ability to make well informed decisions. The difficulties in tracking expirations and consumption patterns are major contributors to drug losses and to poor ordering practices, in that facilities have to resort to guesswork rather than using data.

Furthermore, the operational challenges stemming from manual systems create further burdens on staff by increasing the workload, and contributing to errors. This finding is consistent with existing literature that underscores the critical role of information technology in supply chain management (Modisakeng et al., 2019; Berger et al., 2007; Willems, 1975; and Holm, Rudis, & Wilson, 2015). The findings of this study strongly indicate that the absence of computerization undermines the efficiency of the entire supply chain. The reliance on manual systems appears to be costly hampering decision making, and contributing to increased workloads and errors, leading to an inefficient supply chain. The investment in and use of appropriate technology in public hospitals is essential in order to improve overall supply chain efficiency and prevent drug wastage and shortages (Agarwal, 2020).

5.2.3 Discrepancies between Stock Records and Actual Inventory

An inventory discrepancy happens when the stock on hand inventory is different from the quantity recorded in an inventory system. The analysis of responses regarding stock discrepancies in Lusaka's public hospitals revealed a generally positive picture, with the majority of respondents reporting rare instances of discrepancies between records and actual stock. This suggests that most facilities are implementing effective standard operating procedures in their day to day operations. The strong emphasis on timely updates and the use of multiple record-keeping systems (manual stock control cards, ELMIS, GRNs) appears to be contributing to this success, suggesting good operational practices in the hospitals. However, the identified factors that contribute to discrepancies highlight the importance of maintaining regular routines in order to achieve integral supply chain efficiency. These issues include facility renovations which can impact routines and the high volume dispensation of particular medications that may require different methods of tracking. These exceptions indicate vulnerabilities in the system that need to be addressed, for example the specific requirements for managing high volume and fast moving drugs, may require additional procedures. While the findings are largely positive with many facilities reporting good stock practices, the identified areas that contribute to stock discrepancies warrant further investigation and solutions so that all facilities are performing to a high standard.

5.2.4 Challenges in Maintaining Accurate Inventory and Records

The analysis of challenges faced by facilities in maintaining accurate stock records identified five key areas. Infrastructure deficiencies and human resource constraints emerged as the most prominent challenges highlighting the critical need for improvements in these areas in order to improve the supply chain. These are consistent with the findings from previous questions, indicating an ongoing challenge for these facilities. The lack of adequate storage space and appropriate facilities contributes to a high risk of pilferage, wastage, and difficult stock management. Staff shortages and the subsequent burden of overwork make it difficult to maintain accurate records and can lead to mistakes in ordering, as noted in the responses. The logistical issues related to transportation suggest that the facilities are unable to fully access and redistribute needed medications in a timely manner, further impacting the efficiency of the drug supply chain performance. The presence of technology and system failures further compound the issues, given that the ELMIS system which is supposed to aid with stock management is often non-functional. These findings align with the analysis by Boche, Mulugeta, & Gudeta (2020) in a study on inventory management practices at the Ethiopian Pharmaceutical Supply Agency which revealed that Inventory management challenges include space deficit, outdated warehouse designs, shortage of warehouse equipment, and lack of precise data. The challenges faced by these facilities highlights the need for investment in both the physical infrastructure, technology and human resources of these hospitals. There is also an urgent need for an assessment to understand the causes of the issues with the ELMIS system and developing better system to monitor and Manage supply chain inefficiency of tracer drugs and communication strategies must be enhanced and a better system to support timely data capture.

5.2.5 Measures to Ensure Timely Delivery of Essential Medicines and Supplies

Several measures have been implemented to ensure timely delivery and access to medications despite the challenges. The use of diverse and proactive procurement practices is a clear indication that the hospitals are not solely reliant on ZAMMSA as their single source of drugs, suggesting they have created multiple mechanisms to ensure access to essential drugs. Furthermore, the use of regular monitoring and ordering shows

that they are committed to having some form of control over their inventory and also that they are using data to support decision making and planning. The responses also highlight the need to have strong relationships with suppliers which are evident in the theme Proactive Engagement with Suppliers. While the hospitals have developed these strategies, they are also aware that structural changes are required, hence the efforts being made to try and improve system capacity. The fact that the facilities have to source funding to procure medications from different sources highlights how the current system is not functioning optimally and that the hospitals have to compensate for the inadequacies. Robust inventory control and regular monitoring are vital for maintaining the right quantities of drugs at the right time. E-procurement systems and predictive analytics can optimize inventory management and demand forecasting, reducing stock-outs and overstock situations (Adebayo, Paul, & Eyo-Udo, 2024; Usuemerai, 2024 and Saedi, Kundakcioglu, & Henry, 2016). While these strategies are useful for improving the supply of drugs in the short term, there is still a need to address the underlying issues such as strengthening the central supply and improving data capture, allowing facilities to be more efficient in their operations.

5.2.6 Effects of Coordination and Communication Challenges

Regarding the question of poor communication and coordination thematic analysis has shown that they directly contribute to significant challenges in the tracer drug supply chain in public hospitals in Lusaka. The prominence of inaccurate inventory and stock imbalances suggests a lack of synchronization across departments involved in the drug supply. The responses indicate that poor information sharing, inadequate record keeping, and a lack of communication contribute to the inability to maintain accurate stock records. This directly leads to both overstock and shortages, suggesting that the system is not able to maintain a reliable and consistent drug supply. The identified supply chain inefficiencies such as reduced fill rates and increased lead times also show that the poor coordination affects both the availability of drugs and how quickly they reach the health facilities.

Furthermore, the impact of poor communication and coordination highlights the human impact of an inefficient supply chain, with clear effects on patient care and unmet demand.

The responses also suggest that poor communication means that hospitals are making decisions without access to key information such as the drug status at ZAMMSA and this effects on performance and decision making. Studies such as Costantino et al (2014), Inderfurth, Sadrieh, & Voigt, (2013) and Hosseini-Motlagh, Jazinaninejad, & Nami, (2020) indicate that that a cohesive and well-coordinated approach across procurement, logistics and inventory management is vital to the smooth functioning of any supply chain.

5.2.7 Challenges in Managing Tracer Drug Inventories

The analysis of specific inventory management issues for tracer drugs highlights how a combination of factors, notably human resource constraints, ZAMMSA not fulfilling their orders, supply chain issues, and technology challenges, and barrier in communication can significantly impact the inventory management of tracer drugs in public hospitals in Lusaka. The prominence of resource constraints, particularly staffing shortages and inadequate storage, suggests inefficiency of stock management. The supply chain and coordination issues including the poor performance by ZAMMSA and the lack of coordination with facilities leads to an unreliable supply of medicines and medical supplies and consequently unavailability of tracer drugs, as stated in multiple responses. These issues are impacting the timely access to tracer drugs. In addition, technology also contribute to the poor inventory management of tracer drugs, with the system outages contributing to an inability to effectively capture and monitor data. This is a reoccurring theme that also emerged in previous questions. These findings are consistent with existing literature on health systems management, which highlights that poor resourcing (Gutesa, Jebena, & Kebede, 2024), weak supply chains (Padmavathi, & Rajagopalan, 2022; Zwaida, Pham, & Beauregard, 2021; Zwaida, Elaroudi, & Beauregard, 2021; and Kakade, 2024) and inadequate technology (Padmavathi, & Rajagopalan, 2022 and Panda, & Satapathy, 2021) are the main drivers of poor outcomes in public health. The findings of this study similarly point to significant systemic weaknesses that impede effective supply chain management. There is a need for a comprehensive approach to address these issues that spans from the central supplier, down to the level of each health facility.

5.2.8 Suggestions to Improve Inventory Management

The emphasis on strengthening human resources and capacity indicates that staffing levels and skill gaps are a key area of concern for the facilities. Similarly, the focus on improving infrastructure and logistics suggests that the physical environment and transport limitations significantly affect the effectiveness of the supply chain, and is consistent with what was noted in earlier questions. The recognition that data and technology is key shows a willingness to improve record keeping methods by using bar codes and to also use technology to improve reporting. However, the dependence of ELMIS remains a key challenge and this needs to be resolved. The responses also clearly indicate that there is a need to enhance ZAMMSA's performance and funding, indicating a need for the central procurement body to be more effective and responsive. Finally, the call for better systems and processes highlights the need to review and redesign the methods used for stock management and dispensing of drugs. These findings are consistent with the literature on supply chain management in resource-constrained settings that highlight the need for a multifaceted approach that addresses all the factors that affect a supply chain. The findings here emphasize that a successful system requires a well-trained workforce (Seidman, & Atun, 2017), adequate facilities (Tao, Liang, & Bushuev, 2023; Seidman, & Atun, 2017 and Bushuev, 2018) a dependable supply chain (Seidman, & Atun, 2017), robust technology (Liu et al., 2021; Musamih et al., 2023 and Park & Li, 2021), and effective systems (Cousins, 2019 and Tao, Liang, & Bushuev, 2023). The facilities are clearly outlining what is needed to move towards an optimal drug supply system.

Chapter Summary

This chapter presented a comprehensive analysis of factors influencing tracer drug supply chain performance in Lusaka's public health facilities. Quantitative analysis showed that while control variables (role and experience) had minimal impact, logistics activities significantly contributed to performance. Interestingly, the level of technology an staff competency did not appear to have a significant influence. The chapter then explored qualitative data, revealing significant challenges related to inventory management. These challenges stemmed from issues such as supply chain inefficiencies at ZAMMSA, internal

facility constraints, and technology limitations, including the lack of computer systems for drug tracking and communication breakdowns. The next chapter of this study will discuss conclusions and recommendations based on the analysis and findings.

CHAPTER SIX:

CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter consolidates the key findings from our investigation into the factors affecting the supply chain performance of tracer drugs within public health facilities in Lusaka, Zambia. We embarked on this research to understand how elements like technology, logistics, and staff competence influence the supply chain, alongside an examination of critical inventory management challenges. This chapter will synthesize our quantitative and qualitative results, explore their broader implications, offer specific recommendations for improvement, and address the limitations of the study while highlighting avenues for future research.

6.1 Summary of Research Findings

This study employed a mixed-methods approach, combining quantitative regression analysis with qualitative interviews to provide a comprehensive understanding of the tracer drug supply chain. The quantitative findings, summarized in Table 6.1, revealed the significant roles played by logistics activities, while also challenging initial assumptions about technology and staff competency.

Table 6.1 Summary of Research Findings.

#	Hypothesis	Statistic	Test	Result
H 1	There is a significant positive relationship between the level of technology and supply chain performance	Beta = 0.419**	Regression	Supported
H 2	There is a significant positive relationship between logistics activity and supply chain performance	Beta = 0.594**	Regression	Supported
H 3	There is a significant positive relationship between staff competency and supply chain performance	Beta = 0.002	Regression	Not supported

**significant at $p<0.01$

The regression analysis of factors influencing supply chain performance of tracer drugs in public health facilities in Lusaka, Zambia, revealed that logistics activities are the most significant predictor of performance. The analysis demonstrated that efficient logistics management, encompassing transportation, warehousing, and distribution, plays a

crucial role in ensuring the timely availability of tracer drugs. This finding underscores the importance of investing in and optimizing logistics operations to enhance supply chain efficiency.

In contrast, the level of technology and staff competency did not show significant impacts on supply chain performance. Despite initial expectations that technology would positively influence performance, the results indicated that its current implementation does not significantly contribute to improved outcomes. This suggests that there may be opportunities to better integrate and leverage technology within the supply chain processes.

Similarly, staff competency did not emerge as a significant factor, which was unexpected. This result may point to systemic issues or limitations in how competency is measured or utilized within the supply chain. Further research is needed to understand how staff skills and knowledge can be more effectively harnessed to drive performance improvements.

In addition to these quantitative findings, the qualitative data, obtained from interviews, illuminated numerous challenges impacting the pharmaceutical supply chain in Lusaka's public hospitals. Key issues contributing to medication shortages and overstocking include ZAMMSA's operational inefficiencies, internal inventory control weaknesses at the facility level, and poor communication among stakeholders. The lack of computerized inventory systems hinders effective monitoring, leading to inaccuracies, difficulty tracking expirations, and increased staff workload. While most facilities report accurate stock records, vulnerabilities exist, particularly with high-volume medications and during routine disruptions.

Infrastructure and resource deficiencies, compounded by unreliable technology, further contribute to difficulties in maintaining accurate stock records. Despite these challenges, hospitals have implemented coping mechanisms like diverse procurement practices and regular monitoring, though they acknowledge the need for system-wide improvements. Poor communication and coordination exacerbate these issues, resulting in inaccurate inventories, supply chain inefficiencies, and ultimately impacting patient care. Finally, resource constraints, supply chain issues, and technological limitations significantly impact the management of tracer drug inventories. Respondents identified the need for

stronger human resources, improved infrastructure, reliable technology, enhanced ZAMMSA performance, and robust stock management systems to address the systemic weaknesses and improve the overall supply chain.

6.2 Contribution to Knowledge

This research contributes significantly to the understanding of public health supply chain dynamics in resource-constrained settings. First, it offers crucial empirical evidence of how technology and, most critically, logistics activities influence supply chain performance within Zambian public health facilities, thus adding to the limited literature in this context. The study further highlights the fundamental role of logistics and reinforces the need for robust logistics management practices. In addition, the finding that staff competency did not demonstrate a significant effect on performance challenges commonly held beliefs and encourages a critical re-evaluation of capacity-building efforts. Finally, the qualitative analysis provides rich insight into the realities of inventory management challenges within the local public health setting, offering a detailed look at the issues encountered by staff.

6.3 Implications and Recommendations

The findings of this study have substantial implications for policymakers, health administrators, and supply chain professionals. The overwhelming significance of logistics underscores the need to prioritize investments in logistical infrastructure and process improvements. This includes developing robust protocols for drug transportation and storage, and ensuring efficient and well-coordinated distribution networks. The potential for technology is evident, but it must be accompanied by logistical improvements to maximize its impact. Given the issues we uncovered, we suggest the following specific actions:

a) The government should prioritize logistics management, developing clear protocols for drug transport and storage and investing in adequate infrastructure.
b) A greater emphasis is needed on technology to improve efficiency of processes. This should also go hand in hand with reliable internet connectivity and technical support.
c) Enhancing internal inventory management within facilities is crucial. This necessitates a shift towards digital systems, specifically the implementation of

computerized inventory management platforms across all public hospitals. These systems must enable real-time stock monitoring, track expiration dates, and provide data-driven insights for decision-making. This technological upgrade must be accompanied by training programs for hospital staff to ensure effective utilization, as well as investment in storage infrastructure.

d) Communication and coordination among stakeholders must be improved by establishing clear protocols, encouraging regular meetings, and promoting transparency in information sharing. A well-functioning supply chain depends on cohesion between all entities and clear lines of communication are key to avoiding the poor outcomes of fragmented systems.
e) Addressing human resource limitations. This entails increasing staffing levels, particularly recruiting personnel skilled in inventory management and supply chain operations. Alongside this, investment in training and professional development is critical to ensure that staff are equipped with the necessary skills.
f) The management of tracer drugs must be improved through tailored protocols and an improved approach to dealing with supply chain disruptions. This should be coupled with regular performance monitoring, including the collection and use of real-time data to enable data-driven decision making.
g) Continuous monitoring and evaluation mechanisms must be implemented. This involves conducting regular audits of inventory practices, developing a feedback mechanism between stakeholders, and ensuring regular reviews of established protocols. It is also recommended that a specific study is conducted to understand the current ongoing issues with the ELMIS system and develop a solution for these.

6.4 Research Limitations and Future Directions

Several limitations should be acknowledged when interpreting the results of this study. Our research was geographically limited to Lusaka, which may not be fully representative of other regions in Zambia. Additionally, the method for measuring staff competence may not have captured all relevant aspects and may have been constrained by systemic

issues. The use of a cross-sectional research design presents challenges in establishing direct causality of issues.

Future research should extend geographically, refine staff competency measurement tools, and employ longitudinal designs. It is also necessary to explore the mediating effects of different variables and also to better understand the effects of organizational culture on supply chain effectiveness. Such research would help further our understanding of how to improve public health supply chains in resource-constrained environments.

6.5 Final conclusion

To conclude, this research has offered vital insights into the factors affecting tracer drug supply chain performance within public health facilities in Lusaka. The results underscore the importance of logistics while also highlighting the need to address systemic issues, communication gaps, and inventory management challenges. By implementing the recommendations provided and pursuing further research, stakeholders can work towards a more robust and efficient supply chain, ultimately improving access to essential medicines and patient health outcomes in Zambia.

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Appendices

Research Questionnaire

UNIVERSITY OF LUSAKA

RESEARCH QUESTIONNAIRE

Dear Participants,

The researcher is grateful for your involvement in this critical research study. Your important participation will help the researcher understand assessing the factors that affect supply chain performance of tracer drugs in public health facilities in Lusaka, Zambia. By completing this questionnaire, you will assist the researcher in gathering critical data and insights that will help her make evidence-based findings for this study, and make policy recommendations that can enhance the public procurement process.

Your responses are completely private. The researcher will combine the data so that no individual responses are identifiable. Your privacy is extremely important to the researcher. Please do not hesitate to contact the researcher if you have any questions or concerns about this questionnaire on:

Section A: Demographic Profile

1. What is your role in the public health facility?

a) Supply Chain Manager
b) Pharmacist
c) Logistics Coordinator
d) Healthcare Administrator

2. How many years of experience do you have working in supply chain management for healthcare or pharmaceutical settings?

a) Less than 1 year
b) 1 to 3 years
c) 4 to 7 years
d) More than 7 years

3. Which type of public health facility do you work in**?**

a) Primary Health Care Center
b) District Hospital
c) Regional Hospital
d) Central or Tertiary Hospital

4. What is the highest level of education you have completed related to supply chain management or healthcare**?**

a) Certificate or Diploma
b) Bachelor's Degree
c) Master's Degree
d) Doctorate or Higher

Section B: Dependent Variable

Select the response that best represents your opinion or experience. The numbers on the table below under the responses presents the following: 1= Agree, 2= Strongly Agree, 3= Neutral, 4=Disagree and 5 = Strongly Disagree.

Supply Chain Performance

#	STATEMENTS	RESPONSES				
		1	2	3	4	5
1	The availability of essential medicines is generally consistent in our facility					
2	Delays in the delivery of essential medicines are a common issue in our facility.					
3	Current supply chain processes are sufficient to meet the demand for essential medicines					
4	Overall, the performance of the supply chain in delivering medicines to our facility is satisfactory					

Section C: Independent Variable

Please use the following table to indicate your level of agreement or disagreement with the statements provided. Select the response that best represents your opinion or

experience. The numbers on the table below under the responses presents the following: 1= Agree, 2= Strongly Agree, 3= Neutral, 4=Disagree and 5 = Strongly Disagree

Level of technology

#	STATEMENTS	RESPONSES				
		1	2	3	4	5
1	Using technology makes our business processes and supply chain management more flexible and innovative.					
2	The technology we use in managing our supply chain helps us accurately predict and restock important medicines.					
3	There is a big difference between the technology we have and the technology we need to make our supply chain work better.					
4	Staff training on the use of technology in supply chain management is regularly updated to keep up with technological advancements					

Logistics Activities

#	STATEMENTS	RESPONSES				
		1	2	3	4	5
1	Logistics activities, such as transportation and distribution, are efficiently managed, ensuring timely delivery of tracer drugs to our facility					
2	There are frequent delays in the logistics processes that affect the availability of tracer drugs in our facility					
3	The logistics infrastructure supporting the delivery of tracer drugs is well-maintained and reliable					
4	Coordination between different logistics partners is effective, minimizing disruptions in the supply chain					

Staff Competency

#	STATEMENTS	RESPONSES				
		1	2	3	4	5
1	The staff involved in managing the supply chain for tracer drugs are adequately trained and possess the necessary skills					
2	Staff training helps improve the management and delivery of medicines.					
3	There is enough training for staff to handle the challenges in supply chain management					
4	The staff who manage the supply of important medicines are well-trained and have the right skills					

Thank you for your participation

Interview Guide

UNIVERSITY OF LUSAKA

INTERVIEW GUIDE

Dear Participants,

The researcher is grateful for your involvement in this critical research study. Your important participation will help the researcher understand the Factors Affecting Supply Chain Performance of Tracer Drugs in Public Health Facilities in Lusaka, Zambia. By completing this questionnaire, you will assist the researcher in gathering critical data and insights that will help her make evidence-based findings for this study, and make policy recommendations that can enhance the public procurement process.

Your responses are completely private. The researcher will combine the data so that no individual responses are identifiable. Your privacy is extremely important to the researcher. Please do not hesitate to contact the researcher if you have any questions or concerns about this questionnaire on:

Section A: Demographic Profile

1. What is your gender

   …….

2. Age:

   …….

3. What is your highest education qualification?

   ……

4. Position

   ……

5. Experience in dealing with tracer drugs

   ……

CHECK LIST FOR RESEARCH VISIT

IDENTIFYING INFORMATION		
Facility name		
Facility code		
Date of visit		
Date of last visit		
Facility contact details		
Email		

Staff contact details (HOD) pharmacy

name	**Title**	**mobile**		**email**	

Purpose of visit	• **To assess that planned activities are being followed out correctly and according to the plan** • **To assess if all records are carried out correctly and according to plan** • **To establish if logistic activity guidelines and procedures are being followed** • **To assess if persons are doing their job and if they have been trained in logistics and supply chain** • **To improve the performance of logistics and supply chain and mitigate any challenges faced in management of tracer drugs**				

Quality of record keeping				
		yes	**No**	**comments**
1	Stock keeping records			**Bin cards if update and in place**
2	Review facility report(R&R) (ZAMMSA)			
3	Requisition form for the facility			
Monitoring stock status of tracer drugs				
4	Check the stock status of tracer drugs			**% availability**
5	Conduct physical inventory of tracer drugs			

6	If stock status is low what action has been taken			
8	Check stock out rate			
9	Actions taken for stock out rate			
10	If expired or soon to expire, what action has been put in place			
STORAGE AREA				
11	Verify that storage guidelines are being followed			
12	Physical inspection of commodities			
Reference material/ Pharmacy operation				
10	Does the facility have a copy of Standard operating procedure, (if no,			
11	Manages pharmacy workflow efficiently			
ADDITIONAL COMMENTS ON THE SUPPLY CAHIN PERFORMANCE				

Research Objective: To assess challenges in inventory management on supply chain performance in Lusaka, Zambia.

Thank you for participating in this interview guide, we aim to understand the challenges faced in the inventory management of tracer drugs. Your insight will help improve supply chain efficiency.

1. What are the main reasons why some medicines are missing or in too much supply in Lusaka's public hospitals?

……
……
……
…….

2. How does not using computers to track medicines make it difficult for hospitals in Lusaka to manage and provide the essential drugs?"?

……
……
……
…….

3. How often do hospitals in Lusaka find that their records of medicine stock don't match the actual amount they have?

……
……
……
…….

……

5.What challenges do health facilities face in maintaining accurate inventory records for tracer drugs?

……
……

……
……

6. What challenges does your facility face in ensuring timely delivery of tracer drugs, and how do these challenges impact the overall supply chain performance?

……
……
……
……

7. How do problems with coordination and communication between departments like procurement, logistics, and inventory management affect the performance of the tracer drug supply chain?

……
……
……
……

8. What specific issues are encountered in inventory management for tracer drugs at your facility, and how do these issues affect drug availability?

……
……
……
……

9. What improvements or changes would you suggest to better handle inventory management and improve the supply chain performance for tracer drugs in your facility?

……
……

……
……

Thank you for your participation

Data Analysis Output

Sample Characteristics

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	45	45.0	45.5	45.5
	Female	54	54.0	54.5	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

What is your role in the public health facility?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Supply Chain Manager	4	4.0	4.0	4.0
	Pharmacist	68	68.0	68.0	72.0
	Logistics Coordinator	3	3.0	3.0	75.0
	Healthcare Administrator	4	4.0	4.0	79.0
	Pharmacy Technologist	18	18.0	18.0	97.0
	Other	3	3.0	3.0	100.0
	Total	100	100.0	100.0	

How many years of experience do you have working in healthtcare or pharmaceutical settings?

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Less than 1 year	34	34.0	34.0	34.0
	1 to 3 years	18	18.0	18.0	52.0
	4 to 7 years	21	21.0	21.0	73.0
	More than 7 years	27	27.0	27.0	100.0
	Total	100	100.0	100.0	

Which type of public health facility do you work in?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Distric Hospital	14	14.0	14.0	14.0
	Central or Tertiary Hospital	66	66.0	66.0	80.0
	Regional Hospital	10	10.0	10.0	90.0
	Primary Healthcare Centre	6	6.0	6.0	96.0
	Other	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

What is the highest level of education you have completed related healthcare?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Certificate or Diploma	20	20.0	20.0	20.0
	Bachelor's Degree	69	69.0	69.0	89.0
	Master's Degree	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

Reliability Analysis

Scale: Supply Chain Perfomance

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.651	.654	3

Scale: Level of Technology

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.691	.693	3

Scale: Logistics Activities

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.865	.865	3

Scale: Staff Competency

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.627	.620	3

Missing Data, Outliers and Normality

Descriptives

			Statistic	Std. Error
Supply Chain Performance	Mean		2.8833	.10818
	95% Confidence Interval for Mean	Lower Bound	2.6687	
		Upper Bound	3.0980	
	5% Trimmed Mean		2.8815	
	Median		3.0000	
	Variance		1.170	
	Std. Deviation		1.08181	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		1.67	
	Skewness		-.224	.241
	Kurtosis		-.750	.478
Level of Technology	Mean		2.5387	.10239
	95% Confidence Interval for Mean	Lower Bound	2.3355	
		Upper Bound	2.7419	
	5% Trimmed Mean		2.4948	
	Median		2.3333	
	Variance		1.038	
	Std. Deviation		1.01877	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		1.67	
	Skewness		.524	.243
	Kurtosis		-.378	.481

Logistics Activities	Mean		2.9683	.12577
	95% Confidence Interval for Mean	Lower Bound	2.7188	
		Upper Bound	3.2179	
	5% Trimmed Mean		2.9648	
	Median		3.0000	
	Variance		1.582	
	Std. Deviation		1.25768	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		2.00	
	Skewness		-.119	.241
	Kurtosis		-1.201	.478
Staff Competency	Mean		1.9767	.07960
	95% Confidence Interval for Mean	Lower Bound	1.8187	
		Upper Bound	2.1346	
	5% Trimmed Mean		1.9296	
	Median		2.0000	
	Variance		.634	
	Std. Deviation		.79597	
	Minimum		1.00	
	Maximum		4.33	
	Range		3.33	
	Interquartile Range		1.33	
	Skewness		.698	.241
	Kurtosis		.045	.478

Percentiles

		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition 1)	Supply Chain Performance	1.0000	1.0000	2.0000	3.0000	3.6667	4.3333	4.6667
	Level of Technology	1.0000	1.3333	1.6667	2.3333	3.3333	4.0000	4.6667
	Logistics Activities	1.0000	1.0000	2.0000	3.0000	4.0000	4.6667	5.0000

	Staff Competency	1.0000	1.0000	1.3333	2.0000	2.6667	3.0000	3.3333
Tukey's Hinges	Supply Chain Performance			2.0000	3.0000	3.6667		
	Level of Technology			1.6667	2.3333	3.3333		
	Logistics Activities			2.0000	3.0000	4.0000		
	Staff Competency			1.3333	2.0000	2.6667		

Correlation Analysis

Descriptive Statistics

	Mean	Std. Deviation	N
Supply Chain Performance	2.8833	1.08181	100
What is your role in the public health facility?	2.73	1.347	100
How many years of experience do you have working in healthtcare or pharmaceutical settings?	2.41	1.215	100
Level of Technology	2.5387	1.01877	99
Logistics Activities	2.9683	1.25768	100
Staff Competency	1.9767	.79597	100

Correlations

		Supply Chain Performance	What is your role in the public health facility?	How many years of experience do you have working in healthcare or pharmaceutical settings?	Level of Technology	Logistics Activities	Staff Competency
Supply Chain Performance	Pearson Correlation	1	.114	.085	.391**	.593**	.084
	Sig. (2-tailed)		.257	.398	.000	.000	.405
	N	100	100	100	99	100	100
What is your role in the public health facility?	Pearson Correlation	.114	1	-.259**	-.015	-.070	.016
	Sig. (2-tailed)	.257		.009	.885	.491	.874
	N	100	100	100	99	100	100
How many years of experience do you have working in healthtcare or pharmaceutical settings?	Pearson Correlation	.085	-.259**	1	-.137	.173	.069
	Sig. (2-tailed)	.398	.009		.175	.086	.494
	N	100	100	100	99	100	100
Level of Technology	Pearson Correlation	.391**	-.015	-.137	1	.654**	.180
	Sig. (2-tailed)	.000	.885	.175		.000	.074
	N	99	99	99	99	99	99
Logistics Activities	Pearson Correlation	.593**	-.070	.173	.654**	1	.129

	Sig. (2-tailed)	.000	.491	.086	.000		.202
	N	100	100	100	99	100	100
Staff Competency	Pearson Correlation	.084	.016	.069	.180	.129	1
	Sig. (2-tailed)	.405	.874	.494	.074	.202	
	N	100	100	100	99	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

Regression Analysis

Descriptive Statistics

	Mean	Std. Deviation	N
Supply Chain Performance	2.8833	1.08181	100
What is your role in the public health facility?	2.73	1.347	100
How many years of experience do you have working in healthtcare or pharmaceutical settings?	2.41	1.215	100
Level of Technology	2.5387	1.01877	99
Logistics Activities	2.9683	1.25768	100
Staff Competency	1.9767	.79597	100

Correlations

		Supply Chain Performance	What is your role in the public health facility?	How many years of experience do you have working in healthtcare or pharmaceutical settings?	Level of Technology	Logistics Activities	Staff Competency
Pearson Correlation	Supply Chain Performance	1.000	.114	.085	.391	.593	.084
	What is your role in the public health facility?	.114	1.000	-.259	-.015	-.070	.016
	How many years of experience do you have working in healthtcare or pharmaceutical settings?	.085	-.259	1.000	-.137	.173	.069
	Level of Technology	.391	-.015	-.137	1.000	.654	.180
	Logistics Activities	.593	-.070	.173	.654	1.000	.129
	Staff Competency	.084	.016	.069	.180	.129	1.000
Sig. (1-tailed)	Supply Chain Performance		.128	.199	.000	.000	.203
	What is your role in the public health facility?	.128		.005	.442	.245	.437

	How many years of experience do you have working in healthtcare or pharmaceutical settings?	.199	.005		.087	.043	.247
	Level of Technology	.000	.442	.087		.000	.037
	Logistics Activities	.000	.245	.043	.000		.101
	Staff Competency	.203	.437	.247	.037	.101	
N	Supply Chain Performance	100	100	100	99	100	100
	What is your role in the public health facility?	100	100	100	99	100	100
	How many years of experience do you have working in healthtcare or pharmaceutical settings?	100	100	100	99	100	100
	Level of Technology	99	99	99	99	99	99
	Logistics Activities	100	100	100	99	100	100
	Staff Competency	100	100	100	99	100	100

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Staff Competency, What is your role in the public health facility?, Logistics Activities, How many years of experience do you have working in healthtcare or pharmaceutical settings?, Level of Technology[b]		Enter

a. Dependent Variable: Supply Chain Performance

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.614[a]	.376	.343	.87696	.376	11.226	5	93	.000

a. Predictors: (Constant), Staff Competency, What is your role in the public health facility?, Logistics Activities, How many years of experience do you have working in healthtcare or pharmaceutical settings?, Level of Technology

b. Dependent Variable: Supply Chain Performance

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.168	5	8.634	11.226	.000[b]
	Residual	71.522	93	.769		
	Total	114.691	98			

a. Dependent Variable: Supply Chain Performance

b. Predictors: (Constant), Staff Competency, What is your role in the public health facility?, Logistics Activities, How many years of experience do you have working in healthtcare or pharmaceutical settings?, Level of Technology

Coefficients[a]

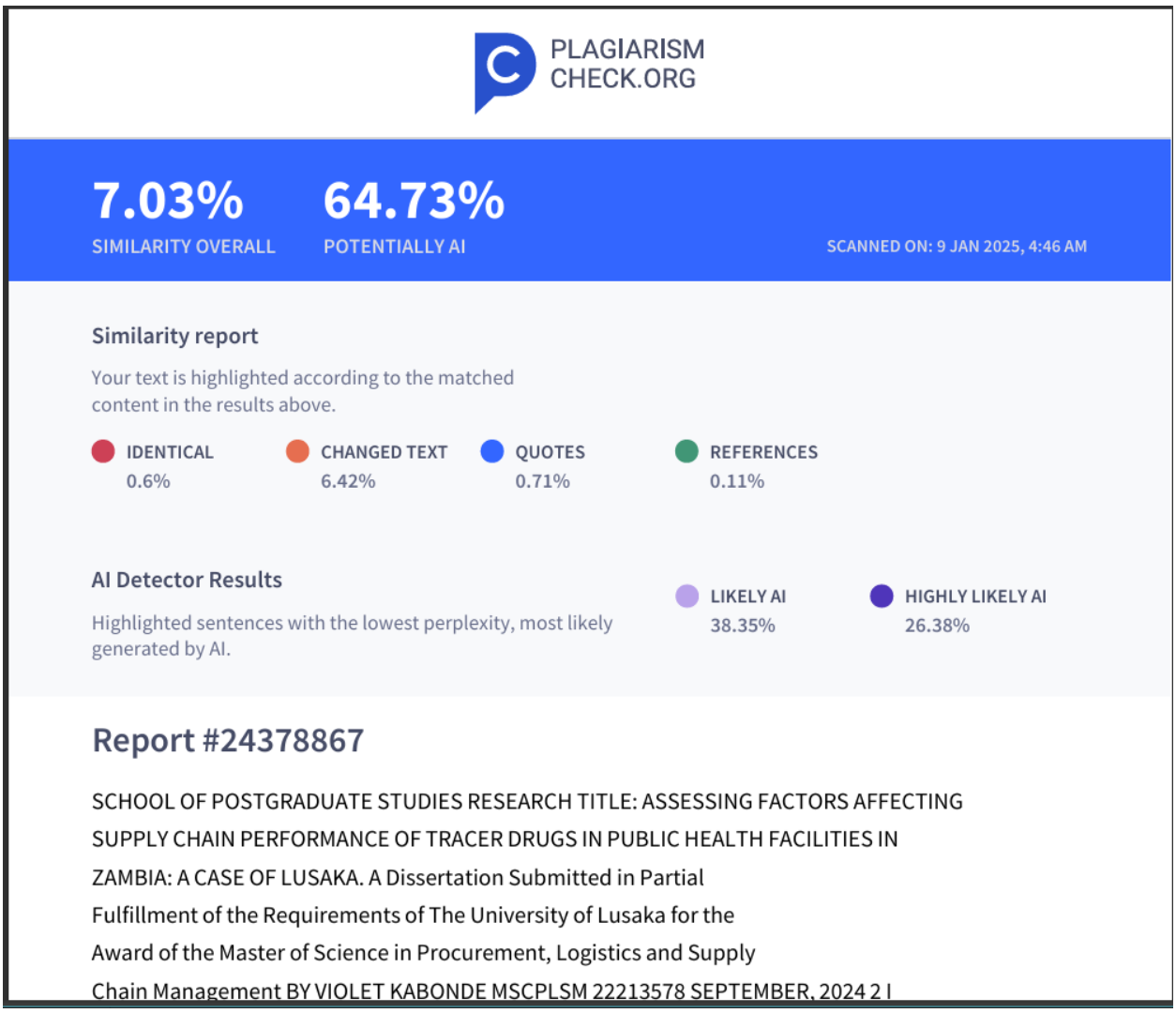
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.928	.429		2.164	.033		
	What is your role in the public health facility?	.131	.068	.163	1.914	.059	.928	1.077
	How many years of experience do you have working in healthtcare or pharmaceutical settings?	.023	.082	.026	.282	.779	.797	1.255
	Level of Technology	.008	.124	.008	.068	.946	.495	2.021
	Logistics Activities	.511	.099	.594	5.142	.000	.502	1.992
	Staff Competency	.002	.114	.002	.021	.983	.956	1.046

a. Dependent Variable: Supply Chain Performance

Collinearity Diagnostics[a]

Model		Eigenvalue	Condition Index	Variance Proportions					
				(Constant)	What is your role in the public health facility?	How many years of experience do you have working in healthtcare or pharmaceutical settings?	Level of Technology	Logistics Activities	Staff Competency
1	1	5.343	1.000	.00	.01	.00	.00	.00	.00
	2	.254	4.586	.00	.37	.28	.00	.01	.00
	3	.198	5.195	.00	.16	.20	.11	.09	.00
	4	.127	6.486	.00	.12	.08	.00	.05	.79
	5	.047	10.686	.21	.11	.00	.38	.68	.16
	6	.031	13.179	.79	.24	.43	.50	.17	.04

a. Dependent Variable: Supply Chain Performance


PLAGIARISM CHECK.ORG
7.03%
SIMILARITY OVERALL
64.73%
POTENTIALLY AI
SCANNED ON: 9 JAN 2025, 4:46 AM
Similarity report
Your text is highlighted according to the matched content in the results above.
IDENTICAL 0.6%
CHANGED TEXT 6.42%
QUOTES 0.71%
REFERENCES 0.11%
AI Detector Results
Highlighted sentences with the lowest perplexity, most likely generated by AI.
LIKELY AI 38.35%
HIGHLY LIKELY AI 26.38%
Report #24378867
SCHOOL OF POSTGRADUATE STUDIES RESEARCH TITLE: ASSESSING FACTORS AFFECTING SUPPLY CHAIN PERFORMANCE OF TRACER DRUGS IN PUBLIC HEALTH FACILITIES IN ZAMBIA: A CASE OF LUSAKA. A Dissertation Submitted in Partial Fulfillment of the Requirements of The University of Lusaka for the Award of the Master of Science in Procurement, Logistics and Supply Chain Management BY VIOLET KABONDE MSCPLSM 22213578 SEPTEMBER, 2024 2 I

UNIVERSITY of LUSAKA
Passion for Quality Education: Our Driving Force

Plot No. 37413, Off Alick Nkhata Mass Media, P.O. Box 36711, Lusaka, Zambia.
Phone: +260211258505 / +26021126994 | Email: info@unilus.ac.zm | Website: www.unilus.ac.zm

All correspondence should be addressed to the Vice Chancellor

Monday, October 14, 2024.

To whom it may concern,

Dear Sir/Madam,

RE: DATA COLLECTION-VIOLET KABONDE

This serves to confirm that **Ms. Violet Kabonde** student number **MSCPLSM22213478** is a registered student of the University of Lusaka pursuing a **Master of Science in Procurement, Logistics and Supply Chain Management** two Year Masters program currently in her **4th semester** of study.

The student is seeking data to enable her write a mandatory dissertation for the award of her degree. Kindly assist with the data she needs in line with her research title to enable her finish in time for submission. A copy of the full dissertation can be availed to you at your request.

Any assistance rendered to her will be highly appreciated.

Yours faithfully,

Mwamba Chanda (Mr.)

DEPUTY REGISTRAR

UNIVERSITY OF LUSAKA
REGISTRAR POSTGRADUATE
14 OCT 2024
P.O. BOX 36711,
LUSAKA.

UNIVERSITY OF LUSAKA

SCHOOL OF POSTGRADUATE STUDIES

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E-mail:unilus@zamnet.zm,ictar@zamnet.zm

UNILUS-RESEARCH ETHICS COMMITTEE

Ref no: FWA00033228-8710/24

Date: 25th October 2024

STUDENT NAME: Kabonde violet

Assessing Factors Affecting Supply Chain Performance of Tracer Drugs in Public Health Facilities in Zambia: A Case of Lusaka

The above research was submitted to the research ethics committee for review. The study has no major ethical problems and is approved subject to the following:

1. The study cannot be changed without express permission of the UNILUS research ethics committee.

2. Approval from the necessary authority should be sought.

The committee wishes you success in your work.

Professor Kasonde Bowa
MSc(Glasgow),M.Med(UNZA),FRCS(Glasgow),FACS,FCS,DPH(LSTMH),MPH(UCL)
Chairman- UNILUS REC
Professor of Urology and Consultant Urologist
Deputy Vice-Chancellor – Research and Innovation
Executive Dean - School of Medicine and Health Sciences

November 1, 2024

The Provincial Health Director,
Provincial Health office
P.O. Box xxx
Lusaka.

Dear Sir/Madam,

REF: REQUEST TO COLLECT DATA FOR AN ACADEMIC RESEARCH, "*ASSESSING FACTORS AFFECTING SUPPLY CHAIN PERFORMANCE OF TRACER DRUGS IN PUBLIC HEALTH FACILITIES IN ZAMBIA: A CASE LUSAKA.*

Reference is made to the subject captioned above.

I am pharmacist employed by the Ministry of Health (MOH) currently based at Children Hospital - University Teaching Hospital in Lusaka. To further my studies and aid medicine management, am pursuing a Master of Science in Procurement, Logistics and Supply Chain Management with University of Lusaka (UNILUS).

As a partial fulfillment for the award of the degree, I must conduct an academic research titled, "A*ssessing factors affecting supply chain performance of tracer drugs in public health facilities"* in Lusaka Province approved by the university of Lusaka.

The research aims to analyze factors affecting supply chain performance of tracer drugs in selected public health facilities in Lusaka, Zambia, focusing on the level of technology, inventory management, logistics activity and staff competency. Focusing on tracer drugs will help identify critical public health challenges that inhibit health institutions achieving their mandate. Further, the research will suggest recommendations for the challenges to be identified to aid resolve challenges to improve efficiency and effectiveness of tracer drugs management in health facilities.

I, thus, write to seek for permission to allow me conduct this research. Enclosed herewith is an approved proposal and a data collection tool.

Your approval to conduct this study will highly be appreciated.

Yours faithfully,

Violet Kabonde
+0976041891

All correspondence should be addressed to the
Provincial Health Director
Telephone: +260 211 256813
Fax: +260 211 256814
Telephone: +260 211 256815
Cell: +260 974 787873
+260 968 908260

REPUBLIC OF ZAMBIA

MINISTRY OF HEALTH

In Reply please quote:

File No.....

LSKPHO/101/8/1

Lusaka Provincial Health Office
P.O. Box 32573
LUSAKA

15th November, 2024

Violet Kabonde
UNILUS
NDOLA
violetkabonde@gmail.com
0976041891

PERMISSION TO CONDUCT RESEARCH

My office is in receipt of your letter requesting for permission to conduct a study titled "**Assessing Factors Affecting Supply Chain Performance of Tracer Drugs in Public Health Facilities in Zambia: A Case Study of Lusaka**"

My office is glad to inform you that it has no objection to your request provided that;

1. The relevant Institution Director where the study is being conducted are fully appraised;
2. Progress updates are provided to Lusaka Provincial Health Office and the District Health Office biannually from the date of commencement of the study;
3. The final study report is cleared by NHRA before any publication or dissemination within or outside the country;
4. After clearance for publication or dissemination by NHRA, the final study report is shared with all relevant Provincial and District Directors of Health where the study was being conducted.

Kindly ensure minimum interruption in health service delivery at selected health facilities.

By copy of this letter, the District Health Office / Institution are advised to allow you undertake the above-mentioned research and provide you with the relevant support.

Yours faithfully,

Dr. Simulyamana Aspha Choonga
Provincial Health Director
LUSAKA PROVINCE

CC: District Health Director – Lusaka