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EAC REGIONAL CENTRE OF EXCELLENCE FOR VACCINES, IMMUNIZATION & HEALTH SUPPLY CHAIN MANAGEMENT (EAC RCE-VIHSCM)"

FACTORS AFFECTING HEALTH SUPPLY CHAIN PERFORMANCE IN PUBLIC HEALTH FACILITIES AT PEMBA ISLAND, TANZANIA

By

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DECLARATION

I, Hassan Ali Said, declare this dissertation to be my original work, except where otherwise properly cited or acknowledged and referenced. “I further confirm that this work has neither been presented in any organization, institution, or university for examination nor previously published in its entirety or parts”.

Signature:  **Date: 29th August 2025**

SUPERVISOR'S APPROVAL

This dissertation has been submitted for evaluation with my approval as University Supervisor.

Signature: 

Dr. Ernest Lomnyak Moses, PhD **Date: 29th August 2025**

Lecturer

DEDICATION

This work is dedicated to my beloved wife Sabahiya Subeit Ali, my son Subeit Hassan Ali and my parents.

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ABSTRACT

Background: In the health aspect among the essential components is the health supply chain, encompassing the movement of information, goods, services, and resources to meet customer needs. Effective health supply chain performance ensures that health commodities are available in quantity and quality at the right time, thereby improving patient outcomes. However, many developing countries, including Tanzania, face challenges to have effective health supply chain, which leads to inadequate healthcare delivery and rising patient demand. This study focuses on Pemba Island, Tanzania, where health supply chain performance remains challenging due to various influencing factors.

Objective: This study aims to determine the factors affecting health supply chain performance in public health facilities at Pemba Island, Tanzania, as the main objective.

Methodology: The cross-sectional descriptive study was conducted in public health facilities across Pemba Island, Tanzania. The study population includes healthcare professionals directly involved in the health supply chain; the sample size was 70 public health facilities with one respondent in each facility. Slovin's formula was used to calculate a representative sample size for each district. Data was collected using semi-structured questionnaires, on-site visits and interviews. The collected data were pre-tested for validity and reliability and analysed using descriptive statistics in STATA version 15.1. Ethical considerations were adhered to, with approvals obtained from relevant institutional review boards and consent from participants.

Results: Among the assessed health facilities in Pemba, observed supply chain performance was 50.0%. A higher proportion of facilities in Kusini Pemba (70.3%) were classified as having above-average performance compared to Kaskazini Pemba (27.3%), and the difference was statistically significant (Chi-square = 12.9, $p < 0.001$).

Conclusion: The regional disparities, human resource challenges and logistical inefficiencies found in this study should be addressed to improve supply chain performance in Pemba public health facilities.

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CMSA	Central Medical Store Agency
DDR	Daily Dispensing Register
GSP	Good Storage Practices
ICT	Information and Communications Technology
IRB	Institutional Review Board
MSD	Medical Store Department
ODK	Open Data Kit
SDPs	Service delivery points
STG	Standard Treatment Guideline
URT	United Republic of Tanzania
WHO	World Health Organization
ZAHREC	Zanzibar Health Research Ethical Committee
ZAHRI	Zanzibar Health Research Institute
ZCMSA	Zanzibar Central Medical Store Agency

DEFINITION OF TERMS

Delivery of health commodities: Is moving health commodities from one location to the specified one. This study involves delivering health commodities to Pemba Island Tanzania's public health facilities.

Essential Medicines: Meet the most basic healthcare needs for the majority of the population and must always be readily available and affordable.

Health supply chain: Involving the movement of information, goods, services, and resources in the health sector to meet patient needs.

Human resources for the supply chain: Are personnel that manage and operate in the health supply chain, including their training, knowledge, skills, and experience.

Inventory control management: The process of managing the ordering, receiving, storing, and tracking of health commodities to ensure their availability and minimize wastage.

Public health facilities: Government-run healthcare establishments, including hospitals, health centres, and dispensaries providing medical services.

Storage management: Practices and procedures involved in maintaining the quality and stability of health commodities through proper storage conditions.

"Supply chain performance: Refers to the effectiveness of actions that enable the delivery of health commodities in the appropriate amounts and quality, at the appropriate time, to improve patient outcomes".

CHAPTER 1: INTRODUCTION

1.1 Background of the study

“In the health aspect among the essential components is the health supply chain, encompassing the movement of information, goods, services, and resources to meet customer needs (1,2). Health supply chain performance involves all activities that ensure customers deliver the health commodities as required in the context of the right commodities at the right quantities, safe, effective, quality, and sufficient within a specified lead time to improve patient outcomes (3,4). Proper health supply chain management is vital in guaranteeing the availability and access of essential medicines and other associated health commodities to public health institutions (5).

According to WHO, essential medicines are those that meet the most basic healthcare needs of the majority of the population and must always be readily available and affordable (6). Different efforts were made to ensure the supply and accessibility of needed medicine to public health facilities globally for improving patient outcomes and stabilizing the performance of the health supply chain to the public health facilities, In optimising the health supply chain performance to meet the goals and objectives of the health system the effective coordination and collaboration among health supply chain stakeholders should be well strengthened and maintained (7,8)

The health supply chain comprises different components such as management support, product selection, quantification and procurement, inventory management, storage and distribution (delivery), and customer service (7,9,10)”. Those components are coordinated by quality monitoring as indicated in Figure 1 below (6)”.

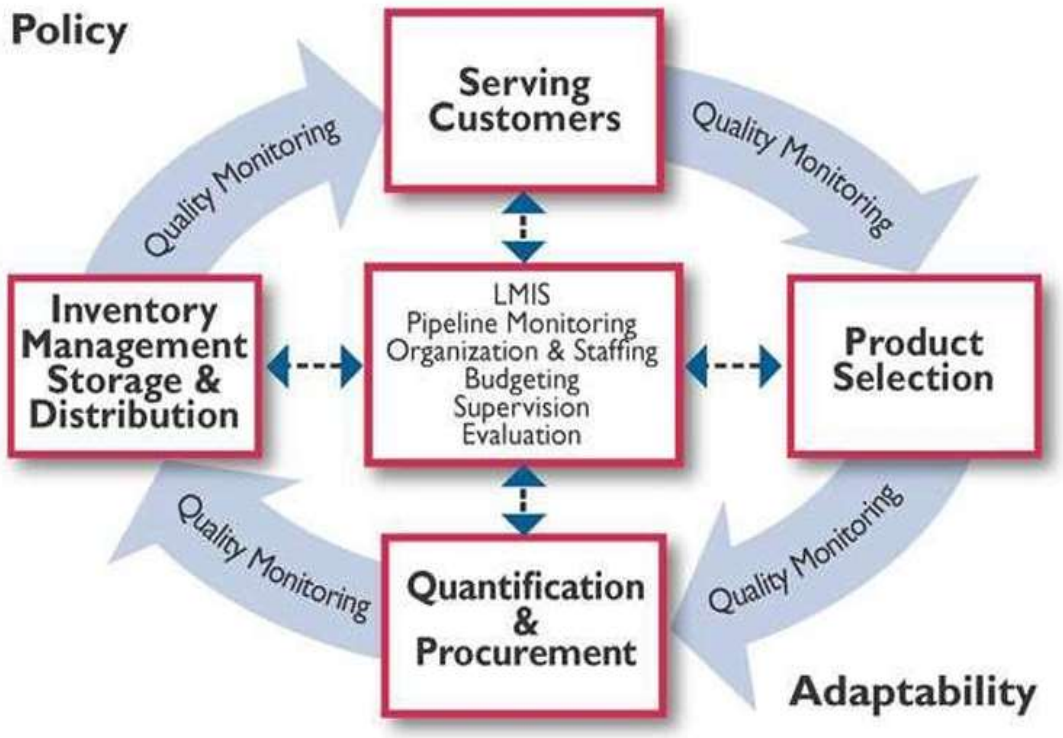

Figure 1: Health supply chain management cycle.

Source: Ref. No. (6).

"Management support in the health supply chain is a crucial aspect of ensuring the efficient and effective health supply operation. It involves: LMIS, pipeline monitoring, organisation and staffing, budgeting, supervision and evaluation (6)".

The selection of health commodities involves selecting essential health commodities that are priorities in the health care setting according to the Essential Medicine List (EML) and standard treatment guidelines(11).

"Quantification is estimating quantities and costs of health commodities required during a specific period and determining when the products should be delivered to ensure an uninterrupted supply of health commodities. Quantification involves two main activities which are, demand forecasting and supply planning. Demand forecasting implies estimating the quantities of products and costs required to meet customer demand for products used during a particular time frame. While supply planning implies detailing the quantities required to fill the supply pipeline, costs, and arrival dates of shipments this is the final output of the quantification (6,12)".

Procurement is the process of acquiring goods and services by legal means, this is a vital function within a health supply chain by ensuring the health commodities are procured and available at all times to the customer according to plan (12,13). In Tanzania, the procurement process is done by the Medical Store Department (MSD) for the Tanzania mainland and headquarter of Central Medical Store Agency (CMSA) Zanzibar (Unguja and Pemba) Tanzania.

"Inventory management is the process of overseeing, tracking, and controlling the order of health commodities to ensure max-min inventory level to avoid understock and overstock. Effective inventory control management will ensure that public health facilities have a sufficient quantity of health commodities at all times and minimize the associated costs to satisfy customer needs, storage, and delivery also are part of inventory management (14)".

Serving customers considers the services provided to them. Providing good services depends on the proper function of all health supply chain components, such as selecting the right quantity, quantification, procurement, proper storage, and distribution(15).

Quality monitoring is a vital aspect of the health supply chain system it involves monitoring the quality of health commodities, quality assurance, and quality of services provided. It also acts as the interconnection between one component and another in the health supply chain management cycle (6,9,16)

Most developing countries face limited availability of health commodities, resulting in frequent stock outs these scenarios disappoint the clients when visiting health facilities to find a health service (9,17). In Tanzania, the health supply chain performance remains a challenge in the public health sectors which contributes to insufficient availability of essential medicine that can cause delays of the services, inadequate healthcare delivery, and rising patient demand (14).

The health supply chain does not perform well due to various factors that affect it such as; insufficient essential health commodities, human resources for the health supply chain, procurement process, information technology (IT), poor inventory control management, poor storage management, and delivery, information sharing, customer demand, forecasting method (15,18–20). Previous research undertaken in many countries, including India, Rwanda, Uganda, Zambia, Kenya, Ethiopia, and Tanzania, reported these factors that affect the health supply chain's performance (11,21–24).

1.2 Problem statement

The performance of the health supply chain is a vital aspect in the field of health for ensuring effective and timely healthcare delivery to public health facilities worldwide, but this performance of the health supply chain operates poorly due to different affecting factors, including human resources in terms of knowledge, skills, training and experience, poor inventor control management, poor storage management and delivery of health commodities to the public health facilities, These factors contribute on inadequate health supply chain performance and remains a matter of concern worldwide (25,26). The inadequacy of supply chain performance causes poor essential health commodities available to public health facilities, affecting the patient's health care outcomes and disappointing the prescription. According to WHO recommendations, at least 80% of essential medicines must be available to meet customer demand. However, in most developing countries public health facilities the essential medicines available range from 38% to 64%, including Tanzania which is about 56% this scenario will contribute to the frequent stock out of some essential medicines and other related health commodities that increase the morbidity and mortality (6,25).

Stock out of essential health commodities will make the patients find health services in private health facilities, and traditional healers, and also influence the irrational prescribing and dispensing because the prescribers may prescribe the medicine available in the health facilities, those happen due to ineffective health supply chain performance (6,9)

"Different studies have been conducted to determine the factors that affect the performance of the health supply chain in public health facilities globally (6). Those studies show limited information on factors affecting health supply chain performance in public health facilities at Pemba Island, Tanzania. Therefore, it is necessary to investigate the factors that affect health supply chain performance in Pemba Island, Tanzania, to improve performance and ensure proper health care delivery to the facilities and patient outcomes".

1.3 Research objectives

The study objective is to determine factors affecting health supply chain performance in public health facilities in Pemba Island, Tanzania. Its specific objectives are as follows:

1. To determine health supply chain performance levels in public health facilities at Pemba Island, Tanzania.

2. To evaluate the effects of human resources on health supply chain performance in public health facilities at Pemba Island, Tanzania.
3. To examine the effects of storage management and delivery on the effectiveness of health supply chain performance in public health facilities at Pemba Island, Tanzania.
4. To determine the effect of inventory control management on health supply chain performance in public health facilities at Pemba Island, Tanzania.

1.4 Research questions

1. What is the health supply chain performance level in public health facilities at Pemba Island, Tanzania?
2. What are the effects of human resources on health supply chain performance in public health facilities at Pemba Island, Tanzania?
3. What are the effects of storage management and delivery on the effectiveness of health supply chain performance in public health facilities at Pemba Island, Tanzania?
4. How does inventory control management affect health supply chain performance in public health facilities at Pemba Island, Tanzania?

1.5 Relevance or significance of the research

The significance of this study is to determine the factors affecting health supply chain performance in Tanzania's Pemba Island public health facilities. The results of this finding are useful to the Government and other health supply chain stakeholders to know the factors affecting supply chain effectiveness to public health facilities which are associated with insufficient health commodities availability and accessibility to the customers.

The wider communities will also benefit from these advancements because an effective health supply chain guarantees continuous better healthcare service delivery, including sufficient medicine availability and other health-related products.

Additionally, the study's relevance is to improve Pemba Island public health facilities' supply chain performance in Tanzania.

1.6 Scope of the study (Delimitation)

The Research was conducted in Pemba Island, Tanzania, and examined what aspects of public health facilities' supply chain operate poorly. Focused on the level of health supply chain performance in Pemba public health facilities, characteristics of human resources for supply chain, storage management and delivery of health commodities, and inventory control management, and how they interact, relate, and affect supply chain performance. The study population includes healthcare professionals who are directly involved in the supply chain of pharmaceuticals in the selected public health facilities.

1.7 Limitations of the study

The study was limited to Pemba Island, Tanzania public health facilities and did not include private health facilities. The study acknowledges certain limitations that influenced the research process and outcomes. The time for the study is limited, and a longer duration might be necessary to have an in-depth analysis of the theme under study. Considering the number of public health facilities in Pemba Island to be visited for data collection, such an extensive coverage requires significant time, infrastructure, and resources, potentially posing constraints on the study's timeline and available resources.

The data collection exercise was challenged due to bureaucratic procedures, mostly at Tanzania's Pemba public health facilities. Another challenge to be encountered in this study is the existence and availability of academic literature that has studied supply chain performance within the context of Pemba Island, Tanzania.

1.8 The research structure

"The structured format of this research is composed of six chapters: Chapter 1 presents the introduction, chapter 2 presents the literature review on the factors affecting health supply chain performance in public health facilities, Pemba Island, Tanzania and chapter 3 presents the methodology and research design.

Presentation of research findings is in chapter 4 and discussion on the findings is presented in chapter 5. The conclusion and recommendations are presented in chapter 6".

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

“This part begins by reviewing previous studies conducted by academics and researchers regarding supply chain effectiveness, particularly focusing on the factors affecting supply chain performance in public health facilities in Pemba Island, Tanzania. The guidance of this study is proposed through a conceptual framework, drawing from theoretical and empirical reviews.

The chapter starts with a review of fundamental ideas underlying this field to the facilities. Subsequently, an empirical analysis of the factors affecting, both generally and specifically Pemba Island, Tanzania is provided. This chapter identifies the research gap and examines the conceptual framework used.

2.2 Theoretical review

Health supply chain: This is a vital aspect of the health field, which involves the movements of information, goods, services, and resources that satisfy customer’s needs(27). The performance of this system consists of the set of activities ensuring commodities are delivered to the customer within the context of six logistics and supply chain rights”.

An effective supply chain should have a proper link to its components such as warehousing, transportation, and service delivery points for optimizing the performance of the health facilities by ensuring sufficient availability of medicine at all times (24).

2.3 Empirical review

2.3.1 Availability of essential medicine

“Essential medicine is available when a particular medication or treatment is generally available and accessible to the healthcare provider, patient, and public. According to the World Health Organization (WHO), the availability of essential medicine, vaccines, and other related health commodities is vital for public health facilities to cover universal health coverage. It should have at least 80% of medicine available to public health facilities at all times, however, in most developing countries public health facilities the essential medicines available range from 38% to 64%, including Tanzania which is about 56% (6,7,28)”.

According to the World Health Organisation (WHO) report in 2019 Tanzania faced on significant challenge in providing public healthcare, as well as report of WHO and World Banka in 2020, Tanzania indicated to have medicine availability rate of 50- 60%, this implies that 40-50% of medicine in Essential Medicine List (EML) are not available, though Pemba public health facilities faced with the same challenges, to be in good performance on public health facilities the medicine availability should around minimum standard of 80% as WHO, benchmark (28).

2.3.2 Human resource for the health supply chain

"Human resource is a key stakeholder that influences supply chain performance and makes the organization meet its goals and objectives, so must be trained, skilled, knowledgeable, and experienced, those aspects remain a challenge to the healthcare professionals who are directly involved in the supply chain of pharmaceuticals and can affect the effectiveness of the health supply chain performance in public health facilities (5)".

Worldwide, around 57 countries are faced with the challenge of health workers in different cadres. A global shortage of 4.3 million health workers affects the medical field; of these, 2.4 million are physicians, nurses, and midwives; the remaining 1.9 million are management and support personnel, such as managers, health administrators, and logisticians for the health supply chain. Compared to America, Africa has a lower ratio of healthcare workers (19).

Projected gaps in human resources will be 12.9 million by 2035 globally (29). According to research done in Uganda, human resources have a direct influence on strengthening the health system, which needs trained, skilled, knowledgeable, experienced, and competent to ensure supply chain performance. However, human resources continue to be challenging because there is a higher demand for supply chain staff, particularly at the lower levels of health facilities, where approximately 10% to 55% of posts are vacant at different health levels (29). According to research, about 87.5% and 67% of private and public health institutions in Tanzania experienced a crisis related to human resources for health (30).

2.3.3 Inventory control management in the health supply chain

Inventory: in health describe the goods, materials, and products, such as Medicine, vaccines, medical supplies, medical equipment, and laboratory products that are stored and controlled within the warehouse/organization. While Inventory control management; consider the proper inventory

management within the warehouse/organization. Effective and efficient inventory control management involves; proper inventory planning such as forecasting and demand of goods and services needed for the health facilities to satisfy the customer, and organizing needs (14,31).

"Well-documented recordkeeping can help easily track the commodities and monitor them. Inventory control is important because it guarantees the availability and accessibility of essential health commodities, improves the confidence between the patient and health care provider, minimises the stock-out cost, overstock cost, and lost cost, and reduces procurement and transport costs. Overestimated 4% to 9% of the waste of pharmaceutical products is attributed to poor inventory management, and approximately 37.5% of medicine stock in Uganda and Ethiopia is related to improper inventory management (21)".

A survey conducted in Ghana shows poor pharmaceutical inventory management as a challenge on health supply chain management at health facilities, as well as in South Africa and Addis Ababa only 50% and 33.5% bin card ware filled correctly respectively, this this factor remaining as a challenge in the area of health supply performance (32). Research conducted in Tanzania to assess the pharmaceutical inventory management performance only 30.4% and 47.3% of inventory records were accurate in the Mwanza region at Sekou Toure Regional Hospital and Pemba Public Health facilities respectively (6,31).

2.3.4 Storage management and delivery of health commodities

"Storage and delivery are a crucial component of health supply chain management, ensuring the availability, accessibility, and effectiveness of essential health commodities, including medicines, vaccines, and other related health products. Proper storage management and delivery ensure that health commodities are safely stored and delivered efficiently, Improper storage practices can lead to stakeouts, product expiration, damage, reduced patient satisfaction, increased unnecessary costs, and inadequate monitoring and reporting. Effective storage management is therefore vital for maintaining the integrity and reliability of the health supply chain (33)".

In managing and maintaining the quality and stability of essential medicine a good storage practice (GSP) must be considered for the whole supply chain and the health facilities generally, because some pharmaceuticals are extremely sensitive to poor storage conditions worldwide, including

humidity, temperature, ventilation, and sanitation, and other related storage condition like; inadequate storage space, kept together usable and expired product, improper storage operation for that reason must be well monitored with the aims of improving supply chain performance in the health facilities (34).

Research done in Ethiopia's Gamo and West Walloga zones to evaluate the system's effectiveness in public healthcare services shows that only 42% of those facilities had enough storage space. Proper store management also minimizes wastage and expired products are estimated to account for 70% of the budget spent on lost or wasted medication (35).

"The delivery of health commodities is a vital component in the health supply chain, as it ensures that health facilities have the essential health commodities, such as essential medicines, vaccines, medical supplies, and equipment to deliver quality healthcare services to patients. In Pemba Tanzania, public health facilities deliver health commodities from the Pemba Zonal Central Medical Store Agency".

2.4 Conceptual framework

"The performance of the health supply chain is crucial for ensuring effective healthcare delivery. However, various factors influence the overall performance of the health supply chain. For this study, the performance of the health supply chain is named as a dependent variable, while the independent variables are human resources for the supply chain, stock availability, inventory management, storage management, and delivery performance in public health facilities in Pemba Island, Tanzania.

Figure 2 below illustrates the conceptual framework which shows the dependent in relation to independent factors that influence health supply chain performance in public health facilities".

On the left; human resources include knowledge, skills, training and experience are shown as the primary independent variable. Moving right, these human resources impact four critical supply chain components: stock availability (measured by essential medicines per STG), delivery performance (assessed through lead time), inventory management (evaluated by stock-out frequency), and storage management (including accuracy of inventory records and stock rotation

mechanisms). The diagram also depicts interactions between these components, such as the influence of stock availability on inventory management. On the far right, these elements collectively influence the overall supply chain performance as the dependent variable.

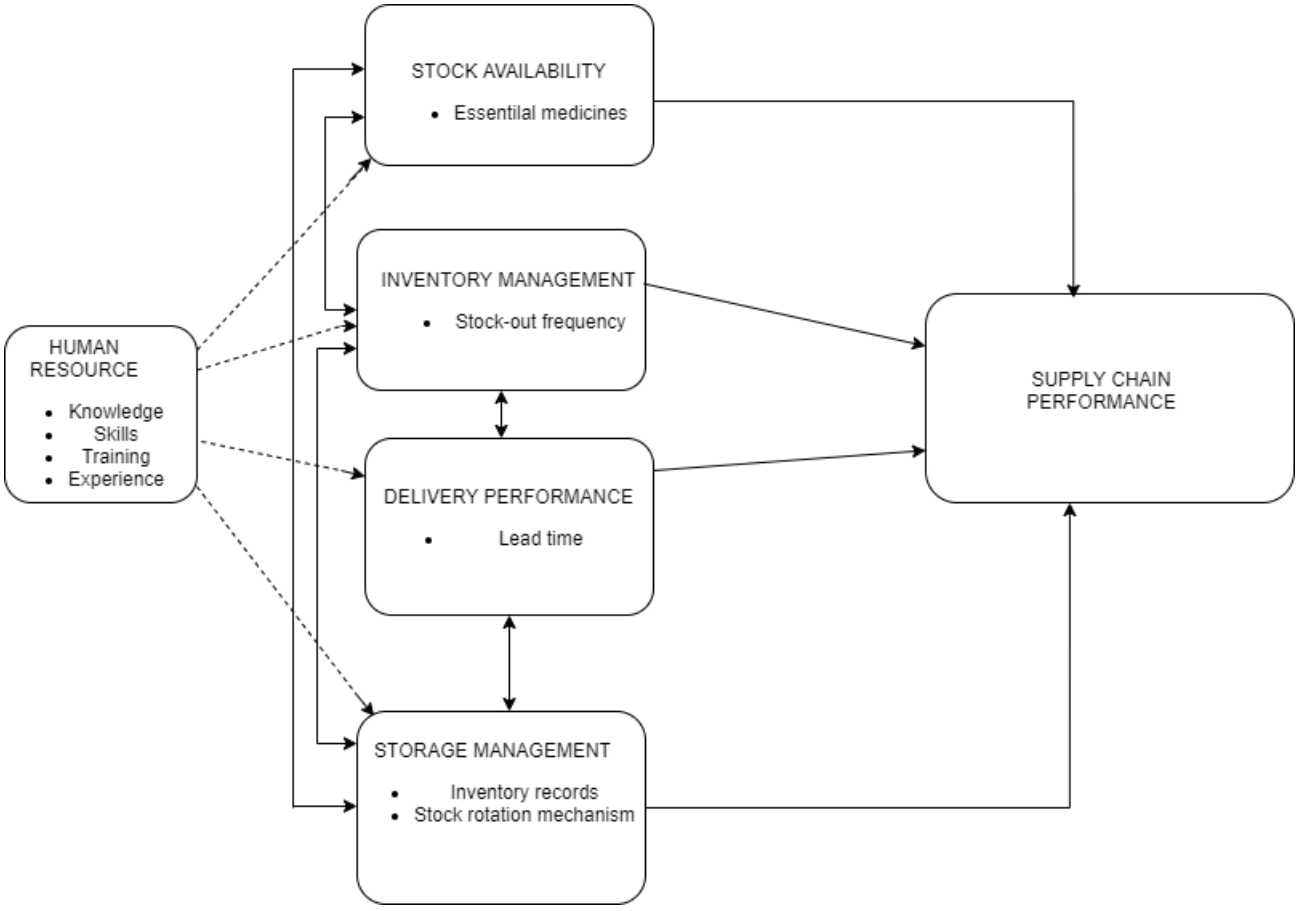

Figure 2: Conceptual framework.

Source: Own research work, 2025.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The study methodology was identified in this chapter, which includes the study setting, study design, study population, study sample, and sampling, data collection instrument, validity and reliability, and logistical and ethical clearance of the study.

3.2 Study setting

This study is conducted at Pemba Island, Tanzania. This is Indian Ocean Island located across the port of Tanga, Tanzania, 35 miles (56 km) off the coast of East Africa. The island measures 14 miles (22 km) in width and 42 miles (67 km) in length. It is composed of two regions north and east Region, with four districts, the north region is made by the Wete and Micheweni Districts, while in east region is made by the Chake Chake and Mkoani Districts, according to Tanzania national sensor results of the 2022, total population in Pemba is 543,441(males ware 262,857 and female ware 280,584) out of 61,741,120 (males ware 915,492 and female ware 974,281) of the total population in Tanzania (36).

Pemba Island has 78 health facilities (1 referral hospital, 4 district hospitals, 23 health centres, and 50 dispensaries). The selected health facilities for this study were included health centres and dispensaries, representing a mix of urban and rural settings, ensuring inclusive assessment of the supply chain across different contexts within Pemba.

The different reviewed literature identifies the challenge of health supply chain performance in low-level public health facilities, therefore, this research is selected because the Pemba public health facilities are currently suffering from performance improvement for the health supply chain (21).

3.3 Study design

The cross-sectional descriptive study design was used for gathering the information on the issues affecting supply chain performance at public health facilities located in Pemba Island, Tanzania. This study design is suitable because it facilitates the data collection from the population within a relatively shorter period. Furthermore, a descriptive, cross-sectional study design allows the investigator to investigate multiple variables at a specific time, it is less costly and provides information for descriptive analysis (37).

3.4 Study population

"The study was comprise of healthcare professionals who are directly involved in the health supply chain in the selected public health facilities".

3.4.1 Inclusion criteria

Human resources in health supply chain management from selected public health facilities at Pemba Island Tanzania ware included.

3.4.2 Exclusion criteria

i. Public health facilities that have outsourced services to private organizations.
ii. Temporary or part-time staff who have been employed at the facility for less than six months.
iii. Private health facilities in Pemba Island Tanzania.

3.5 Sample and sampling

Total number of public health facilities eligible in Pemba Island is 74, which includes 49 dispensaries and 25 health centers. The island comprises two regions, the North and South regions, and four districts. The north region comprises Wete and Micheweni Districts while Chake Chake and Mkoani Districts make the South region with each district having dispensaries and health centres. "To get the representation of the whole Island, **Slovin's formula** (39,40) was applied to each of the four districts in Pemba, ensuring adequate representation from each district".

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

Whereby

N = Population size

n = Sample size

e = Marginal error (e = 5%)

The total number of eligible health facilities was (74 facilities) includes 21 in Chake Chake District, 18 in Mkoani District, 15 in Micheweni District, and 20 in Wete District. By calculating the sample size separately for each district, we accounted for the unique distribution of health facilities within each area. This method provided a precise calculation with a 5% margin of error, resulting in

representative sample sizes of 20, 17, 14, and 19 facilities for Chake Chake, Mkoani, Micheweni, and Wete Districts respectively, making a total of 70 facilities in the whole Pemba. In this study, there were 70 participants, while each health facility had one respondent involved in the health supply chain in the selected health facility.

Within each district, health facilities were further stratified into dispensaries and health centres to ensure proportional representation (Appendix 9). All health centres from the 4 districts across Pemba were selected for inclusion in the assessment. In contrast, all the dispensaries in each of the four districts in Pemba were assigned a number. A random number generator computer program was then used to select a respective number of dispensaries from each district randomly. Appendix 10 represents the selected health facilities for the study.

3.6 Data collection instrument and procedures

The semi-structured questionnaire (Appendix 1) targets human resources, stock availability, delivery, inventory control management, and storage management ware used. Data was collected through on-site visits and interviews with selected health facility staff in the supply chain. Observations and document reviews supplement questionnaire responses, ensuring effective data collection. Each facility's performance was categorized based on established thresholds, facilitating the classification of supply chain performance as "above average" or "below average."

3.7 Pre-testing

Before the commencement of data collection, a pilot pre-test survey study was carried out to ascertain the data gathering tool's validity and reliability as well as to determine if it would collect all the information required to respond to the study's objectives and questions, and if any data collection errors might occur. The identified gaps during pre-testing were worked out to improve the tool and data collection procedure.

3.8 Validity

When a variable is measured correctly, it is said to have validity. The measurement of the study findings' strength proves the validity according to research instruments and yields precise results. To ensure the validity of this study the pre-tested data collection tools were used The pre-tested data collection tools are used and the collected data was reviewed by the principal investigator for accuracy and completeness (13).

3.9 Reliability

Under data collection, reliability is the level of consistency with which an instrument produces the same results when applied under the same circumstances, across time, space, and methodologies. The data reliability in this study will be assured by adequate training of research assistants and through pre-testing of the tool, gaps identified and mitigated before the study commencement.

3.10 Data input, analysis and presentation

The data collection process was facilitated using the Open Data Kit (ODK) platform, programmed with KoboToolbox software and deployed on smartphones. Healthcare professionals at the selected public health facilities will input responses into the ODK-based semi-structured questionnaire, covering various aspects such as stock availability, delivery, inventory management, and storage management. This method not only streamlines data collection but also minimizes errors associated with manual entry.

Upon completion of data collection, the responses will be extracted from ODK and transferred into Microsoft Excel for preliminary processing. This stage involves thorough cleaning and consistency checks to ensure data integrity. Any anomalies or discrepancies identified during this process will be addressed to maintain the accuracy of the dataset. The cleaned and verified data will then be imported into STATA version 15.1 for comprehensive statistical analysis. Descriptive statistics will be utilized to summarize key metrics, while inferential statistics will explore relationships between variables, providing insights into factors affecting supply chain performance.

Supply chain performance was assessed based on four key sections of the questionnaire: Stock Availability, Measuring Delivery, Inventory Management, and Storage Management. A predefined scoring system was applied (See data collection tool), where higher scores were assigned to responses reflecting favourable performance, while lower or zero scores were given to responses indicating unfavourable performance.

The total supply chain performance score for each facility was calculated by summing the scores across all four sections. To classify overall performance, the mean supply chain performance score was used as the cutoff point. Respondents whose total score was above the mean were classified as having above-average performance, while those scoring below the mean were categorized as below average.

The analysed data was presented using a combination of visual and textual formats to facilitate understanding and interpretation. Tables, charts, and graphs are employed to illustrate findings effectively, highlighting critical trends and patterns. Descriptive summaries provide an overview of health supply chain performance, and detailed statistical results will offer deeper insights into the factors influencing this performance. The presentation ensured that stakeholders could easily comprehend the results, enabling informed decision-making and targeted interventions to improve health supply chain management in Pemba Island's public health facilities.

3.11 Ethical considerations

Before conducting the study, the Rwanda Institutional Review Board (IRB) was consulted to provide ethical approval for the research conduction. "This was followed by obtaining permission from the second vice president's office, the office of chief Government statistician in Zanzibar, and the Zanzibar Health Research Ethical Committee (ZAHREC) for the research investigation in Zanzibar". This approval was granted to the Regional, District, and health facilities levels. All responder information was kept private and used exclusively for the objectives of this study. Informed consents were obtained from study participants before their participation.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter summarises the study's findings. The study was conducted in 70 public health facilities, with one participant involved in the health supply chain for each selected facility at Pemba Island, Tanzania, to determine the factors affecting health supply chain performance. The four key sections of the questionnaire, i.e., Stock Availability, Measuring Delivery, Inventory Management and Storage Management, were used to assess supply chain performance.

The analysed data was presented using a combination of visual and textual formats to facilitate understanding and interpretation. Tables, charts and graphs illustrate findings effectively.

4.1.1 Respondents' characteristic in assessed health facilities

The assessed health facilities (N = 70) consisted mainly of dispensaries (62.9%), with health centres accounting for 37.1%. The facilities were almost evenly distributed across the two regions, with 47.1% in Kaskazini Pemba and 52.9% in Kusini Pemba. Respondents were primarily pharmaceutical personnel (45.7%) and nurses (35.7%), with smaller proportions of clinical medicine and laboratory personnel. Nearly all respondents (97.1%) held a diploma, while only 2.9% had a certificate. "These findings are summarized in Table 1 below".

Table 1: General characteristics of facilities

Characteristic	Frequency N (%)
Facility type	
Dispensaries	44 (62.9)
Health centers	26 (37.1)
Region	
Kaskazini Pemba	33 (47.1)
Kusini Pemba	37 (52.9)
Respondents' profession	
Pharmaceutical technician	32 (45.7)
Nurse	25 (35.7)
Clinical officer	12 (17.1)
Laboratory technician	1 (1.4)
Qualification	
Diploma	68 (97.1)
Certificate	2 (2.9)

Source: Own research work, 2025.

4.1.2 Human resource responsible for supply chain management

Among the assessed facilities, 78.6% of respondents reported receiving formal training in supply chain management with workshops reported as the most common type of training, attended by 65.7% of respondents. Respondents had a median of 2 years of experience in supply chain management, with an interquartile range (IQR) of 2 to 6 years, the majority (51.4%) reported being "somewhat confident", with their knowledge of stock management procedures. 27.1% of respondents indicated that they were knowledgeable about different techniques, while the majority (72.9%) were not. Among those knowledgeable, 17 out of 19, (89.4%) reported using the physical count method. A small proportion mentioned emergency orders, redistribution, and re-order level techniques. Table 2 summarises the findings.

Table 2: Human resource characteristics

Variable	Frequency N (%)
Received formal training	
Yes	55 (78.6)
No	15 (21.4)
Type of Training	
Workshops	46 (65.7)
On-the-job training	5 (7.1)
Formal courses	4 (5.7)
Confidence in their knowledge	
Very confident	30 (42.9)
Somewhat confident	36 (51.4)
Not confident	4 (5.7)
Knowledge of different inventory control techniques	
Yes	19 (27.1)
No	51 (72.9)
Technique used	
Physical count method	17(89.4)
Years of experience	Median = 2 (IQR 2 – 6)

Source: Own research work, 2025.

4.1.3 Stock availability

Majority of the facilities assessed (82.86%) reported having essential medicines available. Regarding stock-outs, the number of medicines currently out of stock (among the facilities reported having stock-outs at the time of assessment) varied, with up to six medicines reported not available in some facilities. The most reported shortages were of four (25%, n=3) and six (33.3%, n=4) medicines. Figure 3 below illustrates this finding.

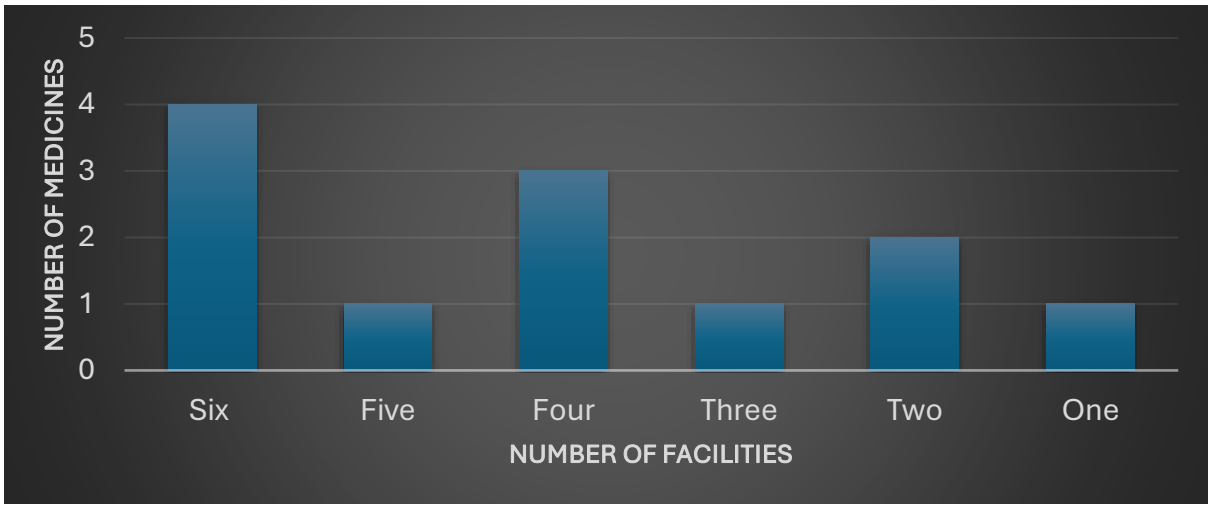

Figure 3: Distribution of health facilities reporting stock-outs by number of medicines unavailable.
Source: Own research work, 2025.

4.1.4 Storage management

All the assessed facilities reported having a dedicated store for keeping medicines. Accuracy of inventory records, 67. 1% (47 out of 70 facilities) reported that they are somewhat accurate whereas 32.9 %(23 out of 70) reported having very accurate inventory records. The majority, 88.6% of the respondents reported conducting inspections to verify stock monthly. Sixty-nine out of seventy (98.6%) facilities reported using a stock rotation mechanism to avoid stock out, whereas most 95.7% reported using FEFO as the preferred mechanism. 48.6% reported that the stock rotation mechanism employed is somewhat effective with 32 out of 70 reported that it is very effective. Table 3 below illustrates the findings in detail.

Table 3: Storage management

Variable	Frequency N (%)
Dedicated room for store	
Yes	70 (100.0)

Accuracy of inventory records	
Very accurate	23 (32.9)
Somewhat accurate	47 (67.1)
Frequency of conducting inventory inspections to verify records' accuracy	
Weekly	8 (11.4)
Monthly	62 (88.6)
Usage of the stock rotation mechanism	
Yes	69 (98.6)
No	1 (1.4)
Mechanism used	
First Expired, First Out (FEFO)	67 (95.7)
First In, First Out (FIFO)	2 (2.9)
Not applicable	1 (1.43)
Effectiveness of stock rotation mechanism implemented	
Very effective	32 (45.7)
Somewhat effective	34 (48.6)
Not effective	3 (4.3)
Not Implemented	1 (31.4)

Source: Own research work, 2025.

4.1.5 Inventory management

The frequency of stockouts in public health facilities varied, with 42.9% of respondents reporting experiencing stockouts "sometimes." The mean time it took to receive stock of essential medicines after a stockout was 3.4 days (SD = 1.7). Measures to prevent stockouts were reported to be used in 91.4% of the facilities, while 8.6% indicated the absence of such measures. Among those facilities with preventive measures, 48.6% reported performing "regular inventory inspection," while 20.0% mentioned "emergency ordering." Table 4 illustrates the results in detail.

Table 4: Inventory management

Variable	Frequency N (%)
Frequency of stock-outs	
Never	2 (2.9)
Rarely	17 (24.3)
Sometimes	30 (42.9)

Often	15 (21.4)
Always	6 (8.6)
Use measures to prevent stock-out	
Yes	64 (91.4)
No	6 (8.6)
The measure used to prevent stock-out	
Emergency ordering	14 (20.0)
Regular inventory inspection	34 (48.6)
Safety stock levels	8 (11.4)
Other	8 (11.4)
Not applicable	6 8.6)
Days it takes to reload stock after stock out	Mean 3.4 ± 1.7

Source: Own research work, 2025.

4.1.6 Delivery

"The average number of days to receive stock after pressing the order is 16.9 days (SD = 3.9). Delivery delays were reported to be experienced "sometimes" by 47.1% of the assessed facilities.

Table 5: Delivery delays experience

Variable	Frequency (%), N = 70
Experience delivery delays	
Sometimes	33 (47.1)
Rarely	26 (37.1)
Often	8 (11.4)
Never	3 (4.3)
Always	0 (0.0)
Days to receive stock after stock out	Mean 16.9 ± 3.9

Source: Own research work, 2025.

4.2 Supply chain performance

It is described on the effectiveness of actions that enable the delivery of health commodities in the appropriate amounts and quality, at the appropriate time, to improve patient outcomes in public health facilities at Pemba Island, Tanzania.

4.2.1 Supply chain performance levels

The supply chain performance scores were constructed from an assessment of four key dimensions: Stock Availability, Measuring Delivery, Inventory Management and Storage Management. Higher scores were assigned to favourable conditions, while lower scores corresponded to less desirable conditions (See questionnaire). To categorize the overall performance level, the total supply chain performance scores were evaluated against the mean score of 100 (SD = ± 8.9). Facilities scoring above the mean were classified as having "above average performance", whereas those scoring below the mean were categorized as "below average performance". The distribution of supply chain performance levels across the two regions in Pemba is illustrated in Figure 4 below.

Supply chain performance was evenly distributed among the assessed health facilities, with 50.0% classified as having above-average performance, while the other 50.0% fell into the below-average performance category. A higher proportion of facilities in Kusini Pemba (70.3%) were classified as having above-average performance compared to Kaskazini Pemba (27.3%) and the difference was statistically significant (Chi-square = 12.9, $p < 0.001$).

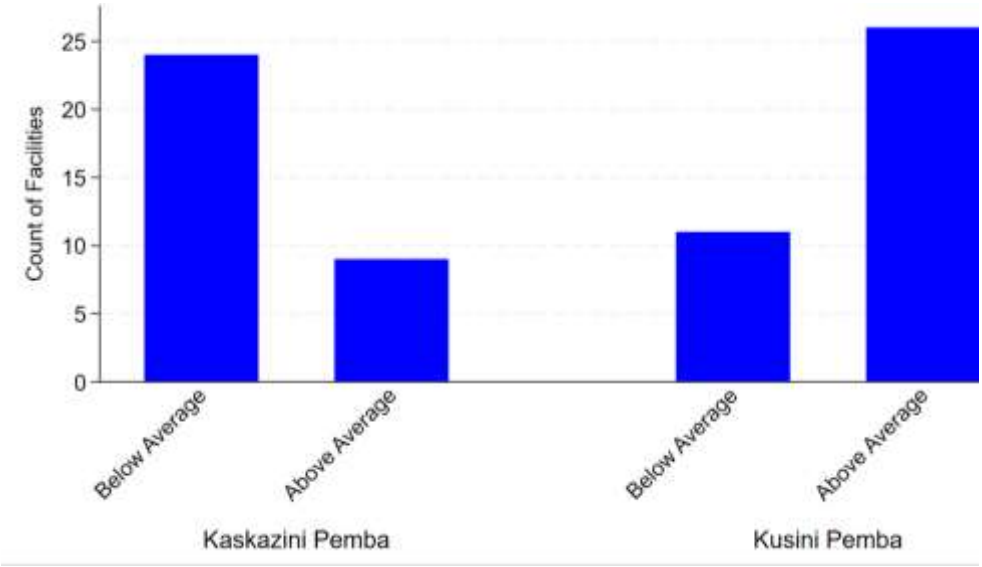

Figure 4: Supply chain performance across the regions in Pemba

Source: Own research work, 2025.

4.2.2 Effect of human resource on health supply chain performance

Among facilities with above-average performance, 45.5% had staff who had received formal training in supply chain management, compared to 66.7% of facilities without formal training. However, there was no statistically significant association between formal training and performance

levels (Fisher's Exact Test, p = 0.12). Staffing levels demonstrated a positive correlation with total supply chain performance scores, and this association was statistically significant (Spearman's rho = 0.41, p <0.01). In contrast, years of experience in supply chain management, which median is 2 years (IQR = 2 – 6 years), showed a marginal difference between above-average and below-average performers and the difference was not statistically significant (z = 1.823, p = 0.07). Confidence in stock management knowledge did not show a statistically significant association with supply chain performance levels (Fisher's exact test, p = 0.19). While individuals who reported being not confident in their stock management knowledge were exclusively in the below-average performance group, those who were somewhat confident (52.78%) and very confident (53.33%) were nearly evenly distributed between the two performance categories.

Table 6: Effect of human resource on health supply chain performance

Variable	Above-average supply chain performance	Below-average supply chain performance	Fisher's Exact Test
	N (%)	N (%)	
Formal Training			
Received	25 (45.5)	30 (54.6)	
Not received	10 (66.7)	5 (33.3)	0.12
Confidence in their knowledge of supply chain management			
Very confident	16 (53.3)	14 (46.7)	
Somewhat confident	19 (52.8)	17 (47.2)	
Not confident	0 (0.0)	4 (100.0)	0.19

Source: Own research work, 2025.

4.2.3 Effect of storage and delivery on health supply chain performance level

There was no significant association between the use of a stock rotation mechanism and supply chain performance levels (Fisher's exact test, p = 1.00). Most facilities (98.6%, 69 out of 70) reported implementing a stock rotation mechanism, with an almost equal distribution between below-average (97.1%) and above-average (100%) performers. Only one facility (1.4%) did not use a stock rotation mechanism, and it fell into the below-average performance category. Among facilities that often experienced delays, 37.5% (3 out of 8) achieved above-average performance,

while 65.4% (17 out of 26) of those who rarely experienced delays were classified as above-average performers. Similarly, 36.4% (12 out of 33) of facilities that sometimes experienced delays achieved above-average performance. The observed differences in performance levels across delay experience categories were statistically significant (Fisher's exact test, $p = 0.031$). The average lead time (in days) between facilities with below-average and above-average supply chain performance levels was significantly different ($t=2.89$, $p=0.005$).

Table 7: Effect of storage and delivery on health supply chain performance level

Variable	Above-average supply chain performance	Below-average supply chain performance	Statistical test results
	N (%)	N (%)	(P-value)
Stock rotation mechanism			
Implemented	35 (50.7)	34 (49.3)	
Not Implemented	0 (0.0)	1 (100.0)	1
Effectiveness of stock rotation mechanism			
Very effective	24 (75.0)	8 (25.0)	
Somewhat effective	11 (32.4)	23 (67.7)	
Not effective	0 (0.0)	3 (100.0)	
Not Implemented	0 (0.0)	1 (100.0)	**<0.01**
Delivery delays			
Never	3 (100.0)	0 (0.0)	
Rarely	17 (65.4)	9 (34.6)	
Sometimes	12 (36.4)	21 (63.6)	
Often	3 (37.5)	5 (62.5)	**0.031**
Lead time			
Mean days	18	23.2	**0.005**

Source: Own research work, 2025.

4.2.4 Effect of inventory control management on health supply chain performance

The frequency of stock-outs had a significant effect on supply chain performance (Fisher's exact test, p = 0.025). Facilities that always experienced stock-outs were more likely to have below-average performance (83.3%, 5 out of 6), with only 16.7% (1 out of 6) achieving above-average performance.

Similarly, among facilities that experienced stock-outs often, 40.0% (6 out of 15) had below-average performance, while 60.0% (9 out of 15) achieved above-average performance. In contrast, facilities that rarely experienced stock-outs had a higher likelihood of above-average performance (76.5%, 13 out of 17). The average number of days taken to receive stock after a stock-out appeared to affect supply chain performance levels such that facilities with below-average performance appeared to take slightly longer, 3.66 days (SD = 1.84) to receive stock after a stock-out compared to those with above-average performance, 3.01 days (SD = 1.68). The difference was not statistically significant

(p=0.15). The implementation of measures to prevent stock-outs was not significantly associated with supply chain performance levels (Fisher's exact test, p = 0.198). While most facilities (91.4%, 64 out of 70) reported implementing stock-out prevention measures, their performance distribution was nearly even, with 53.1% (34 out of 64) achieving above-average performance and 46.9% (30 out of 64) falling into the below-average category. Conversely, among facilities that did not implement stock-out prevention measures (8.6%, 6 out of 70), 83.3% (5 out of 6) had below-average performance.

Table 8: Effect of inventory control management on health supply chain performance

Variable	Above-average supply chain performance	Below-average supply chain performance	Statistical test results
	N (%)	N (%)	(P-value)
Experience of stock out			
Never	1 (50.0)	1 (50.0)	
Rarely	6 (42.9)	8 (57.1)	
Sometimes	10 (41.7)	14 (58.3)	
Often	2 (11.7)	15 (88.2)	
Always	2 (15.5)	11 (84.6)	0.1
Measures to prevent stakeouts			
Yes	17 (38.6)	27 (61.4)	
No	4 (15.4)	22 (84.6)	0.05
Time taken to receive stock after a stock out			
Mean days	6.6	8	0.22

Source: Own research work, 2025.

CHAPTER 5: DISCUSSION OF FINDINGS

Supply chain performance levels

The findings suggest a balanced distribution of medicine supply chain performance among health facilities, with half of the assessed facilities achieving above-average performance. However, a notable regional difference was observed, with Kusini Pemba exhibiting a significantly higher proportion of above-average performers compared to Kaskazini Pemba. This difference suggests potential regional differences in infrastructure, governance, or supply chain strategies that may influence performance in pharmaceutical supply chain management (40). Similar findings have been reported in studies assessing pharmaceutical supply chain efficiency in resource-limited settings, where regional disparities play an important role in performance outcomes (41).

Effect of human resource on health supply chain performance

"Human resource capacity emerged as a significant determinant of pharmaceutical supply chain performance. While formal training in pharmaceutical supply chain management was more dominant in below-average performing facilities compared to above-average performers, the lack of statistical significance suggests that other factors beyond training may influence performance outcomes. This is consistent with findings by Donkor et al. (2021), which indicate that while training is crucial, its direct impact on supply chain efficiency is often mediated by experience, managerial competencies, and systemic challenges (42)".

Staffing levels, however, showed a positive correlation with pharmaceutical supply chain performance, supporting existing literature that identifies workforce adequacy as a critical enabler of pharmaceutical supply chain efficiency (45,46). Conversely, confidence in stock management knowledge did not significantly influence performance, despite evidence suggesting that confidence levels among personnel may affect decision-making quality in inventory control (45,46). This discrepancy may be attributed to factors such as primary healthcare facilities often operate within highly standardized and protocol-driven inventory systems, limiting the extent to which individual decision-making impacts overall pharmaceutical supply chain performance. In such environments, external constraints including procurement policies and supplier reliability may play a more dominant role than personnel confidence.

Effect of storage and delivery on health supply chain performance

The study found that stock rotation mechanisms were almost universally implemented in the assessed facilities, yet their presence did not significantly affect performance levels. This suggests that while stock rotation is standard practice, its impact on pharmaceutical supply chain outcomes may be minimal unless combined with other robust inventory management strategies (47,48). In contrast, delivery delays and lead times had a more pronounced effect on pharmaceutical supply chain performance. Facilities experiencing fewer delays were more likely to achieve above-average performance. "The significant difference in lead time between below-average and above-average performers aligns with previous studies that emphasized the important role of timely delivery in mitigating stock-outs and enhancing pharmaceutical supply chain resilience (16,27)". This finding corroborates studies in low-resource settings, where lead time variability is identified as a major challenge to pharmaceutical supply chain reliability (49).

Effect of inventory control management on health supply chain performance

Stock-out frequency was a key determinant of pharmaceutical supply chain performance, with facilities experiencing frequent stock-outs being more likely to fall into the below-average performance category. This finding is consistent with previous research highlighting stock-outs as a primary driver of poor supply chain performance in healthcare systems (52). Interestingly, while most facilities implemented stock-out prevention measures, their effectiveness did not significantly impact performance (53). This suggests that while preventive measures are widely adopted, their implementation quality or alignment with broader supply chain strategies may vary. Comparative studies have shown that stock-out prevention effectiveness is highly dependent on real-time demand forecasting and supplier coordination (17,54). The time taken to receive stock after a stock-out did not significantly differ between performance groups. This is consistent with findings by Chang et al. (2019), which suggest that while replenishment speed is important, systemic inefficiencies in procurement and distribution networks may limit its impact on overall pharmaceutical supply chain performance (16).

Study limitations

This study was limited by its design, a cross-sectional design which precludes causal inferences. Future research should explore these findings with larger, more diverse samples (doing in both Unguja and Pemba) and longitudinal design to better understand the dynamics of pharmaceutical supply chain performance.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

CONCLUSION

This study highlights key factors influencing pharmaceutical supply chain performance in primary healthcare facilities, showing regional disparities, human resource challenges, and logistical inefficiencies. “Given these findings, a more systematic approach integrating human resource capacity-building, pharmaceutical supply chain digitalisation and region-specific interventions is important for enhancing pharmaceutical supply chain management in Pemba”.

RECOMMENDATIONS

To improve pharmaceutical supply chain performance at primary healthcare facilities, the following should be done;

1. Regional disparities should be dealt with by tailoring supply chain strategies to specific infrastructural and governance challenges available.

2. Human resource capacity should be strengthened through a shift from training-based interventions to experience-driven competency-building, alongside optimising staffing levels.

3. Future studies should adopt a mixed methods approach to gain a better understanding of pharmaceutical supply chain performance in Zanzibar.

4. These studies should extend beyond the specific zone (Pemba) to include the entire Zanzibar Island, allowing for a comparative analysis of systemic challenges, infrastructure disparities, and governance structures in pharmaceutical supply chain management in the Island.

REFERENCES

1. Mount Kenya University, Kamanzi D. Supply Chain Management Practices and Quality Performance of Butaro Level II Teaching Hospital. J Procure Supply Chain. 2023 Jun 29;7(1):64–87.
2. Lugada E, Ochola I, Kirunda A, Sembatya M, Mwebaze S, Olowo M, et al. Health supply chain system in Uganda: assessment of status and of performance of health facilities. J Pharm Policy Pract. 2022 Oct 5;15(1):58.
3. Singh CD, Singh R, Mand JS, Singh S. APPLICATION OF LEAN AND JIT PRINCIPLES IN SUPPLY CHAIN MANAGEMENT. 2013;
4. Xiao Q, Khan MS. Exploring factors influencing supply chain performance: Role of supply chain resilience with mixed method approach empirical evidence from the Chinese healthcare Sector. Cogent Bus Manag. 2024 Dec 31;11(1):2287785.
5. Milulu A, Mwita S, Basinda N. Electronic Logistic Management Information System in Public Health Facilities and Its Implications for the Medicine Supply Chain in Singida District Council, Tanzania. 2024;
6. Eliakimu H. PHARMACEUTICAL LOGISTICS SYSTEM PERFORMANCE OF PUBLIC HEALTH FACILITIES IN PEMBA. 2013;
7. Alemu AA, Fenta TG, Gebregeorgise DT. Factors Affecting Inventory Management Performance of Tracer Medicines Across Primary Health Care Units, Gamo Zone, Southern Nations Nationalities and People's Region, Ethiopia. Integr Pharm Res Pract. 2023 Feb;Volume 12:49–60.
8. Xiong T. The analysis of the impact of different supply chain factors using statistical perspective. Appl Comput Eng. 2024 Aug 14;87(1):241–9.
9. Lugada E, Ochola I, Kirunda A, Sembatya M, Mwebaze S, Olowo M, et al. Health supply chain system in Uganda: assessment of status and of performance of health facilities. J Pharm Policy Pract. 2022 Oct 5;15(1):58.
10. Tien NH, Anh DH, Thuc TD. Global Supply Chain And Logistics Management.
11. Kanda MK, Iravo MA. Access Factors Affecting Supply Chain Efficiency of Medical Supplies in public Health Centers in Kenya: A Case Study of Public Health Centers in Elgeyo Marakwet Count. Int J Acad Res Account Finance Manag Sci. 2015 Jun 19;5(2):Pages 32-41.
12. Adhikari B, Ranabhat K, Khanal P, Poudel M, Marahatta SB, Khanal S, et al. Procurement process and shortages of essential medicines in public health facilities: A qualitative study from Nepal. Robinson J, editor. PLOS Glob Public Health. 2024 May 2;4(5):e0003128.
13. Ajulong MG, Okiria JC, Owako M. Factors Influencing Annual Procurement Planning of Medicines and Medical Supplies in Public Health Facilities in Kampala District. Rwanda J Med Health Sci. 2021 Sep 10;4(2):292–309.
14. Johnson A, Peter K, Shital M. Inventory Management Practices and Supply Chain Performance of Antiretroviral Medicines in Public Hospitals in Nyamira County, Kenya. Rwanda J Med Health Sci. 2021 Sep 10;4(2):257–68.
15. Lugada E, Komakech H, Ochola I, Mwebaze S, Olowo Oteba M, Okidi Ladwar D. Health supply chain system in Uganda: current issues, structure, performance, and implications for systems strengthening. J Pharm Policy Pract. 2022 Dec;15(1):14.
16. Bilal AI, Bititci US, Fenta TG. Effective Supply Chain Strategies in Addressing Demand and Supply Uncertainty: A Case Study of Ethiopian Pharmaceutical Supply Services. Pharmacy. 2024 Aug 28;12(5):132.
17. Olaniran A, Briggs J, Pradhan A, Bogue E, Schreiber B, Dini HS, et al. Stock-outs of essential medicines among community health workers (CHWs) in low- and middle-income countries

(LMICs): a systematic literature review of the extent, reasons, and consequences. Hum Resour Health. 2022 Jul 15;20(1):58.
18. Kar S, Mohanty MK, Thakurta PKG. Efficient healthcare supply chain: A prioritized multi-task learning approach with task-specific regularization. Engineering Applications of Artificial Intelligence. Available from: https://ouci.dntb.gov.ua/en/works/loDwwRj9/
19. Meier E, Brown AN, McHenry B, Buki IKG, Egharevba M, Kabatende J. Labor markets for health supply chain management in Rwanda: a qualitative study of stakeholder perspectives. BMC Health Serv Res. 2023 Dec 7;23(1):1376.
20. Vledder M, Friedman J, Sjöblom M, Brown T, Yadav P. Improving Supply Chain for Essential Drugs in Low-Income Countries: Results from a Large Scale Randomized Experiment in Zambia. Health Syst Reform. 2019 Apr 3;5(2):158–77.
21. Jobira T, Abuye H, Jemal A, Gudeta T. Assessment of Knowledge, Practices, and Challenges of Pharmaceuticals Inventory Control Among Pharmacy Professionals Working in Selected Public Health Facilities of West Arsi Zone, Oromia, Ethiopia. Health Serv Insights. 2022 Jan;15:11786329211066403.
22. Ruhago GM, Ngalesoni FN, Msasi D, Kengia JT, Mganga M, Kapologwe NA, et al. The public health sector supply chain costs in Tanzania. Haghparast Bidgoli H, editor. PLOS Glob Public Health. 2022 Nov 28;2(11):e0000960.
23. Fredrick EJ. FACTORS INFLUENCING PERFORMANCE IN PHARMACEUTICAL SUPPLY CHAIN; A CASE OF MEDICAL STORES DEPARTMENT (MSD) IN DAR ES SALAAM REGION. Pharm SUPPLY CHAIN.
24. Alemu AA, Fenta TG, Gebregeorgise DT. Public Health Supply Chain Performance of Primary Health Care Units, Gamo zone, SNNPR, Ethiopia [Internet]. 2022 [cited 2025 Mar 8]. Available from: https://www.researchsquare.com/article/rs-1897846/v1
25. Fredrick EJ. FACTORS INFLUENCING PERFORMANCE IN PHARMACEUTICAL SUPPLY CHAIN; A CASE OF MEDICAL STORES DEPARTMENT (MSD) IN DAR ES SALAAM REGION. Pharm SUPPLY CHAIN.
26. Chukwu OA, Chukwu U, Lemoha C. Poor performance of medicines logistics and supply chain systems in a developing country context: lessons from Nigeria. 2019 Oct 14; Available from: https://academic.oup.com/jphsr/article-abstract/9/4/289/6068323
27. Cuvero M, Pilkington A, Barnes D. Supply Chain Management and Resilience During Disruption. Evaluation of the Covid-19 Pandemic on the Supply of Personal Protective Equipment. In: 2021 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM) [Internet]. Singapore, Singapore: IEEE; 2021 [cited 2025 Mar 9]. p. 233–7. Available from: https://ieeexplore.ieee.org/document/9672913/
28. Overview of Drug Availability and Influencing Factors in Several Low, Lower and Upper-Middle Countries: A Systematic Review.
29. Miseda MH, Were SO, Murianki CA, Mutuku MP, Mutwiwa SN. The implication of the shortage of health workforce specialist on universal health coverage in Kenya. Hum Resour Health. 2017 Dec;15(1):80.
30. Sirili N, Kiwara A, Nyongole O, Frumence G, Semakafu A, Hurtig AK. Addressing the human resource for health crisis in Tanzania: the lost in transition syndrome. Tanzan J Health Res [Internet]. 2014 May 14 [cited 2025 Mar 8];16(2). Available from: http://www.ajol.info/index.php/thrb/article/view/91057
31. Peter J. ASSESSMENT OF INVENTORY MANAGEMENT PRACTICES ON THE PERFORMANCE OF PUBLIC HOSPITAL IN MWANZA REGION A CASE STUDY OF SEKOU TOURE REGIONAL HOSPITAL.

32. Bahiru Tefera B, Tilahun Anbessa G. Pharmaceutical Supply Chain Practices and Its Associated Factors in Public Health Facilities, West Gojjam Zone, Ethiopia: Cross-Sectional Study. Hosp Pharm. 2022 Oct;57(5):622–32.
33. Dr Sabine Kopp,. GOOD STORAGE AND DISTRIBUTION PRACTICES FOR MEDICAL PRODUCTS [Internet]. 2019. Available from: https://iris.who.int/bitstream/handle/10665/330887/DI332-194-225-eng.pdf
34. Charlotte AKINGENEYE, Dr. Vedaste HABYALIMANA. ASSESSMENT OF STORAGE CONDITIONS OF PHARMACEUTICAL PRODUCTS IN RWANDA Case of Rwanda Biomedical Center / Medical Procurement and Production Division and District Pharmacies. 2019 Oct 14;58.
35. Getahun H, Belew S, Hasen G, Tefera Mekasha Y, Suleman S. Assessment of the extent and monetary loss in the selected public hospitals in Jimma Zone, Ethiopia: expired medicine perspectives. Front Med. 2024 Feb 15;11:1283070.
36. The 2022 Population and Housing Census Initial Results [Internet]. 2022. Available from: https://www.nbs.go.tz/uploads/statistics/documents/sw-1720088450-2022%20PHC%20Initial%20Results%20-%20English.pdf
37. Wang X, Cheng Z. Cross-Sectional Studies. Chest. 2020 Jul;158(1):S65–71.
38. Tejada JJ, Punzalan JRB. On the Misuse of Slovin's Formula. 2012;61(1).
39. Anugraheni TD, Izzah L, Hadi MS. Increasing the Students' Speaking Ability through Role-Playing with Slovin's Formula Sample Size. J Studi Guru Dan Pembelajaran. 2023 Dec 30;6(3):262–72.
40. Feyisa D, Jemal A, Aferu T, Ejeta F, Endeshaw A. Evaluation of Cold Chain Management Performance for Temperature-Sensitive Pharmaceuticals at Public Health Facilities Supplied by the Jimma Pharmaceuticals Supply Agency Hub, Southwest Ethiopia: Pharmaceuticals Logistic Management Perspective Using a Multicentered, Mixed-Method Approach. Abdulah R, editor. Adv Pharmacol Pharm Sci. 2021 Sep 14;2021:1–13.
41. Maluleke K, Musekiwa A, Kgarosi K, Gregor EM, Dlangalala T, Nkambule S, et al. A Scoping Review of Supply Chain Management Systems for Point of Care Diagnostic Services: Optimising COVID-19 Testing Capacity in Resource-Limited Settings. Diagnostics. 2021 Dec 8;11(12):2299.
42. Frank Donkor, Thanos Papadopoulos, Virginia Spiegler. The supply chain integration – Supply chain sustainability relationship in the UK and Ghana pharmaceutical industry: A stakeholder and contingency perspective. 2021 Nov;Volume 155, November 2021, 102477. Available from: https://www.sciencedirect.com/science/article/abs/pii/S1366554521002404
43. Haji M, Kerbache L, Sheriff KMM, Al-Ansari T. Critical Success Factors and Traceability Technologies for Establishing a Safe Pharmaceutical Supply Chain. Methods Protoc. 2021 Nov 22;4(4):85.
44. Dixit A, Routroy S, Dubey SK. Analysis of government-supported health-care supply chain enablers: a case study. Emerald Publ Ltd. 2019 Jun 26;
45. Bruccoleri M, Cannella S, La Porta G. Inventory record inaccuracy in supply chains: the role of workers' behavior. Int J Phys Distrib Logist Manag. 2014 Nov 3;44(10):796–819.
46. Du Plessis M. Reinforcement learning for inventory management in information-sharing pharmaceutical supply chains. Stellenbosch Univ Httpsscholarsunacza [Internet]. Available from: https://scholar.sun.ac.za/server/api/core/bitstreams/a17b4067-44b4-4180-8850-145f6dc073c6/content
47. Papalexi M, Bamford D, Nikitas A, Breen L, Tipi N. Pharmaceutical supply chains and management innovation? Supply Chain Manag Int J. 2022 May 6;27(4):485–508.

48. Wangari KL. INFLUENCE OF INVENTORY MANAGEMENT PRACTICES ON ORGANIZATIONAL COMPETITIVENESS: A CASE OF SAFARICOM KENYA LTD. Open Access. 1(5).
49. Shieshia M, Noel M, Andersson S, Felling B, Alva S, Agarwal S, et al. Strengthening community health supply chain performance through an integrated approach: Using mHealth technology and multilevel teams in Malawi. J Glob Health [Internet]. 2014 Dec [cited 2025 Mar 9];4(2). Available from: http://www.jogh.org/documents/issue201402/Shieshia_FINAL.pdf
50. Kuupiel D, Tlou B, Bawontuo V, Drain PK, Mashamba-Thompson TP. Poor supply chain management and stock-outs of point-of-care diagnostic tests in Upper East Region's primary healthcare clinics, Ghana. Hsiao N yuan, editor. PLOS ONE. 2019 Feb 27;14(2):e0211498.
51. Gaukler GM. Preventing avoidable stockouts: the impact of item-level RFID in retail. Pelton LE, editor. J Bus Ind Mark. 2010 Oct 12;25(8):572–81.
52. Bilal AI, Bititci US, Fenta TG. Challenges and the Way Forward in Demand-Forecasting Practices within the Ethiopian Public Pharmaceutical Supply Chain. Pharmacy. 2024 May 31;12(3):86.

Table 9: Work plan

S/N	ACTIVITIES	DURATION												
		Aprl 24	**May 24**	**Jun 24**	**Jul 24**	**Aug 24**	**Sep 24**	**Oct 24**	**Nov 24**	**Dec 24**	**Jan 25**	**Feb 25**	**Mar 25**	**Aprl 25**
1	Proposal development and writing													
2	Proposal Presentation and submission for Ethical clearance													
3	Data collection													
4	Data analysis													
5	Dissertation report writing													
6	Dissertation Submission													
7	Defending													

Source: Own research work, 2025.

Table 10: research budget

S/N	Items	Units	Quantity	Unit cost	Cost (TZS)	Cost (Euro)
1	**EQUIPMENT**					
	Writing pad (Notebook)	Pcs	8	2,000	16,000	5
	Writing Pen	Boks	1	3,500	3,500	1
	Printing plain paper	Rim	6	20,000	120,000	40
	Flash Disk	Pcs	2	50,000	100,000	33
	Anti-virus Software	Pcs	1	60,000	60,000	20
	Sub-total				**299,500**	**100**
2	**TRAVEL/TRANSPORT**					
	Field Transport (Fuels)	Litters	172	3,500	602,000	200
	sub-total				**602,000**	**200**
3	**TRAINING AND WORKSHOP**					
	Venue	Each	1	100,000	100,000	33
	Refreshments (2 days for 8 participants)	Each	16	11,000	176,000	58
	Allowance (2 days for 8 participants)	Each	16	20,000	320,000	106
	Sub-total				**596,000**	**198**
4	**RESEARCH**					
	(I) PROPOSAL DEVELOPMENT					
	Internet package	Each	1	50,000	50,000	17
	Printing and Binding	Pcs	4	18,000	72,000	24
	Sub-total				**122,000**	**41**
	(II) DATA COLLECTION AND ANALYSIS					
	Software installation for collection	Each	1	200,000	200,000	66
	Allowance for data collectors	Each	8	100,000	800,000	266
	Data analyst(statistician)	Each	1	350,000	350,000	116
	Sub-total				**1,350,000**	**449**
	(III) DISSERTATION REPORT AND PUBLICATION					
	Printing and binding of dissertation	Pcs	4	25,000	100,000	33
	Manuscript preparation	Pcs	2	25,000	50,000	17
	Article Processing Charges and Publication	Pcs	1	2,900,000	2,900,000	964
	Sub-total				**3,050,000**	**1,014**
	Sub-total for Research				**4,522,000**	**1,503**
	GRAND TOTAL				**6,019,500**	**2,000**

Source: Own research work, 2025.

APPENDICES

Appendix 1: Questionnaire

QUESTIONNAIRE (English version)

Data collection tool on

Questionnaire number……

HEALTH FACILITY DETAILS		
S/N	**Question**	**Description**
2	Facility type	
3	District	
4	Region	

SECTION A: Characteristics of Supply chain personnel

Please mark the relevant box by putting a **TICK (√).**

1. Professional of respondent
   i. Pharmaceutical Personnel ( )
   ii. Clinical Medicine ( )
   iii. Laboratory Personnel ( )
   iv. Nurse ( )
   v. Others ( )
2. Qualification
   i. Certificate ( )
   ii. Diploma ( )
   iii. Bachelor's degree ( )
   iv. Master's degree ( )
3. How many years of experience do you have, doing health supply chain management? _____
4. Total number of staff in pharmacy/store _____
5. Have you received any formal training in supply chain management?

   [ ] Yes

   [ ] No

If yes, please specify the type of training:

[ ] Workshops

[ ] Seminars

[ ] Formal courses

[ ] On-the-job training

[ ] Other (please specify): _____

6. How confident are you in your knowledge of stock management procedures (e.g., ordering, receiving, storing)?

[ ] Very confident

[ ] Somewhat confident

[ ] Not confident

7. Are you knowledgeable about different inventory control techniques?

[ ] Yes

[ ] No

If yes, please specify which technique(s) you are familiar with: _____

SECTION B: STOCK AVAILABILITY

1. Are all essential medicines available as per the national Standard Treatment Guidelines (STG)?

[ ] Yes (10 points)

[ ] No (0 points)

If NOT, list the essential medicines that are currently out of stock, fill in the checklist below;

2. On average, how often do you review stock levels for essential medicines?

[ ] Daily (10 points)

[ ] Weekly (7 points)

[ ] Monthly (4 points)

[ ] Other (please specify): _____ (2 points)

SECTION C: MEASURING DELIVERY

1. What is the average lead time (in days) from placing an order to receiving the medicines?

Days = _____ (Less than 14 days: **10 points**; 14-21 days: **7 points**; More than 21 days: **4 points**)

2. How often do you experience delays in the delivery process?

[ ] Never (10 points)

[ ] Rarely (8 points)

[ ] Sometimes (5 points)

[ ] Often (3 points)

[ ] Always (0 points)

3. What are the common reasons for delivery delays? (Select all that apply)

[ ] Supplier issues

[ ] Transportation problems

[ ] Administrative delays

[ ] don't understand

[ ] Other (please specify): _____

SECTION D: INVENTORY MANAGEMENT

1. How frequently do you experience stock-outs of essential medicines?

[ ] Never (10 points)

[ ] Rarely (8 points)

[ ] Sometimes (5 points)

[ ] Often (3 points)

[ ] Always (0 points)

2. On average, how long does it take to reload stock after a stock-out?

Days = _____ (Less than 3 days: **10 points**; 3-7 days: **7 points**; More than 7 days: **4 points**)

3. Are there measures in place to prevent stock-outs?

[ ] Yes (10 points)

[ ] No (0 points)

If yes, please specify (do not mention), if any is mentioned + 4 points:

[ ] Safety stock levels

[ ] Regular inventory inspection

[ ] Emergency ordering

[ ] Other (please specify): _____

SECTION E: STORAGE MANAGEMENT

1. Is there a dedicated store for pharmaceutical storage?

[ ] Yes (10 points)

[ ] No (0 points)

If **yes**, fill in the observational checklist below.

2. How accurate are your inventory records?

[ ] Very accurate (10 points)

[ ] Somewhat accurate (7 points)

[ ] Not accurate (3 points)

[ ] Don't know (0 points)

3. How often do you conduct inventory inspections to verify records' accuracy?

[ ] Weekly (10 points)

[ ] Monthly (8 points)

[ ] Quarterly (5 points)

[ ] Annually (3 points)

[ ] Other (please specify): _____ (2 points)

4. Do you use any stock rotation mechanism do you use?

[ ] Yes (10 points)

[ ] No (0 points)

If yes, please specify (do not mention), if any is mentioned + 4 points:

[ ] First Expired, First Out (FEFO)

[ ] First In, First out (FIFO)

5. How effectively is the stock rotation mechanism implemented?

[ ] Very effective (10 points)

[ ] Somewhat effective (7 points)

[ ] Not effective (3 points)

[ ] Not Implemented ***(this selection is also fixed for those who select No in Qn 4 of this section)*** (0 points)

Appendix 2: Checklist for Stock out Essential Medicine

S/N	ESSENTIAL MEDICINE

Appendix 3: Observation checklist for facilities storage condition

NOTE: Put "0" if the statement is NO, and "1" if the Statement is YES

S/N	STATEMENTS	CODE 0=NO 1= YES
1	Are there adequate shelves?	
	Are there adequate Pallets?	
2	Are the products arranged appropriately?	
3	Are products being stored/issued according to FEFO?	
4	Is there adequate security in the store room and dispensing area (locks, windows barred, etc)?	
5	Are the damaged and/or expired products separated /removed from usable products?	
6	Are products protected from direct sunlight?	
7	Are the products stored at the appropriate temperature?	
8	Does the storeroom have sufficient ventilation (i.e. A/C, fan, window)?	
9	Are there any refrigerators for storing cold chain health commodities?	

Appendix 4: Dodoso

QUESTIONNAIRE (Kiswahili version)

Chombo cha kukusanyia data

Namba ya Dododso……

TAARIFA YA KITUO CHA KUTOLEA HUDUMA ZA AFYA		
S/N	**Swali**	**Maelezo**
1	Jina	
2	Aina ya kituo	
3	Wilaya	
4	Mkoa	

SEHEMU A: Sifa za Wafanyikazi wa Mnyororo wa Ugavi

Tafadhali weka alama kwenye kisanduku husika kwa kuweka TICK (√).

1. Taaluma

i. Fundi sanifu Madawa ( )

ii. Afisa Tabibu ( )

iii. Fundi sanifu Maabara ( )

iv. Muuguzi ( )

v. Muhudumu wa Afya ( )

vi. Nyingine ( )

2. Sifa

i. Cheti ( )

ii. Diploma ( )

iii. Shahada ya kwanza ( )

iv. Shahada ya Uzamili ( )

3. Miaka ya uzoefu (katika taaluma yako) _____

4. Je, una uzoefu wa miaka mingapi katika usimamizi wa mnyororo wa ugavi wa bidhaa za Afya? _____

5. Jumla ya idadi ya wafanyakazi wa kada ya Madawa katika ghala _____

6. Je, ulishawahi kupata mafunzo yoyote rasmi katika usimamizi wa ugavi?

[ ] Ndiyo

[ ] Hapana

Ikiwa ndio, tafadhali taja aina ya mafunzo:

[ ] Warsha

[ ] Semina

[ ] Kozi rasmi

[ ] Mafunzo ya kazini

[ ] Nyingine (tafadhali taja): _____

6. Je, ni kwakiasi gani ujuzi wako wa usimamizi wa bidhaa za Afya (k.m., kuagiza, kupokea, kuhifadhi)?

[ ] Kujiamini sana

[ ] Kujiamini kwa kiasi fulani

[ ] Sijiamini

7. Je, una ujuzi kuhusu mbinu tofauti za udhibiti wa bidhaa?

[ ] Ndiyo

[ ] Hapana

Kama ndiyo, tafadhali taja mbinu/mbinu gani unazozifahamu: _____

SEHEMU B: UPATIKANAJI WA BIDHAA

1. Je, dawa zote muhimu zinapatikana kwa mujibu wa Kanuni za Kitaifa za Tiba (STG)?

[ ] Ndiyo (alama 10)

[ ] Hapana (pointi 0)

Kama Hapana: Orodhesha dawa muhimu ambazo hazipo kwa sasa, kwenye kiambatanisho hapa chini, Jadweli namba 3;

2. Kwa wastani, gani unahakiki bidhaa za dawa muhimu kwenye ghala yako?

[ ] Kila siku (pointi 10)

[ ] Kila wiki (alama 7)

[ ] Kila mwezi (pointi 4)

[ ] Nyingine (tafadhali taja): _____ (alama 2)

SEHEMU C: KUPIMA UPATIKANAJI WA BIDHAA

1. Je, Inachukua mda gani kutoka kupeleka maombi mpaka kupokea mzigo wa dawa?

Siku = _____

(Chini ya siku 14: alama 10; siku 14-21: alama 7; Zaidi ya siku 21: alama 4)

2. Ni mara ngapi unakumbana na ucheleweshaji wa upokeaji wa mzigo wa dawa?

[ ] haijawahi (alama 10)

[ ] Mara chache (alama 8)

[ ] Wakati mwingine (alama 5)

[ ] Mara nyingi (alama 3)

[ ] Siku zote (alama 0)

3. Je, ni sababu gani za kawaida za ucheleweshaji wa upokeaji wa dawa? (Chagua zote zinazotumika)

[ ] changamoto ya wasambazaji

[ ] Matatizo ya usafiri

[ ] Changamoto za kiutawala

[ ] Sielewi

[ ] Nyingine (tafadhali taja): _____

SEHEMU YA D: USIMAMIZI WA HUDUMA

1. Ni mara ngapi unapata upungufu wa dawa muhimu?

[ ] Haijawahi (alama 10)

[ ] Mara chache (alama 8)

[ ] Wakati mwingine (alama 5)

[ ] Mara nyingi (alama 3)

[ ] Siku zote (alama 0)

2. Kwa wastani, inachukua muda gani kupokea dawa muhimu baada ya kufanya maombi ya dharura?

Siku = _____

(Chini ya siku 3: alama 10; siku 3-7: alama 7; Zaidi ya siku 7: alama 4)

3. Je, kuna hatua zinazochukuliwa kuzuia kumalizika kwa dawa kabla ya wakati?

[ ] Ndiyo (alama 10)

[ ] Hapana (alama 0)

Kama ndiyo, tafadhali taja (alama 4)

[ ] Kuwa na kiwango chakutosha cha bidhaa

[ ] Ukaguzi wa mara kwa mara wa bidhaa

[ ] Maombi ya dharura

[ ] Nyingine (tafadhali taja): _____

SEHEMU E: USIMAMIZI WA GHALA

1. Je, kuna sehemu maalumu iliyotengwa kwa ajili ya kuhifadhia dawa?

[ ] Ndiyo (alama 10)

[ ] Hapana (alama 0)

Kama ndiyo, jaza kiambatanisha cha uchunguzi hapa chini, Jadweli namba 4.

2. Rekodi zako za bidhaa sahihi kwa kiasi gani?

[ ] Sahihi sana (alama 10)

[ ] Sahihi kwa kiasi (alama 7)

[ ] Sio sahihi (alama 3)

[ ] Sijui (alama 0)

3. Je, ni mara ngapi unafanya ukaguzi bidhaa ili kuthibitisha usahihi wa rekodi zako?

[ ] Kila wiki (alama 10)

[ ] Kila mwezi (alama 8)

[ ] Kila robo (alama 5)

[ ] Kila mwaka (alama 3)

[ ] Nyingine (tafadhali taja): _____ (alama 2)

4. Je, unatumia utaratibu wowote katika utoaji wa bidhaa?

[ ] Ndiyo (alama 10)

[ ] Hapana (alama 0)

Kama ndiyo, tafadhali taja

[ ] Bidhaa inayo maliza muda wake wa matumizi mwanzo ndo inatoka mwanzo (FEFO)

[ ] Bidhaa inayo ingia mwanzo, ndo inayotoka mwanzo (FIFO)

[ ] Bidhaa iliyoingia Mwisho ndio inayo toka mwanzo (LIFO)

5. Utaratibu wa utoaji wa bidhaa unaongeza ufanisi kwa kiasi gani?

[ ] Inafaa sana (alama 10)

[ ] Inafaa kwa kiasi fulani (alama 7)

[ ] Haifai (alama 3)

[ ] Haijatekelezwa (alama 0)

Appendix 5: Taarifa ya Dawa muhimu ambazo hazipo kituoni kwa sasa

S/N	JINA LA DAWA		S/N	JINA LA DAWA

Appendix 6: Kuangalia hali ya Ghala ya kuhifadhia Dawa

Kumbuka: Weka "0" kama statement ni NO, and "1" kama ststment ni YES

S/N	**STATEMENTS**	**CODE** **0=NO** **1= YES**
1	Je, kuna selves zakutosha?	
	Je, kuna paleti zakutosha?	
2	Je bidhaa zimepangwa kwa utaratibu ulio mzuri	
3	Je, bithaa zimepangwa au kutolewa kwa mujibu wa FEFO?	
4	Je, kuna usalama wa kutosha katika chumba cha kuhifadhi na eneo la kutolea bidhaa (kufuli, madirisha yenye kizuizi, n.k)?	
5	Je, bidhaa zilizo haribika au kumaliza muda wake wa matumizi zimeondolewa au kutenganishwa na bidhaa zinazotumika?	
6	Je, bidhaa zimekingwa kutokana na muangaza wa jua?	
7	Je, bidhaa huhifadhiwa katika halijoto inayofaa wakati wa misimu yote kulingana na vipimo vya halijoto ya bidhaa?	
8	Je, chumba cha kuhifadhi bidhaa kina ingiza hewa yakutosha (yaani kina A/C, feni, dirisha)?	
9	Je, kuna jokofu zozote za kuhifadhia bidhaa za mnyororo baridi?	

Appendix 7: Participant study consent form (English Version)

Hello!

I am HASSAN ALI SAID, a student from the University of Rwanda, pursuing a Master of Health Supply Chain Management.

Purpose of the study
The purpose of this study is to determine the factors affecting health supply chain performance in public health facilities at Pemba Island, Tanzania.

Participation
You will be required to respond to all questions asked by the investigator if you consent to this study.

Confidentiality
All your information provided in this study will be considered private and used only for this study.

Risk
Participants in this study are not anticipated to suffer any negative consequences

Withdrawal statement
"Participation in this research is entirely voluntary. There will be no consequences if you decide to discontinue your participation in the study or not to participate. Even if you have already consented, you can withdraw from this study at any time. You will not be penalized or forfeit any rewards you would otherwise be entitled to if you choose not to participate in or withdraw from the study".

Benefits
By taking part in this survey, you will help us understand how the health supply chain performance is going, what factors may affect it, and how we may improve it in the public health facilities on Pemba Island, Tanzania.

Who to Contact
For anything, please be in touch with me for the following contact.

Hassan Ali Said (Principal investigator)
hassanallysaid@gmail.com
Mobile no: +255656677171
University of Rwanda

OR

ZAHREC contact person
Chairperson +255777432911
Secretariat +255776264880

OR

Dr. Ernest Lomnyak Moses
Research Supervisor
Mobile no: +255692914383
Dar es Salaam Maritime Institute
P. O. Box 80069
Dar es Salaam
Tanzania

OR
Dr. Domina Asingizwe
Adomina23@gmail.com
Research Coordinator
EAC RCE-VIHSCM

Please write "YES" if you accept to participate …….

Participant signature ……

Principal investigator signature ……

Date…….

Appendix 8: Ridhaa ya mshiriki wa utafiti (Swahili version)

Habari!

Mimi ni HASSAN ALI SAID, mwanafunzi wa Shahada ya Uzamili kwa upande wa mnyororo wa ugavi kuhusiana na mambo ya afya kutoka Chuo Kikuu cha Rwanda.

Madhumuni ya utafiti

Utafiti huu unalenga kubainisha mambo yanayoathiri utendaji wa mnyororo wa ugavi wa afya katika vituo vya afya vya umma katika Kisiwa cha Pemba, Tanzania.

Kushiriki

Endapo ukikubali kushiriki katika utafiti, utahitajika kujibu maswali yote yatakayo ulizwa na mtafiti.

Usiri

Taarifa za ushiriki wako zitawekwa siri na zitatumika tu kwa utafiti huu.

Hatari

Hakuna madhara yanayotarajiwa kutokea kwa yeyote anayeshiriki katika utafiti huu.

Haki ya kujiondoa kwenye utafiti au vinginevyo

“Kushiriki katika utafiti huu ni chaguo lako kabisa. Ukichagua kutoshiriki katika utafiti au ukiamua kuacha kushiriki katika utafiti hutapata madhara yoyote. Unaweza kuacha kushiriki katika utafiti huu wakati wowote, hata kama tayari umekubali. Kukataa kushiriki au kujitoa kwenye utafiti hakutahusisha adhabu au hasara ya manufaa yoyote ambayo unastahiki kuyapata”.

Faida

Kwa kushiriki katika utafiti huu, utatusaidia kuelewa jinsi utendaji wa mnyororo wa usambazaji wa afya unavyoendelea, ni mambo gani yanaweza kuuathiri, na jinsi tunavyoweza kuuboresha katika vituo vya afya vya umma kisiwani Pemba, Tanzania.

Nani wa kuwasiliana

Tafadhali jisikie huru kuwasiliana nami kwa utafiti huu ikiwa una maswali yoyote kwa anwani ifuatayo

Hassan Ali Said (Mtafiti Mkuu)
hassanallysaid@gmail.com
Nambari ya simu: +255656677171
Chuo Kikuu cha Rwanda

AU

Maswasiliano kwenye Taasisi ya Utafiti

Mwenyekiti: +255777432911
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AU

Dk. Ernest Lomnyak Moses
Msimamizi wa utafiti
Nambari ya simu: +255692914383
Chuo cha Bahari Dar es Salaam
P. O. Box 80069
Dar es Salaam
Tanzania

Hata hivyo, ikiwa una maswali yoyote kuhusu haki zako za ushiriki, unaweza kuwasiliana na

Domina Asingizwe
Adomina23@gmail.com
Mratibu wa utafiti
EAC RCE-VIHSCM

Tafadhali andika "ndiyo" ikiwa unakubali kushiriki...

Sahihi ya mshiriki ……

Sahihi ya mpelelezi mkuu…….....

Tarehe……

Appendix 9: Proportional selected health centers and dispensaries

For Chake chake district

$$\text{No. of health centers required} = \frac{\text{No. of health centers available}}{\text{Total health facilities in the district}} \times \text{Total simple size}$$

$$\text{No. of health centers required} = \frac{5}{21} \times 20$$

$$\text{No. of health centers required} = 4.8 \sim 5$$

$$\text{No. of dispensaries required} = \frac{\text{No. of dispensaries available}}{\text{Total health facilities in the district}} \times \text{Total simple size}$$

$$\text{No. of dispensaries required} = \frac{16}{21} \times 20$$

$$\text{No. of dispensaries required} = 15$$

For Mkoani district

$$\text{No. of health centers required} = \frac{\text{No. of health centers available}}{\text{Total health facilities in the district}} \times \text{Total simple size}$$

$$\text{No. of health centers required} = \frac{5}{18} \times 17$$

$$\text{No. of health centers required} = 4.7 \sim 5$$

$$\text{No. of dispensaries required} = \frac{\text{No. of dispensaries available}}{\text{Total health facilities in the district}} \times \text{Total simple size}$$

$$\text{No. of dispensaries required} = \frac{13}{18} \times 17$$

$$\text{No. of dispensaries required} = 12$$

For Micheweni district

$$\text{No. of health centers required} = \frac{\text{No. of health centers available}}{\text{Total health facilities in the district}} \times \text{Total simple size}$$

$$\text{No. of health centers required} = \frac{7}{15} \times 14$$

$$\text{No. of health centers required} = 6.5 \sim 7$$

$$\text{No. of dispensaries required} = \text{available total} \times \text{Total simple size}$$

$$\text{No. of dispensaries required} = \frac{8}{15} \times 14$$

$$\text{No. of dispensaries required} = 7$$

For Wete district

$$\text{No. of health centers required} = available \times \text{Total simple size}$$

$$\text{No. of health centers required} = \frac{9}{20} \times 19$$

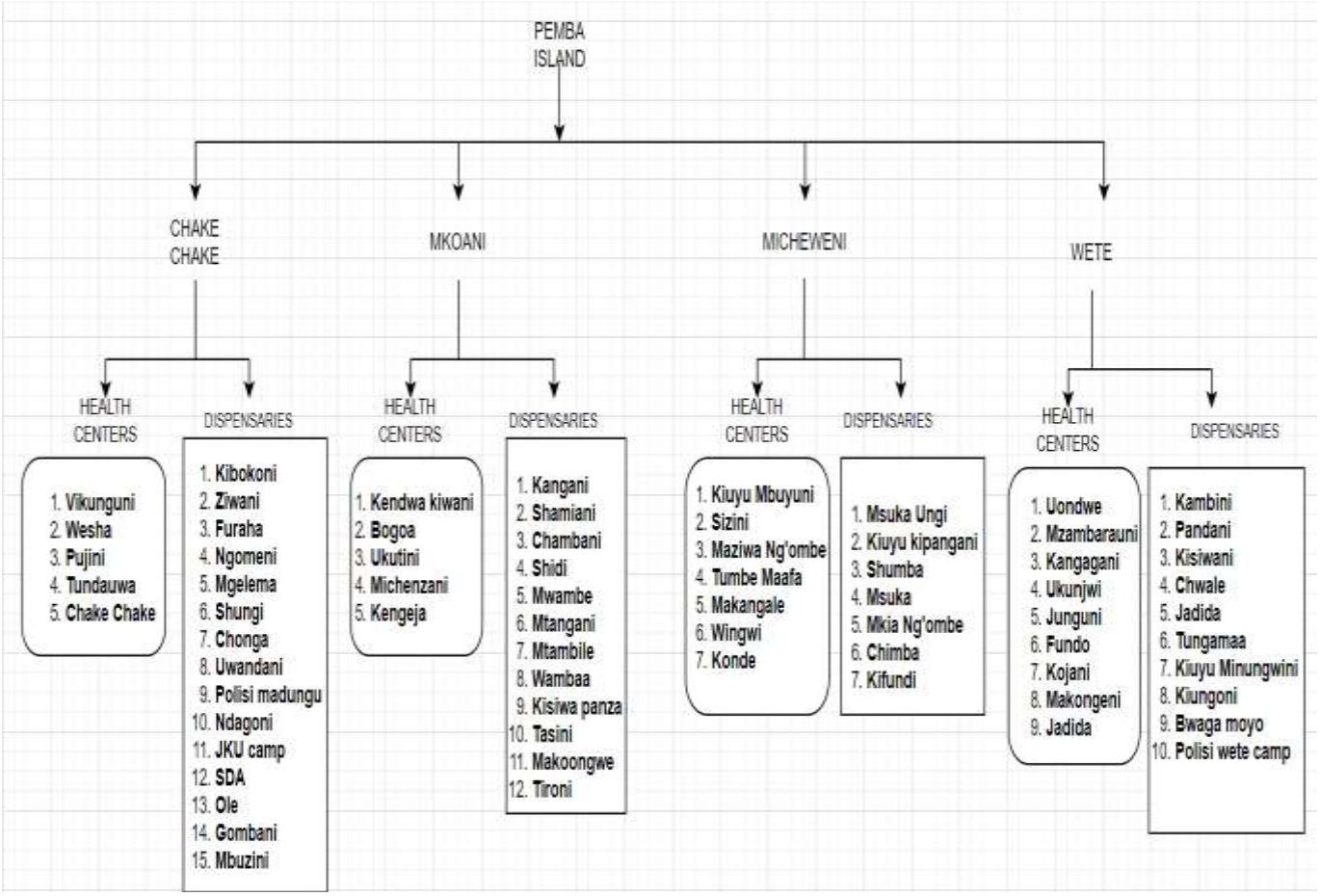
$$\text{No. of health centers required} = 8.55 \sim 9$$

$$\text{No. of dispensaries required} \times \text{Total simple size}$$

$$\text{No. of dispensaries required} = \frac{11}{20} \times 19$$

$$\text{No. of dispensaries required} = 10$$

Appendix 10: List of selected facilities



Appendix 11: Ethical approval

REVOLUTIONARY GOVERNMENT OF ZANZIBAR

SECRETARY
ZANZIBAR RESEARCH COMMITEE
P. O. Box 2321 - MAZIZINI, ZANZIBAR
Tel: 024 2231869
Fax: 024 2231742

RESEARCH/FILMING PERMIT
(This Permit is only Applicable in Zanzibar for duration specified)

SECTION

Ref: 20017312962404443 58064

Name	HASSAN ALI SAID
Gender	M
Date and Place of Birth	15-01-1988 - MADENJANI WETE, PEMBA
Nationality	TANZANIAN
Data Collection Duration	06 Month(s)
Research Title	FACTORS AFFECTING HEALTH SUPPLY CHAIN PERFORMANCE IN PUBLIC HEALTH FACILITIES AT PEMBA ISLAND
Date of Issue	22-10-2024
Valid until	22-04-2025
FULL ADDRESS OF SPONSOR	
Name of the Authorizing Officer	ASHA HIJA KHAMIS
Signature and Seal	
Institution	Office of the Chief Government Statistician
Address	P. O. Box 2321, Zanzibar
Printed Date	22 10 2024