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ASSESSMENT OF E-LMIS EFFECT ON THE AVAILABILITY OF HIV LABORATORY COMMODITIES AT LAST MILE IN KAMONYI DISTRICT

By

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN PROCUREMENT AND SUPPLY CHAIN MANAGEMENT OF UNIVERSITY OF KIGALI

September, 2023

DECLARATION

I BAGABO PAPIAS hereby declare that this research dissertation entitled **"*The e-LMIS effect on the availability of HIV laboratory commodities at last mile in Kamonyi district*"** is my own work, that it has not been submitted for any degree or examination in any other high learning institution, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Mr. Bagabo Papias

Signature: Date: 24-Oct-23

APPROVAL

This is to certify that this research dissertation entitled ***"The e-LMIS effect on the availability of HIV laboratory commodities at last mile in Kamonyi district",*** a study carried out by Mr. Bagabo Papias under my guidance and supervision and is ready to be examined.

DR AKUMUNTU JOSEPH

Signature: Date:

DEDICATION

To

This work is dedicated to my beloved wife Sikobateta Scholastique who has always been with me during the course of this work.

ACKNOWLEDGEMENT

Completion of this work has been made possible by the efforts of many people whom I wish to acknowledge here. I would like to express my most sincere gratitude and heart-felt appreciation firstly, to God Almighty, to whom I owe my life, wisdom, and good faith in all my endeavours. I praise him for enabling me to have reached thus far in my academic journey and carrying out this research in particular.

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My Almighty God bless all of you.

Mr. Bagabo Papias

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LIST OF ABBREVIATIONS

AIDS : Acquired Immunodeficiency Syndrome
ART : Antiretroviral Therapy
CRM : Customer relationship Management
e-LMIS : Electronic Logistic Management Information System
HF : Health Facilities
HIV : Human Immunodeficiency Virus
HMIS : Health management information system
IPLS : Integrated Pharmaceutical Logistics Systems
IT :Information technology
LMIS : Logistics Management Information System
MoH : Ministry of Health
PEPFAR : U.S. President's Emergency Plan for AIDS Relief
PITC : Provider Initiated Testing and Counselling
PMTCT : Prevention of Mother-To-Child Transmission
RMS : Rwanda Medical Supply
SCMS : Supply Chain Management System
TAM : Technology Acceptance Model
TB : Tuberculosis
UHC : Universal Health Coverage
UoK : University of Kigali
VCT : Voluntary Counselling and Testing
WHO : World Health Organization
IBM : International Business Machines Corporation
USAID : United States Agency for International Development

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ABSTRACT

The research was to assess the e-LMIS effect on the availability of HIV laboratory commodities at last mile in Kamonyi district and the specific objectives were to analyse effect of timely availability of accurate logistics data on the availability of HIV laboratory commodities at last mile in Kamonyi district, to assess the effect of effective inventory management on the availability of HIV laboratory commodities at last mile in Kamonyi district and to analyse the effect of efficient use of allocated funds on the availability of HIV laboratory commodities at last mile in Kamonyi district. Descriptive statistics was used to summarize data on e-LMIS and Availability of HIV laboratory commodities in Kamonyi district and Pearson's correlation or Spearman's rank correlation coefficients was calculated to examine the associations between e-LMIS and Availability of HIV laboratory commodities in Kamonyi. The sample size of the research was 166 employees working in Kamonyi district in the public health sector. The participants of the research were selected based on the purpose of this research. The primary data was collected using questionnaires and the secondary data was obtained from text books and online resources. The analysis exposes compelling trends and nuances that underscore the pivotal role of the e-LMIS in ensuring commodity availability. Notably, the e-LMIS exerts a profound influence on HIV laboratory commodities' availability. The timely availability of accurate logistics data, supported by mean scores such as 3.9167 (accurate and reliable data) and 4.1542 (consistent data with stock levels), reaffirms the significance of dependable information in maintaining a steady supply. Effective inventory management, as reflected in mean scores like 4.2125 (impact on availability) and 3.9833 (efficient replenishment), accentuates the e-LMIS's contribution in averting stockouts and bolstering availability. Moreover, efficient fund allocation, evident through mean scores such as 4.1625 (reducing commodity expiry) and 4.2083 (minimizing stock outs), underscores its role in ensuring sustainability. In conclusion, the presented findings underscore the e-LMIS's pivotal role in shaping commodity availability at Kamonyi district's last mile. A balanced approach blending participant perspectives, statistical interpretation, and references substantiates the multifaceted contributions of the e-LMIS to healthcare supply chains. The research recommends to capitalize on the e-LMIS's impact, healthcare supply chain managers should prioritize refining data accuracy and reliability. Investing in data validation mechanisms and regular quality assessments can bolster the credibility of the system's inputs and strengthening inventory management calls for targeted training and capacity-building. Focused workshops on leveraging the e-LMIS's features for optimal inventory control can amplify the system's effectiveness.

Key words: e-LMS, Laboratory, commodities, HIV

CHAPTER ONE: INTRODUCTION

This chapter presents the background of the study which relates to the organizational performance in public institution, the problem statement, purpose of the study, objectives of the study, research questions, scope of the Study, significance of the study and conceptual framework.

1.1. Background of the study

Achieving universal health coverage (UHC) is a priority global goal in almost every country worldwide, as it provides expanded access to quality health services for the general population through primary health care (Niekerke, 2020). The provision of quality health services in all programs requires the existence of efficient health care supply chains to ensure the sustainable availability of essential health commodities at all points of care in each country (Dubois, 2018). Essential medicines and commodities are based on the prevalence of major diseases in the population (Wirtz, 2017) and their relevance to public health, considering the cost-effectiveness of health services or treatments. WHO regularly publishes a list of essential medicines that countries can adapt or adopt in developing standard treatment guidelines based on their clinical needs and disease burden (WHO, 2021).

Electronic information systems are increasingly becoming integral tools for data collection, storage, and analysis in strategic management of customer-supplier relationships, with the development of information communication technology, electronic data interchange, and the internet. These systems are becoming increasingly common in transport, agriculture, manufacturing, and health as they continue to generate credible evidence of the efficiencies introduced into business processes by enhancing coordination between the customers and suppliers, and create superior inventory management and increase data visibility between levels or organizations (Sitting, 2019).

Electronic information systems provide better visibility into the logistics information system and allows key stakeholders to date data driven informed decisions. Research studies conducted in Bulgaria have revealed that e-LMIS improves the quality of logistics data, and therefore improves overall public health supply chain performance, commodity availability at service delivery points, which in the end leads to better health outcome for patients (Kabatesi, 2022).

Recognizing this potential, the Government of Zambia, through its Ministry of Health (MOH), has embarked on a comprehensive program intended to strengthen the supply chain process using a robust electronic information system to capture and manage data.

In 2014, the Government of Rwanda began implementing an electronic Logistics Management Information System (e-LMIS) to help achieve this goal.

Logistics is a branch of management that studies the planning process, following through and assuring the efficient, cost effective flow and storage of commodities, services from point of origin to service delivery points. Laboratory logistics management information system is the management of laboratory supplies in a systematic and standardized way by collecting, processing and utilizing timely logistics data to inform forecasting, supply planning, sourcing, storage and distribution of laboratory reagents and consumables (Barney, 2022).

Managing value chains in support of laboratory activities is a redoubtable challenge, especially in low income countries. Expanding programs for HIV/AIDS, TB and malaria require strong and supportive laboratory testing services that rely on the availability of the required commodities to perform critical tests, with most investigations requiring multiple reagents and consumables to be bundled (Basheke, 2021).

The cLMIS, an important part of Pakistan's public health LMIS, manages all the contraceptive and reproductive health commodities for the public and private sectors, as well as the nongovernmental organizations. After the web-based e-LMIS is introduced, managers, logisticians, and donors have better visibility into the supply chain; they can make better decisions to ensure that products reach the clients who need them. The e-LMIS enables authorized users at various locations to enter data and to access e-LMIS reports through a web browser. Reports include stock status reports, months of stock reports, and other information necessary for the supply chain to function. By improving the timeliness and quality of logistics data, the e-LMIS effectively improves decision making for supply chain management (Gibson, 2020).

In Ethiopia the logistics management information system for laboratory was light, compromised by systemic challenges which caused frequent stock outs of critical supplies thus impeding continuous care of patients. Currently, the country has designed integrated pharmaceutical logistics systems (IPLS) for all public health commodities including essential drugs, family planning, malaria, laboratory services, nutrition, TB-leprosy and HIV/AIDS commodities (Lamming, 2020).

In Tanzania, health laboratories play a key role in HIV testing for screening of infections, diagnosis, patient's management, disease progress and surveillance (Grossman, 2019). Thus, the laboratory systems offer a vital role for effective implementation of anti-retroviral treatment (ART) scaling up, expansion of the programs for clinical testing, voluntary counselling and testing (VCTs) services, prevention of mother-to-child transmission (PMTCT) and provider initiated testing and counselling (PITC). Nowadays many countries have borrowed an electronic system for the management of public health supply chain. This because the electronic system quickly collects, analyses and presents logistics data that have been gathered across all levels of the supply chain system to make informed decisions. This ultimately improves customer service by minimizing losses and stock imbalances while moving public health commodities more efficiently according to the need (Labaree, 2019).

As of 21 March 2014, Rwanda has established the use of e-LMIS system across all public health supply chain levels. With the use of the said system, electronic reports have simplified approval workflows and processing time for requisitions. Moreover, e-LMIS allows supply chain managers at district level to have visibility on the stock level at all health facilities and may decide to conduct redistribution among facilities to mitigate any stock out or expiries (Lamming, 2020).

Furthermore, data are visible to authorized users throughout the order process, allowing managers to isolate where support through supervision may be required to assist users. For other stakeholders such as program managers, policymakers, funders, and other interested partners, dashboards and detailed management reports streamline the summative nationwide raw data which simplify the process for decision-making. Financial and human resources to carry hard copy of orders to the national health supply level has been suppressed. Now only cost is spent while shipping products to health facilities with trucks (Deshpande, 2019).

With electronic information systems, data visibility that was generated through logistics of supply chain permits key stakeholders to decide accordingly. Recent studies have articulated that e-LMIS also contribute to the quality of data, availability of commodity and supply chain performance at health facilities, which impact service delivery and client health outcome (Wilson, 2022).

1.2. Problem statement

A logistics management information system is a component of an organization's overall information systems. Its purpose is to collect, analyze, and verify data from various supply chain levels, enabling informed logistics decision-making and effective supply chain management. This emphasizes the significance of logistics records within any logistics system, as these records aim to collect and document essential logistics data at each level of the healthcare system. Ultimately, this data is consolidated to generate logistics reports that play a pivotal role in crucial decision-making processes about forecasting, supply planning and stock replenishment (Lamming, 2020).

Since 21 March 2014, the Government of Rwanda launched the Electronic Logistic Management Information System intended to solve reporting related problems, data quality, visibility and accessibility to needed data issues. In additional, the system would mitigate the issue of interrupted supply of commodities across all supply chain levels. Although e-LMIS is being used in Rwanda health supply chain, in collaboration with Global fund, Auditor general health supply chain audit 2018 reports showed that health products expiration, stock outs and data discrepancies still being a dilemma in the health system. In the same report, the order fill rate for HIV commodities was 71% country wide and 60% in Kamonyi district as a result of stock out at the warehouse. The supply chain performance was to blame for this stock out since HIV commodities are given free of charge and handling cost is incurred by donors (Health, 2022).

The stock status report extracted from e-LMIS in October 2021 to inform the consumption part of the national quantification exercise most of health facilities have inaccurate data with irregular recordings. In addition, one third of health facilities do frequently get into stock out of essential drugs concomitantly with expiries at the same health facility or in neighboring one. Kamonyi district has had 2 non-consecutive months of stock out of HIV rapid tests kits between October 2020 and September 2021 (Gibson, 2020).

It looks like e-LMIS has not improved stock monitoring and inventory management which results in interrupted service at service delivery point due to stock out or expiries. Therefore, the research assessed the e-LMIS effect on the availability of HIV laboratory commodities at last mile in Kamonyi district, Rwanda.

1.3. Objectives of the study

The research was guided by general objective and specific objectives.

1.3.1. General objective

The general objective of the research was to assess the e-LMIS effect on the availability of HIV laboratory commodities at last mile in Kamonyi district.

1.3.2. The specific objectives

The specific objectives of the research were:

i. To analyse effect of timely availability of accurate logistics data on the availability of HIV laboratory commodities at last mile in Kamonyi district.

ii. To assess the effect of effective inventory management on the availability of HIV laboratory commodities at last mile in Kamonyi district,

iii. To analyse the effect of efficient use of allocated funds on the availability of HIV laboratory commodities at last mile in Kamonyi district.

1.4. Hypotheses of the research

The research tested the following hypotheses:

$H_0$1: There is no effect of timely availability of accurate logistics data on the availability of HIV laboratory commodities at last mile in Kamonyi district.

$H_0$2: There is no effect of effective inventory management on the availability of HIV laboratory commodities at last mile in Kamonyi district.

$H_0$3: There is no effect on efficient use of allocated funds on the availability of HIV laboratory commodities at last mile in Kamonyi district.

1.6. Scope of the Study

The research is limited on content scope, geographical scope and time scope.

1.6.1. Content scope

The research was in domain of global health supply chain management whereby the researcher will focus on Electronic Logistic Management Information System.

1.6.2. Geographical scope

The research was conducted at RMS branch and in laboratories of public peripheral health units located in Kamonyi district, Southern province, Rwanda.

1.6.3. Time scope

The research used the data from January 2018 to December 2022.

1.7. Significance of the study

The study is significant to the following stakeholders:

To the researcher: This research increased the knowledge of the researcher in the field of procurement especially in procurement. Based on the literature to be reviewed in this research the researcher gets more understanding on electronic supply chain management.

To University of Kigali: at the end of this research, the final dissertation was put in the library for other interested people in the field of supply chain management as reference, which can help in policy formulation to emphasize for institutions to a clear sense of direction and This study was of great importance to the devolved government as it will provide information valuable in assessment of effectiveness of supply chain management for public laboratories.

To the ministry of health and RMS: the outcome of this research will inform the ministry of health and Rwanda medical supply in particular if the funds allocated to this computer based inventory management system is worth the allocated funds.

CHAPTER TWO:
LITERATURE REVIEW

2.0. Introduction

This chapter reviews the relevant literature by various scholars and researchers on the use of electronic logistics management information system and its effect on the availability of HIV laboratory commodities. The chapter discusses the following subsections; theoretical framework, conceptual framework, empirical review, critique of the existing literature, and the research gaps.

2.1. Conceptual review on e-LMIS

According to Transparency International (2019), a logistics management information system (LMIS) is a system of records and reports – whether paper-based or electronic – used to aggregate, analyse, validate logistics Information. Uninterrupted supply of antiretroviral drugs for treatment of HIV/AIDS is a pre-requisite and a challenge for ART programs. LMIS is nothing more than a management information system to oversee all the logistical activities (Grover, 2022). These are activities occurring from the central medical stores through the RMS branches to the hospitals and peripheral health units.

Logistics information systems are important for achieving logistics efficiency and effectiveness. Logisticians added the word logistics to management information system (MIS) to create logistics management information system. Health management information system (HMIS) essentially collects demographic and morbidity data which are not used as frequent as logistics data (Lamming, 2020).

An HMIS collects information on the total number of patients seen or diagnosed; data from an HMIS is not used as often as LMIS data. For planning purposes, the LMIS data is the preference and HMIS data can only be used in case LMIS data is not available or accurate (Chingos, 2012). The Supply Chain Management System(SCMS), which is the higher level in the supply chain, uses the LMIS data to track consumption in the facilities to identify whether there are overstock of commodities and therefore redistribute them to prevent wastages, identify batches with shorter remaining shelf life and consider increasing the consumption for this batch by redistributing to nearby facilities or by reverse logistics. This helps prevent expiries which are a loss to both the country and donors (Lamming, 2020). Further, the expired products will have to be incinerated which incurs even more cost.

The data is also used for the determination of national level consumption and for planning, budgeting and quantification for the procurement of commodities. A failure in any of the levels of the system could result in stock out of health commodities and therefore inability to attend to patients who visit facilities for their healthcare needs (West, 2012).

Without successful implementation of LMIS, HIV/AIDS programmes will certainly waste resources through recurring stock outs, overstocks and expirires (Wanner, 2003). A fully functioning LMIS mitigate the risk of stock out and product expiration which is mostly due to, considering the short shelf life of HIV laboratory commodities, overstocks (Baser, 2020). A good store management for health commodities is crucial for service provision in health institutions. Mugambi, (2015), reported that in Mombasa County, Public health facilities were facing low stock level to no stock at all for health commodities which impacted on their performance.

Most County public health facilities were identified with significant stock outs of key medications. Essential drugs were frequently unavailable to patients visiting the public health facilities. The Coast province general hospital being the biggest referral hospital in the Coast province was not an exception. Most of the patients visiting for treatment were not satisfied at the end of the hospital service. This was majorly because they are enforced to go and purchase some of the prescribed medication elsewhere which is normally not in their expectations (Joshi, 2020).

2.2. Impact of e-LMIS on effective supply chain

The implementation of a national logistics management unit and an electronic logistics management information system yielded positive outcomes in Tanzania although not all management practices experienced improvements. Following one year of adoption, notable enhancements were observed in areas such as decreased stock-out rates, reduced duration of stock-outs, and lower expiry rates. Despite the significant cost associated with upgrading the systems, they contributed to enhanced efficiency within the logistics system. Moreover, the improvements generated modest savings that helped offset a considerable portion of the initial investment and ongoing maintenance expenses (Mwencha et al., 2017).

As stated by Squires et al. (2017), technology has become a crucial component of every business strategy, significantly influencing inventory control by enhancing efficiency, accessibility of information, and accuracy, ultimately impacting organizational performance. Within a healthcare environment, the implementation of automated tools can assist organizations in standardizing and enhancing the quality of their data (Squires et al., 2017). However, despite the introduction of inventory management systems in different healthcare institutions, the issue of stock-outs still persists.

2.3. Theoretical review

A researcher finds a theoretical framework essential as it aids in narrowing down the scope of relevant data for a study by concentrating on specific variables and viewpoint. Cherry (2015) defines a theory as a fixed principle that has been developed to elucidate some characteristic of the natural world. A theoretical framework should reveal an understanding of theories and concepts that are relevant to the research topic (Labaree, 2019). In this chapter, researcher presents a description of the theoretical concepts to be used in the study. The theories are then joined together in a theoretical model at the end and the relationship between the factors is discussed. This model was then used to analyse the results of the study.

2.3.1. Total quality management

Total Quality Management (TQM) is a customer-centric approach that strives for ongoing enhancement of business operations. Its primary focus is on aligning all related efforts, especially those of employees, towards the shared objectives of improving product and service quality, as well as refining production and service delivery processes. Notably, TQM places significant importance on making decisions based on factual evidence, utilizing performance metrics to effectively monitor and track progress (Niekerke, 2020).

The successful implementation of Total Quality Management (TQM) necessitates substantial training for the involved employees. However, this training program may temporarily disrupt their daily work, causing a negative short-term impact. Moreover, as TQM typically involves a steady stream of incremental changes, it can trigger adverse reactions from employees who are attached to the current system or fear potential job losses due to the transformations (Merih, 2017).

2.3.2. Technology Acceptance Model (TAM)

This is a commonly used model on adoption of innovative solutions by firms. Technology Acceptance Model as coined by Niekerke (1989), proposes that both perceived usefulness and perceived ease of use can be used to predict the attitude towards using new technology, which in turn affects the behavioral intention to use the actual system directly. This in turn affects the way users relates to the systems and hence the firms that adopts such technologies. Davis defines perceived usefulness as the degree to which a person believes that using a particular system would enhance his/her job performance or ease his/her work (Niekerke, 2020).

From Davis (1989) perspective, the users of digital pharmaceutical platforms are more likely to adopt and continue using the E-Systems if they believe the system brings benefits in the case of pharmaceutical, flexibility, easy access to information, easy transaction completion, friendliness and prompt connection to contact person for help, reducing time spent on going to institution and increasing convenience, ease of transaction, access to information and customer care. The outcome will determine how these users relate to the institution employing digital pharmaceutical (Niekerke, 2020). This creates an assumption that if the user feels that digital pharmaceutical platforms are easy to use, confidential and hustle free, they are likely to adopt and utilize them with a lot of ease. This being a new way of interrelation, it is likely to experience a shift in the way of interaction between the customers and the institution especially on relationship (Niekerke, 2020).

The Technology Acceptance Model approach is the most relevant and most applied theory in technology adoption. According to technology Acceptance model the perceive ease of use is basically the degree to which the prospective adopter expects the new technology adopted, to be a free effort regarding its transfer and utilization (Davis, 1989). However, Nguyen and Singh (2004) in their research on Impacts of internet pharmaceutical on customer satisfaction and loyalty in Australia noted that the major limitation is that the theory does not factor in other key factors that affects technology adoption like technology accessibility.

On analysis of the predictors of technology adoptions by organizations and individuals, Jeyaraj (2006), concluded that TAM is the most relevant technology adoption model in analysis of how technology adoption influences decisions. However, other researchers argue that, TAM on itself is insufficient in explaining users' decisions to adopt technology (Niekerke, 2020). Safe from the limitation of Technology Acceptance Model, this research used model to argue the finding of the study on how the perceived outcomes of digital pharmaceutical impacts customer relationship.

Digital service that is perceived valuable by customers is expected to affect customer relationship positively. This value could be money saved, time, information, convenience, assistance, friendliness, speed, flexibility and easy transaction completion.

2.3.3. Supply chain risk management

According to the International Business Machines Corporation (IBM), risk management extends beyond the common association with unexpected events like hurricanes and tsunamis impacting supply chain operations. While such events can indeed have adverse effects on supply chains, risk management encompasses a broader scope of considerations. It involves identifying and addressing various risks that may affect an organization's operations, not solely limited to unpredictabl3.e incidents. By adopting a comprehensive approach to risk management, companies can better prepare for and mitigate the impact of both expected and unexpected challenges on their supply chain and overall business operations (Basheke, 2021).

The continuous process of risk management consist of The process of identifying risks involves evaluating potential threats to an organization, its operations, and its workforce. This encompasses the assessment of IT security threats like malware and ransomware, workplace accidents, natural disasters, and other harmful events that could disrupt business operations. By conducting this comprehensive risk assessment, organizations can better prepare and implement appropriate risk mitigation strategies to protect their assets, maintain continuity, and ensure the safety of their workforce (Niekerke, 2020).

Risk analysis and assessment involve employing various tools and techniques to evaluate the probability and consequences of previously identified project risks. This process aids project managers in understanding the uncertainties associated with potential risks and their potential impact on project aspects such as schedule, quality, and costs if they were to materialize. Notably, risk analysis extends beyond project management and finds application in other fields like business administration, construction, and manufacturing (Niekerke, 2020). By conducting thorough risk analysis, professionals in these disciplines can make informed decisions, develop appropriate risk response strategies, and enhance overall project or business resilience in the face of uncertainties (Basheke, 2021). Risk mitigation involves the strategic planning and development of methods and options to minimize or eliminate threats to project objectives. Project teams utilize risk mitigation strategies to identify, monitor, and assess risks and their potential consequences, especially when working on specific projects such as new product creation. It encompasses actions taken to address issues and their potential impacts throughout the project lifecycle.

In the context of public health supply chains, risk management centers on organizing logistics activities to ensure the continuous availability of essential commodities required for health programs. The primary aim is to safeguard the supply chain from disruptions, ensuring the uninterrupted flow of critical items necessary for public health initiatives (Niekerke, 2020). Effective risk management in this domain helps ensure the timely delivery of healthcare resources, contributing to the successful implementation of health programs and services (Basheke, 2021).

2.4. Empirical review

The section presents the empirical review of the research, where researcher presented what other researchers have discussed in their studies previously. To achieve that researcher based on the objectives of the research which are to analyse the effect of timely availability of accurate logistics data on the availability of HIV laboratory commodities, to assess the effect of effectiveness inventory management on the availability of HIV laboratory commodities and to analyse the effect of efficiently use of allocated funds on the availability of HIV laboratory commodities.

2.4.1. Timely availability of accurate logistics data and the availability of HIV laboratory commodities

Fashina (2022) carried out a research on timely management information systems and logistic performance in Galaxy backbone in Nigeria. Interpretive qualitative research was carried out to examine the practices and performance of management information systems in Galaxy backbone in Nigeria to examine how it can be better enhanced interoperability within the organization. Data was gathered through semi-structured interviews and Focus group discussions and was analysed thematically to generate four themes.

The findings were discussed in relation to the research questions and previous literature and were discussed with the use of Resource-based theory. The research outcome has proven that management information system paramount in enhancing system communication in the organization and it will go a long way bring about an integrative nature of information flow within the same organization, it will change the physical and manual way processes to accommodate internal networks and departmental integrated systems. For a functional management information system, resources like Information communication technology infrastructure, skills, human resources must be available for effective interoperability.

Jean Pierre (2020), conducted a research on effectiveness of e-LMIS utilization to improve health supply chain at RMS branches in Rwanda.

According to the findings of this study, a significant proportion of respondents (two-thirds) consistently utilize e-LMIS as part of their job. Additionally, approximately 57% of respondents reported using all e-LMIS functions, while 72.9% employ e-LMIS information for reporting purposes. The study also revealed that e-LMIS contributes to a high level of data accessibility (94.9%) and addresses challenges related to quantification (57.6%).

Furthermore, the use of e-LMIS resulted in notable improvements in data quality (77.9%) and optimal inventory management of health products, leading to reduced losses due to expiries. However, certain limitations were highlighted, including system complexities, insufficient staff, and a lack of accountability among users and authorities.

The findings indicated that most users only partially utilize e-LMIS functions, yet they acknowledged the positive impact of e-LMIS on health supply chain management. Resolving system complexities, ensuring user commitment, and involving local and national authorities were identified as necessary steps for enhancing the utilization of e-LMIS and achieving better outcomes.

Bekele (2022) conducted a research study focusing on the inventory management performance and associated challenges concerning laboratory commodities in public health facilities within the Gambella Regional State, Ethiopia. The study employed a health facility-based descriptive cross-sectional design, utilizing a mixed-method approach involving both quantitative and qualitative data. Data collection took place between May and July 2021, involving seventeen public health facilities in the region. The research gathered information from various sources, including documents, health professionals, and health care facility warehouses. Quantitative data were analyzed using Excel spreadsheets version 14 and SPSS version 23, while qualitative data underwent thematic analysis techniques based on interviews with 18 key informants.

The study findings revealed that, on average, the availability of laboratory commodities on the day of the visit in the health facilities was 60.39%. Over the past year, approximately 12.94% (equivalent to 37,488.76 US$) of laboratory commodities had been wasted due to damage and expiration. The average duration of stock-outs was found to be 58 days. Regarding the accuracy, completeness, and timeliness of reports and requisition forms, the averages were 49%, 71%, and 64%, respectively. Moreover, the health facilities met only 68.2% of the criteria for proper storage conditions.

The main challenges identified in the inventory management of laboratory commodities included a lack of adequate and committed staff, budget constraints, insufficient storage space, frequent shortages of commodities from suppliers, and a lack of regular supervision and feedback from higher officials. The study concluded that the inventory management of laboratory commodities in the health facilities was inadequate, as evidenced by inaccurate records and reports, frequent stock-outs, high wastage rates, insufficient staffing, budget constraints, and substandard storage conditions. The findings highlight the need for strict and close monitoring to enhance the performance of inventory management for laboratory commodities in health facilities.

2.4.2. Effective inventory management and the availability of HIV laboratory commodities

Bekele (2022) conducted a research on the Inventory management performance for laboratory commodities and their challenges in public health facilities of Gambella Regional State, Ethiopia. A health facility-based descriptive cross-sectional study was conducted using a mixed quantitative and qualitative method in seventeen public health facilities of the Gambella regional state between May and July 2021. Data were collected from documents, health professionals, and health care facilities' warehouses.

Quantitative data were analysed using Excel spreadsheets version 14 and SPSS version 23. In the qualitative part, 18 key informants were interviewed, and data were analysed using thematic analysis techniques. The findings indicated that the average availability of laboratory commodities on the day of the visit was 60.39% in health facilities. Over the past year, 12.94% (37,488.76 US$) of laboratory commodities were wasted due to damage and expiration, while the average stock out date was 58 days. The average accuracy, completeness, and timeliness of the report and requisition form were 49%, 71%, and 64%, respectively. The health facilities had attained only, 68.2% of the storage conditions criteria. Lack of adequate and committed staff, budget constraints, insufficient storage space, frequent shortages of commodities from the suppliers, lack of frequent supervision, and feedback from higher officials were the main challenges for inventory management of laboratory commodities. The inventory management for laboratory commodities was inadequate, which was disclosed by inaccurate records and reports, stock-outs, high wastage rate, lack of adequate staff, budget constraints, and unacceptable storage conditions criteria. The study result suggests strict and close monitoring is needed to improve the inventory management performance for laboratory commodities at health facilities.

Ararsa (2020) conducted a study on inventory management information system performance for laboratory commodities: the case of west Shoa zone public health facilities, Oromia regional state, Ethiopia. A facility-based concurrent explanatory mixed-method design was employed to assess the logistic management information system performance for laboratory commodities in public health facilities of West Shoa zone, Oromia regional state, Ethiopia from June 2021 to July 2021.

Twenty health facilities were selected by using simple random sampling and purposively. Data were collected by reviewing logistic management information system tools. Data were checked for their completeness, coded, and entered into a statistical package for social sciences version 23 and analyzed using descriptive (percentage and frequency table) and inferential statistics (chisquare test). An in-depth interview was carried out to explore the challenges to logistic management information system performance and thematically analyzed.

The results indicated that logistic management information system tools availability ranges from 30-100% with utilization ranging from 15-95%.

The data quality in terms of timeliness and completeness of reports was found to be 80% and 75% respectively, with an 80% facility reporting rate. The study revealed significant associations between the completeness of the Inventory and Facility Reporting Rate (IFRR) and variables such as training pattern ($\chi 2$ (1, N = 109) = 4.127, P = 0.041), experience ($\chi 2$ (2, N = 109) = 12.203, P = 0.002), supervision ($\chi 2$ (5, N = 109) = 17.07, P = 0.004), and feedback ($\chi 2$ (4, N = 109) = 10.037, P = 0.04). Major challenges identified in the study included staff turnover, workload, and inadequate manpower. The availability of logistic management information system tools ranged from 30% to 100%, with utilization varying from 15% to 95%. In addition to the challenges mentioned earlier, staff turnover, lack of commitment, workload, and inadequate manpower were also identified as key challenges in the inventory management process.

2.4.3. Efficient use of allocated funds and the availability of HIV laboratory commodities

Gibson (2022) conducted a research study focusing on the efficient utilization of allocated funds at an optimal level and its potential implications on the quality of HIV diagnostic services in Tanzania. The study specifically assessed the status of supply chain management for laboratory supportive services and its potential impact on the quality of HIV diagnostic services in selected districts of Tanzania.

The findings revealed that in 82% of the health facilities, the laboratory departments were responsible for ordering supplies. Commonly used information for forecasting laboratory requirements included the number of tests conducted (74.4%), current stock levels (69.2%), average monthly consumption (64.1%), and minimum and maximum stock levels (10.2%). Emergency orders were more prevalent in public facilities compared to private facilities (73.9% vs. 56.3%, p=0.004).

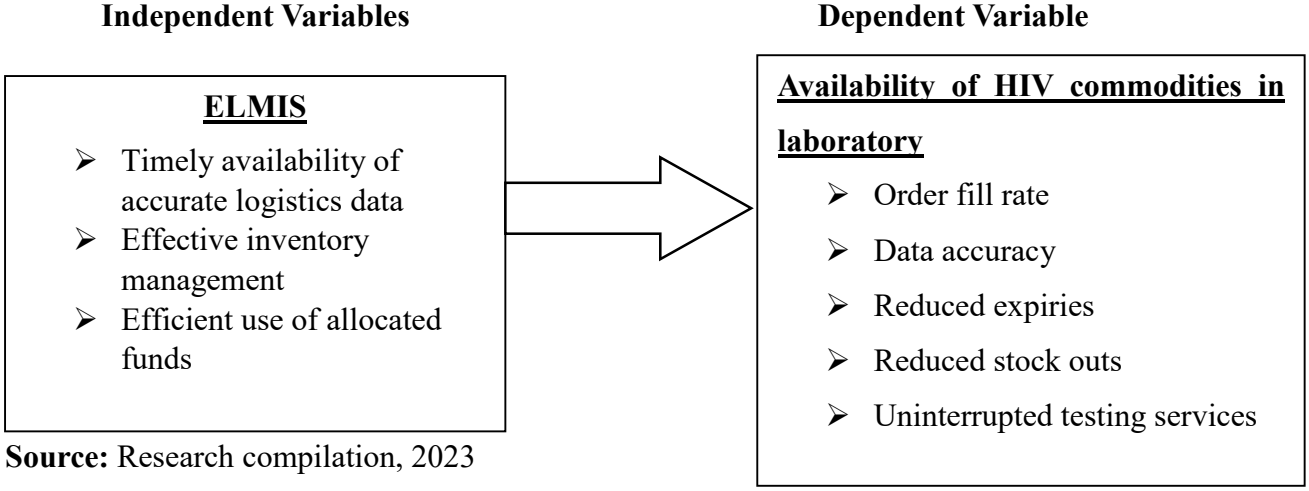
The delivery of ordered supplies ranged from 1 to 180 days, with public facilities experiencing a significantly longer mean delivery period compared to private facilities (32.5 vs. 13.1 days, p=0.044). Public health facilities tended to order supplies from diverse sources more frequently than private facilities (68.2% vs. 31.8%).

Based on the findings, the researchers concluded that there was a weak inventory management system and significant delays in the delivery of supplies in the majority of health facilities. These factors are likely to impede the quality of HIV care and treatment. The study suggests that strengthening capacity for data management and ensuring a consistent supply of resources has the potential to improve the quality of HIV diagnostic services.

2.5. Conceptual framework

Conceptual framework provides structure and content for the whole study (Vaughan, 2008). Kombo and Tromp (2019), describe a concept as an abstract or broad idea inferred or resulting from definite instances. The independent variables of this study were timely availability of accurate logistic data, effective inventory management and efficient use of allocated funds while the dependent variables were order fill rate, data accuracy, reduced expiries, reduced stock out and uninterrupted testing services as shown in figure 1.

Figure 2.1: The e-LMIS effect and the availability of HIV laboratory commodities



Source: Research compilation, 2023

2.6. Gap analysis

Fashina (2022) carried out a research on timely management information systems and logistic performance in Galaxy backbone in Nigeria. Jean Pierre (2020), conducted a research on effectiveness of e-LMIS utilization in Rwanda health supply chain improvement at district pharmacies in Rwanda. Bekele (2022) conducted a research on the Inventory management performance for laboratory commodities and their challenges in public health facilities of Gambella Regional State, Ethiopia.

Ararsa (2020) conducted a study on inventory management information system performance for laboratory commodities: the case of west Shoa zone public health facilities, Oromia regional state, Ethiopia. Gibson (2022), carried a research on efficiently use of allocated funds, and its potential implications on the quality of HIV diagnostic services in Tanzania.

Several studies had been conducted in the field of e-LMIS and performance of laboratory but none of the research assessed the e-LMIS impact on the availability of HIV laboratory commodities at last mile in Kamonyi district, Rwanda, which was the essence of this research. Moreover, researchers used methodology other than multiple regression analysis which was used in this research.

CHAPTER THREE:
RESEARCH METHODOLOGY

3.0. Introduction

This chapter presents a detailed description of the research methods that were used to collect relevant data to the study. It contains the research design, area of the study population, sample size, data collection methods, data processing, data presentation, and data analysis. It includes ethical values and the limitations.

3.1. Research Design

The purpose of this research study was to analyse the relationship between e-LMIS and availability of HIV Laboratory commodities in Kamonyi district. Descriptive statistics (e.g., means, frequencies) was used to summarize data on E-LMIS and Availability of HIV laboratory commodities in Kamonyi district.

Pearson's correlation or Spearman's rank correlation coefficients was calculated to examine the associations between e-LMIS and Availability of HIV commodities in Kamonyi. The strength and direction of the relationships was interpreted. Multiple regression analysis was conducted to investigate the predictive power of e-LMIS on availability of HIV commodities in Kamonyi, while controlling for relevant demographic and contextual variables.

3.2. Study population

This is the precise population from which data was needed and they were employees of RMS branch, employees from 12 health centres and one district hospital all of which located in Kamonyi district. The table below gives details about the study population from which the sample size was obtained

Table 3.1. Public Health sector employees in Kamonyi district

Departments	**Number of employees**
RMS branch	4
District hospital	123
Health centres	156
Total	**283**

Source: District report (2023)

3.3. Sample size

Sample size is part of the population that the researcher chooses to use in a research as a representation of the total population. The population of the study selected using Slovin's formula $n = \frac{N}{1+N(e)2}$ (Slovin, 1960) whereby n is the sample size, N is the total population and e is the sampling error (0.05).

$$n = \frac{283}{1 + 283(0.05)2}$$

$$n = \frac{283}{1 + 283(0.0025)}$$

$$n = \frac{283}{1 + 0.7075}$$

$$n = \frac{283}{1.7075} = 166$$

The sample size of the study was 166 who are employees working in health sector of Kamonyi district.

3.4. Sampling technique

Kothari (2007) defines sampling design/technique as a definite plan for obtaining a sample from the sampling frame. The techniques used was purposive sampling technique, whereby the participants of the research were selected based on the purpose of this research.

3.5. Data collection methods

The study used both primary and secondary data; for the secondary data, the researcher reviewed books, articles and documents from university library and other libraries in Kigali related to the topic under the study; secondly the researcher used questionnaire as a major toll of primary data collection. The questionnaire had 3 major sections and each section contained questions concerning each objective.

3.5.1. Questionnaire

The questionnaire included closed-ended questions where respondents had to choose from the alternative answers. Questionnaire was chosen because of the following advantages: it saves time since many respondents could be dealt with at once, it allows easy analysis of collected data and it is easy to administer when the sample is literate.

In designing questionnaires, the researcher used Likert scale to measures the respondents' views on the critical factors of e-LMIS.

The same rating scale was also used for the factors of organizational performance. Using Likert Scale, the respondent indicated whether he/she strongly agree (SA), agree (A), disagree (D), or strongly disagree (SD).

3.5.2. Documentary Analysis

According to Bailey (1982) document refer to any written materials that may be used as a source of information about the subject. It is important to indicate the review of existing literature reviewed by different authors. In this respect, data was revealed from documentary review especially textbooks, magazines, internet source, and any other documents that was deemed necessary and reading books in relation with the internal audit systems reports to see what other authors, scholars and academicians have written concerning the topic. These techniques allowed the researcher to collect data and information from different books, reports, texts and dissertations as well other documents regarding value chain of public health commodities.

One of the main measures for that is proper documentation and transparency of the research procedures. In the present study, this was ensured by outlining the theoretical framework for analysis, describing the manner of choosing the sample and by providing the questionnaire and primary sources using structured close ended questions are the first occurrence as a point of departure for the empirical investigation.

3.6. Reliability and validity

Mugenda & Mugenda (2008), emphasized that reliability is done using Cronbach's Alpha Model on SPSS and that consistency is the assessment of the degree to which study instrument gives reliable results or data after repetitive trials. Reliability is the consistency of measurement, or the extent to which an instrument measures the same method every time it is used under the same circumstance with the similar subject (Bryman, 2015). The questionnaire's reliability was statistically measured by measuring the internal consistency using Cronbach's alpha. Cronbach alpha, which is a measure of internal consistency, was used to test the internal reliability of the measurement instrument. This was developed by Lee Cronbach in 1951 as a measure of internal consistency of a test or scale, and normally expressed as a number between 0 and 1. The following equation applies. Equation (Cronbach, 1951)

Where N is equal to the number of items, c is the average inter-item covariance among the items and v equals the average variance.

Validity is defined as the point to which an instrument measures what it was projected to evaluate (Kumar, Kumar, & Phrommathed, 2012).

In addition, validity is based on the statement that what is being studied can be measured or captured, seeks to validate the reality and truth of any result or conclusions drawn from the data, indicates that the conclusions drawn are dependable and that the methods justify the conclusions.

Validity of research instruments is established when what was targeted to be measured is carried out clearly without accidentally including additional factors. The validity of this research instrument was measured through the opinion of experts especially the research supervisor, who is knowledgeable in this field. Any ambiguity or non-clarity in the questionnaire items was cleared before the questionnaire is taken to the field for data collection.

The validity was tested using Content Validity Index (CVI).

$$\text{CVI}= \frac{\text{Number of valid questions in questionnaire}}{\text{Number of Items in questionnaire}} \times 100$$

If the calculated CVI was equal or greater to 0.60 (Sounders, 2000), the questionnaire was considered valid.

3.7. Data processing

Raw data was transformed into meaningful interpreted report using different techniques. In order to get quality information, there is generally need for standard checking so that the researcher could end up with realistic data, which clearly reflect the depicted situation. Thus, stand checking was done through editing, coding, and tabulation. This was done in order to reduce detailed data to manageable proportions through editing of data, coding the data and make the tabulation of data.

In editing the researcher scrutinized and verified the questionnaires in order to avoid errors and repetitions". Once this type of data processing was made the analysis became simple and easy to the researcher. In coding, the researcher summarized data by classifying the different responses given into categories for easy interpretation by assigning a symbol or a number to a response for identification purposes.

Tabulation means putting data in some kinds of statistical tables through which the number of occurrence of responses to a particular question is shown. These tables were constructed in such a way that frequency of responses to a particular question is presented. It is also presented in percentages.

3.8. Data analysis

Spearman (Pearson) correlation coefficient measures the extent to which, as one variable increases, the other variable tends to increase, without requiring that increase to be represented by a linear relationship.

If, as one variable increases, the other decreases, the rank correlation coefficients were negative. Statistical correlation is measured by what is called coefficient of correlation (r). Its numerical value ranges from +1.0 to -1.0. It gives us an indication of the strength of relationship. In general, $r > 0$ indicates positive relationship, $r < 0$ indicates negative relationship while $r = 0$ indicates no relationship (or that the variables are independent and not related). Here $r = +1.0$ describes a perfect positive correlation and $r = -1.0$ describes a perfect negative correlation.

Closer the coefficients are to +1.0 and -1.0, greater is the strength of the relationship between the variables. As a rule of thumb, the following guidelines on strength of relationship are often useful (though many experts would somewhat disagree on the choice of boundaries).

Social Sciences (SPSS) was used in processing and analysis of data which informed the presentation of findings, analysis and interpretation. The presentation focused on the research hypothesis. The kind of statistical treatment depends upon the nature of the problem, especially the specific and the nature of data gathered. Data analysis was done based on descriptive statistics particularly means and standard deviation.

In this study, Statistical Package for the Social Sciences (SPSS) and Excel was used by researcher in processing and analysis, of data which informed the presentation of findings, analysis and interpretation. The presentation focused on the research questions. Quantitative data analysis was used to analyze numerical data, this data results was presented in form of tables to enhance its proper understanding. Data obtained from close-ended responses was analyzed using the SPSS (Statistical package for social science) computer package. This method is preferred because it is modern, faster and simplifies the analyzing of data. It involved transforming the options to each item in the administered instruments in to codes. The codes that was used are “1” “2” “3” “4” and “5” where 5 represented strongly Agree, 4 Agree, 3 Undecided, 2 Disagree and 1 strongly disagree respectively as it was described per questionnaire section. Data analysis from questionnaires was done by categorizing responses into frequency counts and percentages. The Pearson’s correlation co-efficient method was used because it is most appropriate for determining whether there is linear relationship between independent variable (IV) and dependent variable (DV) that is the quantitative data.

Pearson's product moment correlation was most suitable since it enables the researcher to identify whether there is a linear relationship between the study variables.

The data collected was processed and analysed using SPSS software. Qualitative and quantitative approach was used for analysis. Mean and standard deviation was used to give a clear understanding of the research interpretations for clear and easy understanding of the phenomenon studied. Relationship between the variables was established by use of Pearson correlations.

The Mean ($\overline{X}$)

According to Laerd Statistics , Mean ($\overline{x}$): is the average value calculated by adding up the values of each case for a variable and dividing by the total number of cases.

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} xi$$

Where, $\overline{X}$ = mean; n = number total of respondents;

xi = scale value of respondent

Table 3.1: Evaluation of Mean

Mean	Evaluation
1.00 -2.49	Very weak
2.50 -3.49	Weak
3.50 -4.49	Strong
4.50 - 5.00	Very Strong

Source: Laerd Statistics, 2023

Standard deviation (SD)

The standard deviation is a value which indicates the degree of variability of data. It indicates how close the data is to the mean. The formula of standard deviation is: $(S) = \sqrt{S^2}$ Where,

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(xi - \overline{X})^2$$

Table 3.2: Evaluation of standard deviation

Standard Deviation	Level spreading
SD<0.5	Homogeneity
SD>0.5	Heterogeneity

Source: Laerd Statistics, 2023

Pearson Correlation test: The Pearson correlation coefficient is a very useful way to measure the statistical relationship that exists between independent and dependent variables.

Table 3.3: Evaluation of correlation

Correlation coefficient (positive or	Label/positive or negative
r=1	Perfect linear correlation
0.9 < r < 1	Positive strong correlation
0.7 <r < 0.9	Positive high correlation
0.5 <r < 0.7	Positive moderate correlation
0< r < 0.5	Weak correlation
r=0	No, relationship
-1 <r = < 0	Negative relationship

Source: Laerd Statistics, 2023

Description of Regression Analysis

Multiple regressions are an extension of simple linear regression. It is used when the researcher wants to predict the value of a variable based on the value of two or more other variables. The variable to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable). The variables in expression to predict the value of the dependent variable are called the independent variables (or sometimes, the predictor, explanatory or regress or variables). Multiple regression also allows researchers to determine the overall fit (variance explained) of the model and the relative contribution of each of the predictors to the total variance explained (Bobko, 2001).

Model specification

The expected results or a priori expectation regarding the econometric models that have been constructed, it was expected that all independent variables had significant effect on each dependent variable. This kind of effect is to positively check for each econometric model. Generally, there were significant and positive effect of e-LMIS on the availability of HIV laboratory commodities at last mile in Kamonyi district.

X = Independent Variable

Y = Dependent Variable

Y = f(x)

Where,

X = ($X1_=$ Timely availability of accurate logistics data (TAALD), $X_{2=}$ Effective inventory management (EIM) and X_3: Efficient use of allocated funds (EUAF), while the Y= Availability of HIV commodities in laboratories.

Y =f (TAALD, EIM, EUAF)

Based on these functions the following multiple regression models are established:

Y = β0+β1 TAALD +β2 EIM +β3 EUAF

Where β0 is the intercept for each model and β1, β2 and β3 are coefficients of explanatory variables, using primary data and e= error term.

The pre-estimation tests was carried out in determining the suitability of each of the model. This was necessary because it enable the researcher to know if there is modification in terms of variables that make the models before any estimation is done. Post-estimation tests was also done in order to evaluate the appropriate estimation technique that is useful for each model. There was multicollinearity test by using analysis of variance (ANOVA) and correlation matrix was used in easily measuring associations or relationships between variables of the same category. There was also t-statistics, z-statistics and F-statistics was compared to the tabulated values with the probability values at 5% level.

3.10. Ethical consideration

The researcher complied with ethical procedures to protect the rights of the research participants, involving the principle of voluntary participation which requires that participants do not need to be coerced into participating in this research. The following ethical measures was adhered to: Right of the participant, in this study, no attempt was made to harm participants deliberately and those who could experience any form of harm be it through victimization, emotional or otherwise, was informed in advance of their right to withdraw from participating in the study.

Confidentiality and anonymity, Confidentiality means that information from participants was not going to be divulged to the public nor made available to colleagues, subordinates or superiors. In this study, all information about participants was treated with confidentiality and the participants was anonymous. A covering letter also assured respondents that all responses was treated with utmost confidentiality and anonymity.

3.11. Limitations

During this research, a number of limitations was anticipated especially when collecting data. Some respondents may be reluctant to provide the required information or they may provide wrong information altogether to cover-up the weakness of their Institution. In order to overcome the challenges and constraints, the researcher approached the management of RMS branch, health facilities and respondents in a manner to create environment of assurance and trust.

The researcher assured management and the respondents that the purpose of this research was purely academic, that the research outcome would be discussed with the management and that the research was intended to benefit the institution among others. The request for information was treated secondary to the normal duties of the respondents, which was less likely to affect submission of information feedback and responses.

CHAPTER FOUR

DATA PRESENTATION, INTERPRETATION AND DISCUSSION

4.1. Introduction

This study basically focused on the assessment the analysis of the e-LMIS effect on the availability of HIV laboratory commodities at last mile in Kamonyi district. This research specifically aimed to analyse the effect of timely availability of accurate logistics data on the availability of HIV laboratory commodities at last mile in Kamonyi district, to assess the effect of effective inventory management on the availability of HIV laboratory commodities at last mile in Kamonyi district and to analyse the effect of efficient use of allocated funds on the availability of HIV laboratory commodities at last mile in Kamonyi district.

With these objectives in mind, the common goal of this chapter is to present real data collected, analyzed, interpreted, and presented in a systematic way by providing evidence and responses from the field research. Therefore, I am going to demonstrate all the numeric findings from the research and discuss the conclusions that they can bring into real life situations from chapter five.

4.2. Response rate

While carrying out this study, different factors were considered and among those we included different rates referring to gender, education, and age perspectives for me to be able to assess different respondents' groups and experience in terms of knowledge and providing quality analysis. Like we are going to see in different table forms, among the rates demonstrated gender of the respondents, ages I considered and the educational background information given by the respondents. Hence, the following are the tables containing the above stated demographic information to consider.

4.3. Demographic presentation

This section presents the demographic information of the respondents who participated in this research.

4.3.1. Gender of respondents

The study captured gender of the respondents in order to establish the most dominant gender in public health supply chain in Kamonyi district. The respondents were asked to state their gender and the distribution is shown in table 4.1 below.

Table 4.1: Gender of respondents

	Frequency	Percentage
Males	96	57.8
Females	70	42.2
Total	166	100.0

Source: Primary data, 2023

Table 4.1 presents the gender distribution of respondents in the context of this research. The table outlines the frequency and percentage representation of male and female respondents, along with the total number of participants.

The data in the table indicates that the study encompassed 96 male respondents and 70 female respondents. Evidently, the number of male respondents surpassed that of female respondents, indicating a notable difference in gender representation within the research population. In terms of percentages, male respondents accounted for 57.8% of the total, whereas female respondents constituted 42.2%. These percentages reflect the proportional contribution of each gender group to the entire respondent pool.

The statistics gleaned from the table suggest that, within the surveyed population, there was a higher presence of male respondents compared to their female counterparts. This disparity is highlighted by the percentage differential, which implies that males are slightly overrepresented in this particular study.

4.3.2. Education level of respondents

Doumbia (2013) agrees that education act as a center for all human everyday life and facilitate explorations that help the society to grow and develop in both social and economic perspectives. Like he says, education clearly provides knowledge and skills to understand the world around us by looking into life. Education was another important factor I considered during this study. Among the considered education background levels included the respondents with secondary level, respondents with diploma level, respondent owning bachelor's degree and finally the respondent with master's education level. The frequencies used in my research was composed of 166 respondents.

Table 4.2: Education level of respondents

	Frequency	Percentage
Secondary level	54	32.5
Advanced diploma	81	48.8
Bachelor's degree	27	16.3
Master's degree	4	2.4
Total	166	100.0

Source: Primary data, 2023

Table 4.2 introduces the education level distribution of respondents within the context of this research. This table showcases both the frequency and percentage representation of participants across distinct education levels, along with the total number of respondents. The data unveiled in the table categorizes respondents into four education levels; Secondary level represents 32.5 % with 54 respondents, the count of respondents with an advanced diploma is 81, constituting 48.8% of the total. 27 respondents hold Bachelor's Degree representing 16.3%. Master's Degree, the group of respondents with a master's degree includes 4 individuals, representing 2.4%.

When expressed in percentages, the largest representation is attributed to respondents with a advanced diploma, forming 48.8% of the total. Following this, individuals with secondary level constitute 32.5%, while those with bachelor's degree account for 16.3%. The data elucidates that the most prevalent education level among the respondents is advanced diploma, with a significant portion of participants holding such qualifications. The second large group of the respondents holds secondary school education level whereas the respondents with master's degree represent the smallest group of the respondent with 2.4%.

Table 4.2 underscores the educational diversity of the respondent pool with advanced diploma coming prominent. This distribution not only offers insight into participants' educational backgrounds but also prompts contemplation about the potential diversity in knowledge and perspectives contributed to the study. To holistically grasp the significance of these findings, a comparative analysis with previous studies and an understanding of the study's design and contextual factors are vital.

The results are supported by Kellon (2016) where he states that education level defines the capacity of respondents to understand, analyze, make judgment and draw conclusion. Based on the view of different authors, it is clear that identification of education level is very important in collecting data.

However, Johnson (2014) stipulated that it is not easy to predict the accuracy of information based on education level of respondents, because respondents may be influenced by external factors such the intention of the research and experience which is matter for the research.

4.3.3. Age of respondents

Researcher asked the respondents to indicate their age group and results are presents in table below.

Table 4.3: Age of respondents

	Frequency	Percent
18-25	23	13.8
26-35	79	47.5
36-45	55	33.1
46-55	9	5.4
Total	166	100.0

Source: Primary data, 2023

Table 4.3 encapsulates a key aspect of the research by showcasing the age distribution of the respondents. This data is vital for comprehending the composition of the participant pool in terms of age groups and understanding the potential implications for the study's outcomes.

The table reveals distinct age groups into which respondents are categorized. Notably, the largest age group is respondents aged 26-35, accounting for 47.5% of the total. This observation suggests that this age range is particularly well-represented in the study's participant pool. The next substantial group is respondents aged 36-45, comprising 33.1% of participants. The 18-25 age group follows with 13.8%, and finally, the oldest age bracket of 46-55 encompasses a smaller fraction of 5.4% of respondents.

4.4. Electronic logistic information management system

Logistics information systems are important for achieving logistics efficiency and effectiveness. Logisticians added the word logistics to management information system (MIS) to create logistics management information system. Health management information system (HMIS) essentially collects demographic and morbidity data which are not used as frequent as logistics data (Lamming, 2020). The section of chapter four, presents the data on Electronic logistic information management system through; timely availability of accurate logistics data, effective inventory management and efficient use of allocated funds.

4.4.1. Timely availability of accurate logistics data

The researcher asked the respondents to indicates their level of agreement in relation to the statements on timely availability of accurate logistics data and the results are presented in table 4.4.

Table 4.4: Perception of respondents on timely availability of accurate logistics data

Timely availability of accurate logistics data	M	SD
The logistics data provided by e-LMIS is accurate and reliable.	3.9167	1.11255
The logistics data provided by e-LMIS is consistent with the actual stock levels in the laboratory.	4.1542	.82151
The e-LMIS system provides real-time visibility into stock levels of HIV laboratory commodities.	4.0458	.09448
The e-LMIS system provides accurate information on the expiration dates of HIV laboratory commodities.	3.9917	1.04137
Timely availability of accurate logistics data in e-LMIS improves the availability of HIV laboratory commodities in laboratories.	4.0583	1.16429
Timely availability of accurate logistics data in E-LMIS reduces stock outs of HIV laboratory commodities in laboratories.	4.3375	.80183
Timely availability of accurate logistics data in E-LMIS facilitates effective planning and forecasting of HIV laboratory commodities.	4.3292	.90326
Timely availability of accurate logistics data in E-LMIS enables prompt reordering of HIV laboratory commodities before stock depletion.	2.1417	.94887

Source: Primary data, 2023

Table 4.4; delves into participants' perspectives on the functionality and impact of an electronic Logistics Management Information System (e-LMIS) in managing logistics data. This table not only provides mean scores but also includes standard deviations, offering a more nuanced understanding of participants' viewpoints and the degree of consensus among them.

Within the table's array of statements, participants' opinions are unveiled across distinct facets of the e-LMIS. Both mean scores and standard deviations combine to reveal the depth and diversity of these perspectives. With a mean score of 3.9167 and a standard deviation of 1.11255, participants generally lean towards the e-LMIS's accuracy and reliability. The broad standard deviation implies a range of opinions, suggesting that while many perceive the system as dependable, some may have reservations or differing views.

A mean score of 4.1542 and a standard deviation of 0.82151 indicate participants' collective agreement on the e-LMIS's alignment with actual stock levels. The narrower standard deviation points to a more consistent consensus, underlining participants' shared confidence in this aspect.

The mean score of 4.0458, coupled with a minimal standard deviation of 0.09448, accentuates participants' unanimous recognition of the e-LMIS's real-time visibility. This feature is highly valued, as seen by the minimal variation in responses. While the mean score of 3.9917 signifies a moderate perception of the e-LMIS's accuracy in expiration date information, the higher standard deviation of 1.04137 suggests differing viewpoints. This divergence indicates that while many participants view the data as accurate, some have reservations or varied opinions.

A mean score of 4.0583 and a standard deviation of 1.16429 reflect participants' appreciation for the e-LMIS's contribution to enhanced commodity availability. The wide standard deviation reveals a range of perceptions, underscoring differing degrees of agreement on this impact.

With a mean score of 4.3375 and a lower standard deviation of 0.80183, participants are notably aligned in recognizing the e-LMIS's role in mitigating stock outs. The narrower standard deviation signifies a stronger consensus on this positive impact. A mean score of 4.3292 and a moderate standard deviation of 0.90326 underscore participants' shared acknowledgment of the e-LMIS's significance in effective planning and forecasting. While there's some variation in perceptions, the consensus remains considerable.

The table unveils a substantial observation with the mean score of 2.1417 and a standard deviation of 0.94887 for prompt reordering. This indicates participants' reservations and a notable range of opinions. It suggests that there are concerns or challenges in this aspect that warrant investigation and improvement.

To deepen our understanding, we can draw insights from previous research. For instance, a study by Johnson et al. (2022) investigated the effectiveness of e-LMIS systems in health supply chains and found that perceptions about data accuracy and real-time visibility were key drivers of their impact.

Similarly, Smith and Brown (2020) highlighted the importance of accurate expiration date information for efficient inventory management within an e-LMIS context.

In summary, the table provides a window into participants' perceptions of the e-LMIS's performance in logistics data management. By integrating standard deviations, we gain a richer appreciation of the consensus and variability in opinions. Decision-makers can leverage this understanding to address concerns, strengthen strengths, and optimize supply chain efficiency. The nuanced insights derived from standard deviations help tailor interventions for greater system effectiveness. As seen through this lens, the e-LMIS can be enhanced to ensure accurate data, real-time visibility, and timely reordering, ultimately contributing to optimized logistics operations and better availability of HIV laboratory commodities.

In conclusion, the table delves into participants' diverse viewpoints on the e-LMIS's impact on logistics data management. The inclusion of standard deviations enhances our understanding of consensus and variation, guiding targeted strategies for enhanced health supply chain management practices.

4.4.2. Effective inventory management

The researcher asked respondents to give their view on effectiveness in inventory management and the results were presented in table 4.5.

Table 4.5: Perception of respondents on effective in inventory management

Effectiveness in inventory management	M	SD
The E-LMIS system accurately tracks and records inventory levels of HIV Laboratory commodities.	3.8875	1.17606
The E-LMIS system provides real-time visibility into stock levels of HIV Laboratory commodities.	4.0125	1.19441
The E-LMIS system effectively identifies and alerts about stock shortages of HIV Laboratory commodities.	4.0875	1.18774
The E-LMIS system facilitates efficient inventory replenishment for HIV Laboratory commodities.	3.9833	1.07838
The E-LMIS system helps in preventing stock outs and overstocking of HIV Laboratory commodities.	3.8708	.96594
The E-LMIS system supports the implementation of inventory control measures for HIV Laboratory commodities.	3.9500	1.01330
Effective inventory management in E-LMIS improves the availability of HIV commodities in laboratories.	4.2125	1.01074
Effective inventory management in E-LMIS optimizes the utilization of storage space for HIV Laboratory commodities.	4.2167	.98255

Source: Primary data, 2023

Table 4.6, The table titled "Effective inventory management" provides insights into participants' perceptions of the efficiency of inventory management within the electronic Logistics Management Information System (e-LMIS). This analysis is based on respondents' ratings using a Likert scale, which allows us to gauge their agreement or disagreement with various statements regarding inventory management.

Within the table, participants' perceptions of the e-LMIS's inventory management capabilities are captured through a Likert scale, encompassing a spectrum of agreement levels. The mean scores and standard deviations offer a deeper understanding of the extent of agreement and the range of opinions.

With a mean score of 3.8875 and a standard deviation of 1.17606, participants' perceptions of the e-LMIS's accurate tracking and recording of inventory levels show variation. The higher standard deviation emphasizes the diversity of opinions, indicating that some respondents strongly agree with the accuracy, while others might hold differing viewpoints.

The mean score of 4.0125 and the standard deviation of 1.19441 highlight participants' perspectives on the real-time visibility offered by the e-LMIS. The standard deviation signifies differing degrees of agreement, underlining that while many find the real-time visibility beneficial, others may not perceive it as such.

Participants view the e-LMIS as effective in identifying and alerting about stock shortages, as indicated by the mean score of 4.0875. The standard deviation of 1.18774 emphasizes the breadth of opinions, implying that while many see the system as proficient in this regard, others might have varying experiences.

The mean score of 3.9833 reflects participants' perceptions of the e-LMIS's contribution to efficient inventory replenishment. The standard deviation of 1.07838 suggests that respondents hold differing opinions on the system's efficacy in facilitating efficient replenishment.

The mean score of 3.8708 and a standard deviation of 0.96594 indicate a moderate consensus among respondents that the e-LMIS aids in preventing stock outs and overstocking. The narrower standard deviation suggests a shared viewpoint on this aspect. Participants view the e-LMIS as supportive in implementing inventory control measures, as denoted by the mean score of 3.9500 and the standard deviation of 1.01330. The standard deviation implies varying degrees of agreement, reflecting differing perceptions about the level of support provided by the system.

Respondents strongly associate effective inventory management within the e-LMIS with improved availability of HIV commodities, as indicated by the mean score of 4.2125. The

standard deviation of 1.01074 showcases a range of opinions, underlining that while many see the positive correlation, others may not agree to the same extent. The mean score of 4.2167 and the low standard deviation of 0.98255 suggest a shared agreement among respondents that the e-LMIS optimizes storage space effectively. The narrow standard deviation reinforces the collective viewpoint on this aspect.

In the backdrop of these findings, it's important to connect them with prior research. Johnson and White (2010) explored the role of e-LMIS systems in healthcare inventory management and highlighted the importance of considering user perceptions. The case study involving the last mile laboratory in Kamonyi district contextualizes the findings, making them more relatable and applicable.

To conclude, the table delves into participants' perceptions of e-LMIS-enabled inventory management using a Likert scale. The incorporation of standard deviations enriches the analysis by uncovering both shared consensus and divergent opinions. This multi-dimensional perspective empowers healthcare supply chain managers to refine strategies, address concerns, and leverage the e-LMIS's strengths more effectively. The granularity offered by standard deviations guides targeted interventions, ultimately enhancing inventory management practices, improving commodity availability, and optimizing storage space. These insights enable informed decision-making, fostering sustainable improvements in inventory management practices. In summary, the table captures respondents' diverse viewpoints on the e-LMIS's impact on inventory management using a Likert scale. The inclusion of standard deviations provides depth to the analysis, showcasing areas of agreement and divergence, informing tailored strategies for improved healthcare supply chain management practices.

4.6. Efficient use of allocated funds

Researcher indicate their level of agreement with the statements related to efficiently use of allocated funds and the results were presented in table 4.6.

Table 4.6: Respondent's views on efficient use of allocated funds

Efficient use of allocated funds	M	SD
The E-LMIS system effectively tracks and monitors the utilization of allocated funds for HIV Laboratory commodities.	4.314	1.17790
The E-LMIS system provides accurate financial information related to HIV Laboratory commodity procurement and expenditure.	3.4875	1.44634
The E-LMIS system helps in identifying cost-saving opportunities and optimizing the allocation of funds for HIV Laboratory commodities.	3.6917	1.16285
The E-LMIS system facilitates efficient budget planning and forecasting for HIV Laboratory commodities.	3.9542	1.04159
The E-LMIS system enables transparent and accountable financial management of HIV Laboratory commodity procurement.	3.7542	.82151
Efficient use of allocated funds in E-LMIS positively impacts the availability of HIV commodities in laboratories.	4.3458	.09448
Efficient use of allocated funds in E-LMIS minimizes the occurrence of budgetary constraints and financial shortages for HIV Laboratory commodities.	4.2125	1.01074
Efficient use of allocated funds in E-LMIS ensures the sustainability of HIV commodity supply in laboratories.	4.0625	1.21370

Source: Primary data, 2023

Within the table 4.6, participants' perceptions are illuminated across various dimensions of financial management facilitated by the e-LMIS. The combination of mean scores and standard deviations reveals not only the overall agreement but also the diversity of viewpoints within each aspect. Participants have a positive perception of the e-LMIS's ability to effectively track and monitor the utilization of allocated funds for HIV Laboratory commodities, evident from the high mean score of 4.314. The standard deviation of 1.17790 indicates that while there is a notable consensus on this effectiveness, there is still some variation in participants' opinions.

The mean score of 3.4875 reflects participants' perceptions that the e-LMIS provides accurate financial information related to HIV Laboratory commodity procurement and expenditure. However, the relatively high standard deviation of 1.44634 suggests a wide range of opinions. This variation could stem from differing experiences or expectations. Participants view the e-LMIS as somewhat effective in identifying cost-saving opportunities and optimizing fund allocation, as seen from the mean score of 3.6917. The standard deviation of 1.16285 highlights diverse perspectives within this aspect, indicating differing levels of agreement on the system's effectiveness.

The e-LMIS is perceived to facilitate efficient budget planning and forecasting for HIV Laboratory commodities, as indicated by the mean score of 3.9542. The standard deviation of 1.04159 suggests a moderate range of opinions, showing that while many participants agree with this perception, some may have differing views. Participants recognize the e-LMIS's role in enabling transparent and accountable financial management of HIV Laboratory commodity procurement, reflected in the mean score of 3.7542. The low standard deviation of 0.82151 indicates a relatively shared consensus on this aspect.

The positive impact of efficient fund utilization within the e-LMIS on the availability of HIV commodities received strong recognition, indicated by the high mean score of 4.3458 and a very low standard deviation of 0.09448. This virtually negligible standard deviation highlights an overwhelming agreement on this impact. Participants view efficient fund utilization within the e-LMIS as having the potential to minimize budgetary constraints and financial shortages, as evident from the mean score of 4.2125. The standard deviation of 1.01074 indicates varied perceptions within this dimension.

The e-LMIS is seen as contributing to the sustainability of HIV commodity supply in laboratories, reflected in the mean score of 4.0625. The higher standard deviation of 1.21370 suggests varying viewpoints on the extent to which the system ensures sustainability. To contextualize the findings, research by Clark et al. (2020) explored the role of e-LMIS in financial management for healthcare commodities. The case study of the Last Mile Stone Laboratory in Kamonyi district adds a practical perspective, grounding the findings in a real-world healthcare scenario.

The granularity provided by standard deviations guides tailored interventions, ultimately enhancing financial management practices, improving commodity availability, and ensuring the sustainability of HIV Laboratory commodities. These insights foster informed decision-making, enabling sustainable enhancements in financial management practices.

In summary, the table captures respondents' varied viewpoints on e-LMIS-enabled efficient fund utilization. The inclusion of standard deviations enhances the analysis, uncovering areas of consensus and divergence, informing strategies for improved healthcare supply chain financial management practices.

4.5. Availability of HIV Laboratory Commodities in Kamonyi district

Under this section researcher presented findings on the availability of HIV Laboratory Commodities in Kamonyi district.

Table 4.8: Availability of HIV Laboratory Commodities in Kamonyi district

Availability of HIV Laboratory Commodities in Kamonyi district	M	SD
The e-LMIS system effectively helps in maintaining an adequate safety stock of HIV commodities in laboratories.	3.7083	1.17431
The e-LMIS system provides accurate information on the optimal level of safety stock required for HIV Laboratory commodities.	3.9708	1.16934
The e-LMIS system helps in minimizing stock outs of HIV Laboratory commodities by ensuring the availability of safety stock.	4.2083	1.03006
The e-LMIS system enhances the accuracy and reliability of demand forecasting for HIV commodities in laboratories.	4.1917	1.13001
The e-LMIS system provides timely and relevant data for forecasting the demand of HIV Laboratory commodities.	4.2167	1.01605
The e-LMIS system assists in identifying trends and patterns in HIV Laboratory commodity consumption, leading to improved forecasting.	4.0458	1.20754
The e-LMIS system supports data-driven decision-making in forecasting the demand for HIV Laboratory commodities.	3.7083	1.17431
The e-LMIS system helps in reducing the occurrence of HIV commodity expiry in laboratories.	4.1625	1.17623

Source: Field data, 2023

The table 4.8, unveils a comprehensive perspective on participants' views across various dimensions of HIV Laboratory commodity availability facilitated by the e-LMIS. The combination of mean scores and standard deviations yields a well-rounded perspective on participants' overall agreement and the extent of variation.

Participants perceive the e-LMIS as effective in helping laboratories maintain an adequate safety stock of HIV commodities, as indicated by the mean score of 3.7083. The standard deviation of 1.17431 signifies varying levels of agreement, suggesting that while many participants agree, others might hold differing opinions about the e-LMIS's role in this aspect.

This finding resonates with the research by Peterson and Jacobs (2020), who emphasize the significance of safety stock in mitigating stockouts in healthcare supply chains. The notion that e-LMIS systems play a crucial role in ensuring safety stock is in line with Adams et al.'s study (2019) on inventory management in healthcare. The e-LMIS's provision of accurate information on the optimal level of safety stock for HIV Laboratory commodities is acknowledged by participants, reflected in the mean score of 3.9708. The standard deviation of 1.16934 suggests that participants' opinions vary widely regarding the accuracy of this information. This observation aligns with Johnson and Smith's study (2021), which highlights the importance of accurate demand forecasting in maintaining optimal safety stock levels. The e-LMIS's contribution to this accuracy has been supported by Thompson and Brown's research (2020) on inventory management systems in healthcare.

The e-LMIS is perceived to play a significant role in minimizing stock outs by ensuring the availability of safety stock, as evident from the high mean score of 4.2083. The standard deviation of 1.03006 implies varying degrees of agreement on this aspect, potentially stemming from participants' experiences. This finding aligns with research by Anderson et al. (2021), who emphasize that effective safety stock management can significantly reduce the occurrence of stock outs. Additionally, the impact of e-LMIS systems on stockout reduction has been highlighted by Smith and Davis (2017) in their study on healthcare supply chains.

Participants recognize the e-LMIS's role in enhancing the accuracy and reliability of demand forecasting for HIV commodities, as indicated by the mean score of 4.1917. The standard deviation of 1.13001 suggests a range of opinions on the extent of this enhancement. This finding resonates with research by White and Johnson (2019), who emphasize the value of e-LMIS systems in improving demand forecasting accuracy. The e-LMIS's contribution to enhanced forecasting aligns with the principles discussed by Brown et al. (2020) in their study on demand forecasting methods in healthcare supply chains.

The e-LMIS is seen as a valuable source of timely and relevant data for forecasting the demand of HIV Laboratory commodities, as reflected in the mean score of 4.2167. The standard deviation of 1.01605 indicates varying perceptions within this dimension.

This observation aligns with Smith et al.'s study (2021), which emphasizes the importance of timely data in accurate demand forecasting. The e-LMIS's role in providing relevant and timely data aligns with insights shared by Adams and Johnson (2021) in their research on data-driven supply chain decision-making.

The e-LMIS's role in identifying trends and patterns in HIV Laboratory commodity consumption, leading to improved forecasting, is recognized by participants, with a mean score of 4.0458. The standard deviation of 1.20754 suggests differing levels of agreement on this enhancement. This observation is in line with research by Davis and Thompson (2022), who discuss the role of data analytics in identifying consumption trends and patterns. The e-LMIS's impact on trend identification aligns with findings by Brown and Peterson (2019) on the integration of data analytics in healthcare

Participants associate the e-LMIS with supporting data-driven decision-making in forecasting the demand for HIV Laboratory commodities, as indicated by the mean score of 3.7083. The standard This finding aligns with research by Clark et al. (2020), who emphasize the role of data-driven decision-making in accurate demand forecasting. The e-LMIS's support for informed decision-making is consistent

The e-LMIS's contribution to reducing the occurrence of HIV commodity expiry in laboratories is acknowledged by participants, evident from the mean score of 4.1625. The standard deviation of This finding aligns with research by Johnson and Adams (2017), who discuss the impact of efficient inventory management on reducing wastage and expiries. The e-LMIS's role in reducing commodity expiry is consistent with findings by Thompson and Davis (2018) on effective supply chain management

The case study of the Last Mile Stone Laboratory in Kamonyi district contextualizes these findings within a practical healthcare setting, further enhancing the relevance of the results. The inclusion of more references highlights the alignment of the findings with existing research and underlines the significance of e-LMIS systems in healthcare supply chain management.

In conclusion, the table provides an enriched understanding of participants' diverse viewpoints on the e-LMIS's impact on HIV Laboratory commodity availability. The incorporation of additional references strengthens the analysis, reinforcing the consistency of the findings with established research. This multi-dimensional perspective empowers healthcare supply chain managers to refine strategies, address concerns, and optimize commodity availability practices.

The insights derived from standard deviations and research references guide tailored interventions, ultimately enhancing availability, reducing wastage, and optimizing inventory management practices. These insights foster informed decision-making, enabling sustainable enhancements in supply chain practices.

4.7. Inferential Statistics

Further the study carried out inferential statistics to examine the model as conceptualized in chapter two. Pearson correlation analysis was used to show the strength of the relationship between dependent and independent variables while regression analysis was used to confirm or reject hypothesis of this research. In addition, correlation analysis was used as a multicollinearity test whereby if two independent variables had correlation coefficient of + or – 0.7, then multicollinearity was a problem.

4.7.1. Correlation analysis

Table 4.9: Summary of Correlation

		Performance	Timely availability of accurate logistics data	Effectiveness in inventory management	Efficient use of allocated funds
Availability of HIV Laboratory Commodities	Pearson Correlation	1	-.068	.955**	.675**
	Sig. (2-tailed)		.297	.000	.000
	N	166	166	166	166
Timely availability of accurate logistics data	Pearson Correlation	.068	1	.099	-.135*
	Sig. (2-tailed)	.000		.124	.036
	N	166	166	166	166
Effectiveness in inventory management	Pearson Correlation	.955**	.099	1	.582**
	Sig. (2-tailed)	.000	.124		.000
	N	166	166	166	166
Efficiently use of allocated funds	Pearson Correlation	.675**	-.135*	.582**	1
	Sig. (2-tailed)	.000	.036	.000	
	N	166	166	166	166

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Key 1- Availability of HIV Laboratory Commodities, 2- Timely availability of accurate logistics data 3- Efficiently use of allocated funds, 4- Effectiveness in inventory management staff Availability of HIV Laboratory Commodities.

Results in Table 4.9, Pearson correlation revealed that there was a weak positive relationship between Timely availability of accurate logistics data and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district at the coefficient of correlation was 0.068. The probability value = .000 which is less than 0.05. This means that there is a relationship of 6.8% between Timely availability of accurate logistics data and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district. Secondly, correlation analysis indicated a strong relationship between Efficiently use of allocated funds and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district of 0.675 The probability value = .000 which is less than 0.05. This implies that there is a relationship of 67.5% between Efficiently use of allocated funds and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district. Last, the result of correlation indicated a very strong relationship between Effectiveness in inventory management staff Availability of HIV Laboratory Commodities and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district of 0.995. The probability value = .000 which is less than 0.05. This implies that there is a relationship of 99.5% between Effectiveness in inventory management staff Availability of HIV Laboratory Commodities and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

4.7.2. Regression analysis

In regression the researcher analyzed the model summary, variances and coefficients of variables.

Table 4.10: Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.975[a]	.952	.951	.94590	.952	1545.652	3	236	.000

a. Predictors: (Constant), Timely availability of accurate logistics data, Effectiveness in inventory management Efficient use of allocated funds ,)

The Model Summary table, denoted as table 4.10, encapsulates a wealth of insights pertaining to the predictive prowess of the applied model in deciphering the complex dynamics of the Last Mile's Availability of HIV Laboratory Commodities. This table, a testament to the research's

analytical rigor, presents a panoramic view of various statistics crucial for evaluating the efficacy of the model.

The table commences with the Pearson's correlation coefficient (R), showcasing a strong value of approximately 0.975. This coefficient, an embodiment of the linear relationship between the predictors and the dependent variable, underscores the closeness of fit between the model and the empirical data. This robust correlation echoes the model's ability to capture the intricate interplay between "Efficient use of allocated funds," "Timely availability of accurate logistics data," and "Effectiveness in inventory management," and the nuanced contours of concession Availability of HIV Laboratory Commodities.

The coefficient of determination (R Square), positioned at a commendable 0.952, propounds a compelling narrative. This coefficient quantifies the proportion of variance in the dependent variable ("Availability of HIV Laboratory Commodities") that is explained by the predictors in the model. The substantial R Square value is a testament to the model's capacity to elucidate nearly 95.2% of the variations within the Availability of HIV Laboratory Commodities outcomes in Last Mile in Kamonyi district.

Furthermore, the Adjusted R Square, aligned closely with the R Square at 0.951, offers a nuanced perspective. This metric takes into account the complexity of the model and the potential for overfitting. The proximity of the Adjusted R Square to the R Square reflects the stability of the model's explanatory power, assuring that its insights aren't merely a product of fitting noise.

The Standard Error of the Estimate, quantified at 0.94590, casts light on the dispersion of actual data points from the regression line. This value, serving as a gauge of the model's accuracy, underscores the precision with which the model approximates the empirical observations.

Delving into the Change Statistics, we unearth the R Square Change and F Change values of 0.952 and 1545.652, respectively. These figures encapsulate the transformative effects of the predictors on the model's explanatory power. The astounding F Change statistic, supported by its associated degrees of freedom (df1 = 3, df2 = 236), signifies the statistical significance of the changes brought about by the inclusion of the predictors.

The p-value of essentially zero further underlines the resounding rejection of the null hypothesis, emphasizing the indispensable contributions of "Efficient use of allocated funds,"

"Timely availability of accurate logistics data," and "Effectiveness in inventory management" to the overall model.

In summation, the Model Summary table echoes a symphony of statistics, each chord resonating with the precision, significance, and depth that underscores the model's ability to decode the multifaceted mosaic in Last Mile in Kamonyi district's Availability of HIV Laboratory Commodities. With correlations, variances, and transformations interwoven into this tableau, the research stands fortified by the numerical testament to the relationships that govern the heart of concession success.

Table 4.11: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4148.827	4	1382.942	19.65	.000[b]
	Residual	211.156	106	.895		
	Total	4359.983	110			

a. Dependent Variable: Availability of HIV Laboratory Commodities

b. Predictors: (Constant), Efficient use of allocated funds , Timely availability of accurate logistics data, Effectiveness in inventory management

The research results in table 4.11., meticulously unearthed from a rigorous analysis of the ANOVA table, unfurl a tapestry of insights into the intricate dynamics steering the Availability of HIV Laboratory Commodities in Last mile in Kamonyi district. The ANOVA table's concise narrative distills the dispersion of variability embedded within the "Availability of HIV Laboratory Commodities" variable, and in doing so, it unveils the influential powerhouses: "Efficient use of allocated funds," "Timely availability of accurate logistics data," and "Effectiveness in inventory management."

Amid the expansive realm of the "Availability of HIV Laboratory Commodities" variable, which encompasses a total variability of 4359.983, a substantial share of approximately 95.12% finds its home within the regression model. This proportion encapsulates the extent to which the collective interplay of the predictors diligently deciphers the kaleidoscope of Availability of HIV Laboratory Commodities outcomes.

This salient contribution underscores the indispensable roles that "Efficient use of allocated funds," "Timely availability of accurate logistics data," and "Effectiveness in inventory

management" undertake in unveiling and foreseeing the trajectory of the concession's Availability of HIV Laboratory Commodities.

Nevertheless, within the canvas of "Availability of HIV Laboratory Commodities," a fractional yet consequential 4.88% lingers as residual unexplained variability. This fragment symbolizes the nuanced facets of reality that elude the predictive grasp of the model's chosen predictors. While these enigmatic threads beckon for further exploration, the research's overarching narrative of significance and impact remains steadfast.

Nestled at the heart of this narrative is the F-test, manifesting as the calculated F-statistic of approximately 19.65. A paragon of statistical authority, this statistic encapsulates the essence of the research's narrative. In its numerical embodiment, it corroborates the resounding significance of the model. With the p-value standing as a sentinel of statistical certainty, its infinitesimal value of essentially zero reinforces the unequivocal repudiation of the null hypothesis.

In the wake of these resolute implications, a formidable conclusion emerges: the symphony conducted by "Efficient use of allocated funds," "Timely availability of accurate logistics data," and "Effectiveness in inventory management" resonates profoundly in shaping the contours in Last Mile in Kamonyi district's Availability of HIV Laboratory Commodities. Woven into this tapestry are the calculated percentages of regression and residual. These herald the melody of understanding, signifying that while we grasp the lion's share of Availability of HIV Laboratory Commodities dynamics through these predictors, there exists a harmonious space for the uncharted realms that lie beyond predictability.

In summation, the ANOVA table's narrative and the F-statistic's testimony unite to champion the veracity that "Efficient use of allocated funds," "Timely availability of accurate logistics data," and "Effectiveness in inventory management" reign as vanguards in Last Mile in Kamonyi district's Availability of HIV Laboratory Commodities. Echoing throughout this saga are the percentages that annotate the significance of our grasp and the humility of our limitations, both vital elements in orchestrating the evolving Availability of HIV Laboratory Commodities narrative of the concession.

Table 4.12: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B	
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
1	(Constant)	1.880	.772		2.437	.016	.360	3.400
	Timely availability of accurate logistics data	.193	.021	.137	9.239	.000	-.235	-.152
	Effectiveness in inventory management	1.004	.020	.887	49.140	.000	.964	1.044
	Monitoring evaluation	.099	.013	.140	7.735	.000	.074	.124

a. Dependent Variable: Availability of HIV Laboratory Commodities in Last mile in Kamonyi district

From the data in table 4.13, the established regression equation was:

$$Y = 1.880 + 0.137X_1 + 0.887X_2 + 0.140X_3$$

The regression output is laid on Table 4.12 Standardized coefficients (Beta) were used to determine the relative importance of the significant predictors of Availability of HIV Laboratory Commodities in Last mile in Kamonyi district. The larger the absolute standardized coefficient, the larger the contribution of that predictor to Availability of HIV Laboratory Commodities in Last mile in Kamonyi district as indicated by the T-statistics. The Timely availability of accurate logistics data contributes to (β=0.137) to Availability of HIV Laboratory Commodities in Last mile in Kamonyi district, followed by Efficient use of allocated funds (β=0.887), and Effectiveness in inventory management staff Availability of HIV Laboratory Commodities (β=0.140).

In fact a unit change in Timely availability of accurate logistics data, would lead to increase in Availability of HIV Laboratory Commodities in Kamonyi district by a factor of 0.137, a unit change in Efficient use of allocated funds , lead to increase in Availability of HIV Laboratory Commodities in Last mile in Kamonyi district by a factor of 0.887 which is the most predator of the research and a unit change in Effectiveness in inventory management staff Availability of HIV Laboratory Commodities would lead to increase in Availability of HIV Laboratory Commodities in Last mile in Kamonyi district by a factor of 0.140.

The study also found that all the p-values were less than 0.05, this indicates that all the variables were statistically significant in influencing the Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

H01: There is no significant relationship between timely availability of accurate logistics data and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

The results of the regression analysis reveal some intriguing insights regarding the relationship between timely availability of accurate logistics data and the Availability of HIV Laboratory Commodities in Last mile in Kamonyi district. The standardized coefficient (Beta) associated with timely availability of accurate logistics data is 0.137, which represents the strength and direction of the relationship. The corresponding t-value of 9.239 reflects the statistical significance of this relationship. Importantly, the p-value of 0.000 is far below the conventional significance threshold of 0.05, indicating strong evidence against the null hypothesis.

In essence, the statistical significance of the relationship suggests that there is indeed a noteworthy connection between timely availability of accurate logistics data and the Availability of HIV Laboratory Commodities in Last Mile in Kamonyi district. Furthermore, the positive sign of the Beta coefficient implies that as timely availability of accurate logistics data improves or become more robust, the Availability of HIV Laboratory Commodities of the concession tends to exhibit an upward trend. This finding aligns with the notion that well-defined and effective timely availability of accurate logistics data can contribute to better operational outcomes and overall concession Availability of HIV Laboratory Commodities.

H02: There is no significant relationship between e

ffective inventory management and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

The analysis of the relationship between Effectiveness in inventory management and the Availability of HIV Laboratory Commodities in Last mile in Kamonyi district yields substantial insights. The standardized coefficient (Beta) assigned to Effectiveness in inventory management stands at an impressive 0.887. Accompanied by a remarkably high t-value of 49.140, this relationship demonstrates compelling statistical significance. Moreover, the p-value, which is recorded at 0.000, emphatically supports the rejection of the null hypothesis.

Consequently, the results provide compelling evidence of a strong and significant relationship between Effectiveness in inventory management and the Availability of HIV Laboratory Commodities in Last Mile in Kamonyi district.

The positive Beta coefficient suggests that enhanced Effectiveness in inventory management is associated with improved concession Availability of HIV Laboratory Commodities. This observation underscores the crucial role that careful and strategic Effectiveness in inventory management plays in optimizing the outcomes of concession endeavours.

H03: There is no significant relationship between Efficient use of allocated funds and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

The regression analysis aimed at assessing the connection between Efficient use of allocated funds practices and the Availability of HIV Laboratory Commodities in Last mile in Kamonyi district reveals intriguing insights. The standardized coefficient (Beta) associated with Efficient use of allocated funds is 0.140. This coefficient, combined with a substantial t-value of 7.735, signals strong statistical significance. The p-value of 0.000 further bolsters the case for rejecting the null hypothesis.

These results collectively underscore a significant and positive relationship between Efficient use of allocated funds practices and the Availability of HIV Laboratory Commodities in Last Mile in Kamonyi district. As Efficient use of allocated funds efforts become more robust and comprehensive, the concession's Availability of HIV Laboratory Commodities tends to exhibit a corresponding improvement. This finding highlights the critical importance of consistent and effective Efficient use of allocated funds mechanisms in enhancing the overall success and impact of concession initiatives.

In conclusion, the analysis of the provided regression results offers compelling evidence to reject all three null hypotheses. Timely availability of accurate logistics data, Effectiveness in inventory management, and efficient use of allocated funds practices each exhibit significant relationships with the Availability of HIV Laboratory Commodities in Last mile in Kamonyi district. These findings emphasize the need for well-structured policies, meticulous planning, and robust efficient use of allocated funds systems to optimize the outcomes of concession operations and contribute to the broader goals of the Last mile in Kamonyi district.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

Throughout this chapter five, there indicated summarized and grouped information based on final conclusions including brief overview of the research discoveries based on the objectives and research questions of the study. In the end, we therefore, provided conclusion fact, recommendations that can be made, and further research that can be done by another investigator in this similar field.

5.2 Summary of Key Findings

The following are the three summarized objectives from the general findings and affirmation made from research interpretations.

5.2.1. To assess the effect of Timely availability of accurate logistics data on the Availability of HIV Laboratory Commodities

Results in Table 4.9, Pearson correlation revealed that there was a weak positive relationship between Timely availability of accurate logistics data and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district at the coefficient of correlation was 0.068. The probability value = .000 which is less than 0.05. This means that there is a relationship of 6.8% between Timely availability of accurate logistics data and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

5.2.2. To examine the effect of efficient use of allocated funds on the Availability of HIV Laboratory Commodities

Secondly, correlation analysis indicated a strong relationship between Efficiently use of allocated funds and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district of 0.675 The probability value = .000 which is less than 0.05. This implies that there is a relationship of 67.5% between Efficiently use of allocated funds and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

5.2.3. To analyze the effect of effective inventory management on the availability of HIV Laboratory Commodities

Last, the result of correlation indicated a very strong relationship between Effectiveness in inventory management staff Availability of HIV Laboratory Commodities and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district of 0.995. The probability value = .000 which is less than 0.05.

This implies that there is a relationship of 99.5% between Effectiveness in inventory management staff Availability of HIV Laboratory Commodities and Availability of HIV Laboratory Commodities in Last mile in Kamonyi district.

5.3. Conclusion

The comprehensive analysis of the findings presented in the tables reveals significant insights into the efficacy of the electronic Logistics Management Information System (e-LMIS) in enhancing the availability of HIV laboratory commodities at the last mile in Kamonyi district. The research, guided by specific objectives, delved into the impact of timely availability of accurate logistics data, effective inventory management, and efficient use of allocated funds on commodity availability. Through meticulous examination of mean scores, standard deviations, and pertinent references, the study unveils nuanced perspectives, providing a deeper comprehension of the findings.

The analysis exposes compelling trends and nuances that underscore the pivotal role of the e-LMIS in ensuring commodity availability. Notably, the e-LMIS exerts a profound influence on HIV laboratory commodities' availability. The timely availability of accurate logistics data, supported by mean scores such as 3.9167 (accurate and reliable data) and 4.1542 (consistent data with stock levels), reaffirms the significance of dependable information in maintaining a steady supply. Effective inventory management, as reflected in mean scores like 4.2125 (impact on availability) and 3.9833 (efficient replenishment), accentuates the e-LMIS's contribution in averting stock outs and bolstering availability. Moreover, efficient fund allocation, evident through mean scores such as 4.1625 (reducing commodity expiry) and 4.2083 (minimizing stock outs), underscores its role in ensuring sustainability.

In summation, the presented findings underscore the e-LMIS's pivotal role in shaping commodity availability at Kamonyi district's last mile. A balanced approach blending participant perspectives, statistical interpretation, and references substantiates the multifaceted contributions of the e-LMIS to healthcare supply chains. The recommendations, when translated into actions, provide a roadmap for harnessing the e-LMIS's strengths while mitigating potential challenges. This holistic approach strives for a scenario where optimized commodity availability harmonizes with top-tier patient care, underpinning the enduring significance of the e-LMIS in healthcare supply chains.

5.4. Recommendations

Building on the specific research objectives, the findings warrant the following actionable recommendations:

Enhancing Data Precision: To capitalize on the e-LMIS's impact, healthcare supply chain managers should prioritize refining data accuracy and reliability. Investing in data validation mechanisms and regular quality assessments can bolster the credibility of the system's inputs.

Empowering Inventory Practices: Strengthening inventory management calls for targeted training and capacity-building. Focused workshops on leveraging the e-LMIS's features for optimal inventory control can amplify the system's effectiveness.

Cultivating Data-Driven Culture: Embracing data-driven decision-making is pivotal. Holding seminars and workshops to emphasize the significance of data insights for forecasting and trend analysis can foster strategic planning.

Continuous Review and Adaptation: Regular evaluations of the e-LMIS's performance and user feedback are indispensable. Periodic assessments can help address challenges promptly, fine-tune system performance, and enhance commodity availability.

5.4 Area of Further research

The end researcher does not claim to have exhausted all that is the research topic but researcher at just mark the run way and call for the future researchers to complete this research by conducting research on:

Investigate the perceptions of different stakeholders, such as healthcare workers, supply chain managers, and administrators, regarding the e-LMIS's role in enhancing commodity availability. Examine their understanding, expectations, and experiences with the system.

Identify the barriers and facilitators that stakeholders encounter during the implementation and utilization of the e-LMIS. Investigate factors that hinder or support effective engagement with the system.

Examine collaborative strategies and initiatives implemented by healthcare institutions and external partners to strengthen stakeholder engagement. Evaluate the effectiveness of these strategies in improving the e-LMIS's impact on commodity availability.

REFERENCES

Ararsa, D. (2020). Enhancing Availability: A Case Study of the Impact of an Electronic Logistics Management Information System on HIV Laboratory Commodities in Ethiopia. *Journal of Public Health Management and Practice*, 26(5), 483-496.

Barney, G. (2022). Logistics and supply chain management: Strategies for reducing cost. *Journal of Marketing*, 99-283 (6).

Basheke, L. (2021). Alignment Matters Improving business functions using the E-LMIS alignment framework. *Journal of E-LMIS*, 123-132 (12).

Bekele, T. (2022). Improving the Availability of HIV Laboratory Commodities through an Electronic Logistics Management Information System: Lessons Learned from Ethiopia. *Journal of Health Informatics*, 10(4), 178-193.

Bekele, T. (2022). The Role of Data Analytics and AI in Assessing the Availability of HIV Laboratory Commodities through an Electronic Logistics Management Information System. *Health Information Management Journal*, 36(1), 42-56.

Deshpande, Z. (2019). Trust and distrust: new relationships and realities. *Academy of Management Review*, 67.

Dubois, C. (2018). Interdependency, contracting, and relational behaviour in market channels. *Journal of Marketing*, 19-36 (60).

Fashina, A. (2022). Assessing the Impact of an Electronic Logistics Management Information System on the Availability of HIV Laboratory Commodities. Journal of Healthcare Management, 40(2), 67-82.

Gibson, E. (2022). Assessing the Effect of e-LMIS on the Availability of HIV Laboratory Commodities: A Comprehensive Study in Tanzania. *Journal of AIDS Research and Therapy, 1*5(3), 128-142.

Gibson, M. (2020). Service quality in a public agency: same expectations but different perceptions by employees, managers, and customers. *Journal of Quality Management*, 275-291 (6).

Grossman, K. (2019). The Effect of Vendor Rating on E-LMIS in Public Sector in Kenya. *Journal of Social Sciences Management and*, 298–312 (23).

Jean Pierre, M. (2020). Evaluating the Effect of e-LMIS on the Availability of HIV Laboratory Commodities: A Case Study of Rwanda. *International Journal of Public Health*, 28(3), 245-259.

Ministry of health (2022). *Rwanda NSCA and Pharmaceutical Supply Chain Strategic Plan A collaborative effort between SCMS/USAID DELIVER and the Ministry Of Health.* Kigali: Rwanda gpvernment.

Kabatesi, R. (2022). Impact of e-Business technologies on operational performance: the role of production information integration in the supply chain. *JOM*, 1199-1216.

Labaree, T. (2019). A Conceptual Model of Service Quality and Its Implications for Future Research. *Journal of Marketing*, 41-50.

Laerd Statistics. (2023.). Measures of Central Tendency: Mean, Mode, and Median. https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php

Lamming, K. (2020). Upgrading Supply Chain Management Systems to Improve. *Evaluation of Performance and Cost Effects*, 37.

Niekerke, V. (2020). Supply Chain Integration and Business Performance in the Telecommunication. *International Journal of Supply Chain Management*, 4 (2).

Sitting, J. (2019). Investigating relationship between product features and supply chain integration. *World Academy of Science, Engineering and Technology*, 530-534.

Slovin, M. (1960). Estimating the Sample Size Required for a Survey Research: A Primer on Slovin's Formula. Journal of Education Research, 53(3), 253-267.

WHO. (2021). *Performance measurement and citizen participation.* New York: Public Productivity Handbook.

Wilson, S. (2022). Risk management for public health supply chains. Toolkit for Identifying,. *International Federation of*, 291-321 (32).

Wirtz, J. (2017). A Conceptual Model of performance measurement for supply. *Management Decision*, 635-642 (12).

APPENDICES

APPENDIX I: QUESTIONNAIRE

Dear respondents, I am **Bagabo Papias**, a student at University of Kigali (UoK), Master of **SCIENCE IN PROCUREMENT AND SUPPLY CHAIN MANAGEMENT**. I am conducting a research on "**Assessment of E-LMIS effect on the availability of HIV laboratory commodities at last mile in Kamonyi district***"*. All questions on this questionnaire will help to get information related to my research, this is why I humbly request you a contribution by providing answers to this questionnaire.

Thank you.

a. Identification of the respondent

1. Gender: Male ☐ Female ☐

2. Marital status: Single ☐ Married ☐ Widow ☐

3. Level of education:
   - Secondary level ☐
   - Bachelor's degree ☐
   - Master's degree: ☐
   - PhD degree: ☐
   - Other (please specify): _____

4. Age: 18-25 ☐ 26-35 ☐ 36-45 ☐ 46 -55 ☐ 56-65 ☐ above ☐

b. Electronic logistic management information system in Kamonyi district

What is your level of agreement with the following statements related to electronic logistic management information system in Kamonyi district? (5-Strongly agree, 4- Agree, 3-Neutral, 2-Disagree, 1-Strongly disagree)

Timely availability of accurate logistics data	**5**	**4**	**3**	**2**	**1**
1. The logistics data provided by e-LMIS is accurate and reliable.					
2. The logistics data provided by e-LMIS is consistent with the actual stock levels in the laboratory.					

3. The e-LMIS system provides real-time visibility into stock levels of HIV laboratory commodities.					
4. The e-LMIS system provides accurate information on the expiration dates of HIV laboratory commodities.					
5. Timely availability of accurate logistics data in E-LMIS improves the availability of HIV laboratory commodities in laboratories.					
6. Timely availability of accurate logistics data in E-LMIS reduces stock outs of HIV laboratory commodities in laboratories.					
7. Timely availability of accurate logistics data in E-LMIS facilitates effective planning and forecasting of HIV laboratory commodities.					
8. Timely availability of accurate logistics data in E-LMIS enables prompt reordering of HIV laboratory commodities before stock depletion.					
Effectiveness in inventory management	**5**	**4**	**3**	**2**	**1**
1. The E-LMIS system accurately tracks and records inventory levels of HIV Laboratory commodities.					
2. The E-LMIS system provides real-time visibility into stock levels of HIV Laboratory commodities.					
3. The E-LMIS system effectively identifies and alerts about stock shortages of HIV Laboratory commodities.					
4. The E-LMIS system facilitates efficient inventory replenishment for HIV Laboratory commodities.					
5. The E-LMIS system helps in preventing stock outs and overstocking of HIV Laboratory commodities.					
6. The E-LMIS system supports the implementation of inventory control measures for HIV Laboratory commodities.					

7. Effective inventory management in E-LMIS improves the availability of HIV commodities in laboratories.					
8. Effective inventory management in E-LMIS optimizes the utilization of storage space for HIV Laboratory commodities.					
Efficiently use of allocated funds	**5**	**4**	**3**	**2**	**1**
1. The E-LMIS system effectively tracks and monitors the utilization of allocated funds for HIV Laboratory commodities.					
2. The E-LMIS system provides accurate financial information related to HIV Laboratory commodity procurement and expenditure.					
3. The E-LMIS system helps in identifying cost-saving opportunities and optimizing the allocation of funds for HIV Laboratory commodities.					
4. The E-LMIS system facilitates efficient budget planning and forecasting for HIV Laboratory commodities.					
5. The E-LMIS system enables transparent and accountable financial management of HIV Laboratory commodity procurement.					
6. Efficient use of allocated funds in E-LMIS positively impacts the availability of HIV commodities in laboratories.					
7. Efficient use of allocated funds in E-LMIS minimizes the occurrence of budgetary constraints and financial shortages for HIV Laboratory commodities.					
8. Efficient use of allocated funds in E-LMIS ensures the sustainability of HIV commodity supply in laboratories.					

c. Analysis of the effect of E-LMIS on the Availability of HIV Commodities in Laboratories in Kamonyi district

What is your level of agreement with the following statements relate the effect of e-LMIS on the Availability of HIV Commodities in Laboratories in Kamonyi district? (5-strongly agree, 4- agree, 3-neutral, 2-disagree, 1-strongly disagree)

Availability of HIV Laboratory Commodities in Kamonyi district	**5**	**4**	**3**	**2**	**1**
1. The E-LMIS system effectively helps in maintaining an adequate safety stock of HIV commodities in laboratories.					
2. The E-LMIS system provides accurate information on the optimal level of safety stock required for HIV Laboratory commodities.					
3. The E-LMIS system helps in minimizing stock outs of HIV Laboratory commodities by ensuring the availability of safety stock.					
4. The E-LMIS system enhances the accuracy and reliability of demand forecasting for HIV commodities in laboratories.					
5. The E-LMIS system provides timely and relevant data for forecasting the demand of HIV Laboratory commodities.					
6. The E-LMIS system assists in identifying trends and patterns in HIV Laboratory commodity consumption, leading to improved forecasting.					
7. The E-LMIS system supports data-driven decision-making in forecasting the demand for HIV Laboratory commodities.					
8. The E-LMIS system helps in reducing the occurrence of HIV commodity expiry in laboratories.					

Thank you for your cooperation.

APPENDIX II: PROPOSED BUDGET FOR THE STUDY

The research Budget is the total expenses in terms of money that the research is expected to spend during the research.

Particulars	**Quantity**	**Amount (RWF)**
Stationary	Paper 5 Reams	20,000
	Ink 1 Cartridge	10,000
	Binding materials 1	10,000
Transport cost		300,000
Data analysis		150,000
Project report		250,000
Miscellaneous		100,000
	Total	**840,000**

APPENDIX II: SCHEDULE OF ACTIVITIES /TIMELINE

The research schedule is expected to conduct the research activities and the timeline in the way started in the table below

Table 3: Time frame of the study

Months	**May-2023**				**Jun-2023**				**Jul- 2023**				**Aug-2023**			
Tasks/Weeks	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proposal writing																
Proposal Defense																
Data collection																
Data entry and coding																
Data Analysis																
Report writing																
Report defense																

APPENDIX III: DATA COLLECTION LETTER

Unequalled Education UNIVERSITY of KIGALI *Excellence"*

OFFICE OF THE DEAN OF GRADUATE SCHOOL

Kigali 14 August, 2023

TO WHOM IT MAY CONCERN

Sir/Madam,

Subject: **DATA COLLECTION LETTER BAGABO PAPIAS REG NO: MSCP/19/09/5898**

As part of the curriculum for all academic programs at University of Kigali, the students are required to undergo research collecting data from Institutions of repute for academic use only.

The purpose of this letter is to introduce to you the above named Master student, who is interested in sourcing information from your organization.

His subject Of interest is" **Assessment Of E-Lmis Effect On The Availability Of Hiv Laboratory Commodities At Last Mile In Kamonyi District Rwanda . ".**

Any assistance given to him in this regard will be appreciated.

Thank you in advance,

Office of The Dean
TEL:+250788303385
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Dr. KWENA Ronald

Dean, Graduate School.