Makerere University
College of Health Sciences
SCHOOL OF PUBLIC HEALTH

Research Dissertation

ASSESSMENT OF MONITORING AND EVALUATION PRACTICES IN MANAGEMENT OF LABORATORY REAGENT STOCK OUTS IN SELECTED REGIONAL REFERRAL HOSPITALS IN UGANDA. A CONCURRENT MIXED METHODS STUDY

By

Ms. Sanger Daphine

Reg. No. 2023/HD07/3127U

A RESEARCH DISSERTATION SUBMITTED TO THE DIRECTORATE OF GRADUATE RESEARCH AND TRAINING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF PUBLIC HEALTH MONITORING AND EVALUATION OF MAKERERE UNIVERSITY

APRIL, 2026

Table of contents

Declaration

I, Sanger Daphine, hereby declare that this dissertation is my original work and, to the best of my knowledge, it has not been submitted, either in whole or in part, to any institution for any academic award, publication, or any other purpose. Any references to the work of others have been duly acknowledged.

Signature  Date 23 April 2026

Sanger Daphine

2023/HD07/3127U

School of Public Health, Makerere University

Approval

This dissertation has been prepared under the supervision of the following supervisors and is submitted with their approval

Signature 

Date_23rd April 2026

Dr. Suzanne Kiwanuka

Associate Prof and Head of Department

Health Policy Planning and Management Department

Makerere University School of Public Health.

Signature 

Date: 23rd April 2026

Mr. Noel Namuhani

Research Associate

Health Policy Planning and Management Department

Makerere University School of Public Health

Dedication

To my family and friends, for their unwavering support, encouragement, and sacrifices that made this achievement possible.

Acknowledgement

I sincerely thank God Almighty for granting me the wisdom, strength, and perseverance to complete this dissertation. His grace and guidance sustained me throughout this academic journey and made this achievement possible.

I extend my deepest gratitude to my supervisors, Dr. Suzanne Kiwanuka and Mr. Noel Namuhani, for their invaluable guidance, mentorship, and continuous support throughout this study. Their insightful feedback and commitment greatly shaped the quality of this work. I am equally grateful to my lead reviewer, Dr. Aloysius Ssenyonjo, for his critical review and constructive input that strengthened this dissertation. I also appreciate my lecturers, colleagues, and classmates for their academic support and encouragement. My heartfelt thanks go to my family for their patience, understanding, and unwavering belief in me. I extend special appreciation to Dr. Ocan Moses for his unwavering support, guidance, and encouragement throughout this journey, and to Ms. Ruth Kokusiima for her support, prayers, and encouragement. I am grateful to all friends and individuals who contributed directly or indirectly to this work.

I sincerely appreciate the management and staff of Entebbe and Mbale Regional Referral Hospitals for granting permission and facilitating data collection. I am particularly grateful to all study participants who generously shared their time and experiences, which were invaluable to this research. I further acknowledge the Makerere University School of Public Health and the Directorate of Graduate Research and Training for providing a conducive academic environment and institutional support. May this work contribute meaningfully to improving laboratory systems and healthcare delivery in Uganda.

Abbreviations/Acronyms

EMHS – Essential Medicines and Health Supplies

JCRC – Joint Clinical Research Centre

Lab-SPARS – Laboratory Supervision Performance Assessment and Recognition Strategy

LQMS – Laboratory Quality Management System

M&E – Monitoring and Evaluation

MOH – Ministry of Health (Uganda)

NMS – National Medical Stores

RRH – Regional Referral Hospital

WHO – World Health Organization

ELMIS – Electronic Logistics Management Information System

KII – Key Informant Interview

HIS – Health Information System

E-AFYA – Electronic Afya

ALIS – African Laboratory Information System

IP – implementing Partners

List of Figures

List of Tables

Operational Definitions

Laboratory Reagents: Essential chemical or biological substances utilized in diagnostic tests and laboratory procedures, critical for accurate patient assessment and treatment.

Stockout: The unavailability of a required laboratory reagent at the time it is needed for diagnostic testing, as recorded in stock cards or inventory logs.

Level of stockout: The extent or magnitude of reagent stock depletion.

Stockout Frequency: The number of times a reagent was recorded as unavailable for the period of 33 months (January 2023 – September 2025).

Stockout Duration: The number of days a reagent remained unavailable during each stockout event.

Monitoring and Evaluation Practices: Monitoring and Evaluation practices refer to the systematic processes, tools, and activities used to track, assess, and improve the management of laboratory reagents.

Monitoring: A continuous process of collecting and analysing data related to the usage and availability of laboratory reagents, allowing for real-time assessment of stock levels against predefined performance indicators.

Evaluation: A periodic and in-depth assessment of laboratory reagent management practices to determine their relevance and impact on hospital operations and patient care, enabling informed decision-making for improvements.

Systemic factors: These refer to the institutional and structural elements within the health system that create the enabling environment for implementing monitoring and evaluation practices.

Operational factors: These are the day-to-day technical processes and activities involved in the planning, monitoring, and management of laboratory reagent stocks.

Behaviors factors: These refer to the individual-level attitudes, motivations, and interpersonal dynamics that affect how M&E tools and procedures are applied in practice.

Supply Chain: The interconnected system of processes, personnel, and technology involved in the procurement, handling, storage, and distribution of laboratory reagents to ensure a consistent supply to healthcare providers.

Procurement Management: The strategic approach to sourcing and acquiring laboratory reagents, encompassing supplier selection, ordering processes, and contract management to ensure continuous availability.

Quality Control: The systematic procedures adopted to monitor the integrity and suitability of laboratory reagents from procurement through storage, ensuring they meet established standards and are fit for use in diagnostics.

Stock Management Tools: Systems or records (e.g., stock cards, logbooks, eLMIS) used to track reagent inventory levels, usage, and replenishment needs in laboratories.

Lead Time: The duration between placing an order for reagents and their delivery to the facility, which impacts stock availability.

Electronic Logistics Management Information System (eLMIS): A digital platform for recording, monitoring, and managing the supply chain of medical commodities, including laboratory reagents.

ABSTRACT

Background: Laboratory reagents are essential for accurate diagnosis and efficient healthcare delivery, yet Uganda's referral hospitals frequently experience stockouts. These shortages delay diagnosis, compromise treatment decisions, increase healthcare costs, and reduce the overall quality of patient care.

Aim: This study evaluated monitoring and evaluation(M&E) practices for managing stock out of laboratory reagents, facilitators and barriers to their application at Entebbe and Mbale regional referral hospitals.

Methods: This study is a concurrent mixed-methods study. Data on stock out of laboratory reagents was collected from the stock cards and Order /Requisition forms, Electronic afya(E-AFYA) system in the laboratory using a checklist. Additional data was collected through key informant interviews of laboratory staff in Mbale and Entebbe regional referral hospitals. The interviews were audio recorded and data analyzed using thematic manual coding. Quantitative data was summarized in frequencies and inferential analysis was conducted using chi-square tests.

Results: A total of 171 reagents experienced 848 stockout episodes from 2023–2025, with Entebbe RRH recording 66 reagents and 369 episodes, and Mbale RRH 105 reagents and 479 episodes. Entebbe had more frequent stockouts, while Mbale had fewer but longer episodes. Stockouts were most common in Immunology/Serology (37.6%) and Biochemistry (26.5%). The overall mean stockout duration was 26.7 days (SD: 39.3); Entebbe averaged 19.5 days (SD: 35.2) and Mbale 35.9 days (SD: 42.2). A Chi-square tests ($p < 0.05$) showed significant differences in stockouts between the two hospitals for Microbiology/Parasitology and Immunology/Serology, but not for Hematology and Biochemistry. Qualitative findings indicated that stock monitoring tools, electronic inventory systems, supervision, audits, and reporting mechanisms were in place in both hospitals but were applied inconsistently. Mbale achieved full implementation of the Electronic afya (E-AFYA) system in May 2025, with earlier records maintained manually, while Entebbe had relatively more organized documentation; nevertheless, both facilities demonstrated data quality challenges, including incomplete stock cards, missing records, and inconsistent requisition forms. Use of M&E data for decision-making and accountability was limited. Facilitators included leadership support, availability of digital tools, and inter-facility redistribution of reagents, whereas barriers included staff shortages, weak data-use culture, and irregular supervision.

Conclusion: Strengthening M&E systems including better data quality, reporting, supervision, staff capacity, and digital tools will enhance stockout management and ensure sustained reagent availability.

CHAPTER ONE

1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

In the healthcare sector, laboratory reagents are indispensable for accurate disease diagnosis and patient management. Ensuring their consistent availability is vital for the effective functioning of health facilities, particularly in resource-limited settings. However, stockouts of required reagents pose significant challenges to healthcare delivery in Uganda.

A study by (Boche et al., 2022) in Gambelle, Ethiopia, underscores the need for improved monitoring and evaluation(M&E) practices to enhance access to essential laboratory reagents and services, deficiencies in stock management practices hinder the availability of reagent. According to a study done in Ethiopia, deprived inventory management practice is likely related to supply, staff, and documentation challenge(Bekele et al., 2022). Recent reports highlight that drug stockouts are a recurring issue in Uganda's public health system, with many facilities experiencing shortages shortly after supplies are received(Eceru, 2023).

Monitoring and Evaluation practices play a critical role in ensuring laboratory reagent management within health facilities. Monitoring involves routine data collection and tracking of reagent availability, consumption, stock levels, and reporting timelines, while evaluation entails periodic assessment of the effectiveness, efficiency, and responsiveness of stock management systems. In laboratory settings, M&E practices include the use of stock cards and electronic logistics systems, routine supervision and audits, reporting and feedback mechanisms, accountability structures, and the use of stock data for forecasting and decision-making. When effectively implemented, these practices enable early identification of potential stockouts, timely corrective actions, and improved continuity of diagnostic services.

This study aimed to investigate the current M&E practices in managing laboratory reagents within Uganda's selected regional referral hospitals (RRHs), identify facilitators and barriers to implementation, and proposed strategies to mitigate reagent stockouts. Which will improve healthcare delivery and patient outcomes in Uganda.

1.2 Background

Laboratory services play a crucial role in healthcare by providing diagnostic tests that guide disease detection, treatment, and monitoring. For these services to function effectively, a continuous supply of laboratory re agents is essential. However, Uganda's public health system, particularly its regional referral hospitals, has been facing frequent stockouts of laboratory reagents. These shortages compromise the ability to perform timely and accurate diagnostics, leading to delayed patient care, increased healthcare costs, and poor health outcomes.

The World Health Organization (WHO) emphasizes that the availability of medical supplies, including reagents, is fundamental to ensuring high-quality healthcare (WHO, 2023a). The WHO further notes that frequent stockouts disrupt health services, reduce treatment efficiency, and affect patient outcomes(WHO, 2015). Public hospitals in Uganda are particularly vulnerable, as they provide care to large populations and depend mostly on limited government funding and a centralized distribution system(NMS, 2020).

The issue of laboratory reagent stockouts presents a significant challenge to healthcare delivery in Uganda. Referral hospitals, which serve as critical points of care for large populations, often lack the reagents needed for essential diagnostic tests. This disruption compromises service delivery by delaying the diagnosis of diseases, prolonging treatment timelines, and reducing the quality of care.

Uganda has 16 regional referral hospitals and 9 national referral hospitals, where every region at least has one referral hospital (MOH, 2024) . The National Medical Stores (NMS), responsible for distributing medical supplies, follows a two-month distribution cycle for laboratory supplies, including reagents (Zalwango et al., 2023). However, many facilities experience missed supply cycles, with some hospitals reporting delays of 2–3 cycles due to late disbursement of distribution funds. Poor planning, weak forecasting, and inadequate supervision within the supply chain system further exacerbate the challenge of stockouts (Zalwango et al., 2023). Inefficient data management systems also prevent hospitals from tracking inventory accurately, leading to stock discrepancies and unanticipated shortages (Lugada et al., 2022).

Regionally, the importance of M&E frameworks in managing medical supplies is well recognized. M&E systems enable healthcare providers to track stock levels, forecast demand,

and respond to potential shortages in a timely manner(Befekadu et al., 2020). In Uganda, however, M&E practices in stock management remain under developed, contributing to recurrent stockouts. Strengthening these practices could improve supply chain responsiveness and ensure a steady flow of reagents(Atim et al., 2024).

Despite efforts by the Ministry of Health(MOH), such as redistribution strategies and partnerships with international donors (e.g., Global Fund, PEPFAR, and CDC), gaps in reagent availability remain a significant challenge(MOH, 2024). A study by (Alabdullah et al., 2024) emphasizes that laboratories are vital components of health systems, essential for patient diagnosis, rapid clinical care, disease surveillance, pathogen characterization, and the research and development of treatments. The management of laboratory reagents is a critical component of healthcare delivery, where accurate and timely diagnostics are essential. Hospitals often face significant challenges with stockouts of laboratory reagents, which can severely impact patient care(Niyonzima et al., 2021). Laboratory reagent stockouts result in delays in diagnosis, inappropriate treatment decisions, and increased healthcare costs, ultimately compromising the quality of healthcare services provided to patients(Lee Hilborne, 2022).

Stockouts of laboratory reagents in Ugandan referral hospitals have been a persistent issue, affecting the overall efficiency and effectiveness of healthcare delivery. According to Nkengasong, stockouts can lead to substantial delays in diagnostic services, which are crucial for guiding clinical decisions(Nkengasong et al., 2018). Consistent availability of laboratory reagents is essential for the accuracy and reliability of diagnostic tests, which underpin effective treatment and disease management.

Evidence from Uganda shows that laboratory and pharmacy supply systems already implement several monitoring and logistics management practices. A study by (Lugada et al., 2022) found that nearly all public (100%) and private (97%) health facilities routinely separate expired or damaged medical products and that 91% of public and 92% of private facilities regularly monitor stock status for EMHS. Additionally, 87.5% of facilities conduct commodity forecasting, and about 65.6% use supply chain data to support decision-making. According to the Ministry of Health's Management of Medicines and Health Supplies Manual(MOH, 2012), stock cards and stock books are the primary tools used to document stock movement, determine average monthly consumption (AMC), compute minimum and maximum stock levels, and guide ordering decisions. However, national assessments highlight persistent gaps in adherence to supply plans, incomplete use of electronic LMIS platforms, and low stock card accuracy,

which undermine the reliability of these monitoring systems. Together, these gaps raise concerns about the consistency, quality, and effectiveness of existing M&E practices within laboratory settings underscoring the need for this study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature from different scholars and researchers who have studied management of laboratory reagents stockouts or related field and monitoring and evaluation practices. The chapter aimed at understanding views of other researchers in similar settings.

2.2 Role of Laboratory Diagnostics in Disease Management and Treatment Outcomes

Laboratory diagnostics are widely recognized as a cornerstone of effective healthcare delivery, supporting accurate disease detection, treatment selection, and clinical monitoring. Evidence shows that timely and reliable diagnostic testing improves decision-making by enabling clinicians to confirm disease conditions, guide therapeutic choices, and monitor treatment response (Ciaccio, 2024).

In infectious disease management, laboratory testing plays a critical role in identifying causative pathogens and informing antimicrobial use, which is essential for reducing inappropriate treatment and preventing resistance (Aqdi, 2019). Similarly, in chronic disease care, laboratory monitoring supports long-term disease control through regular assessment of biomarkers and treatment adjustment.

2.3 Practices in Laboratory Reagent Management

Effective laboratory reagent management is essential to ensure the continuous availability of necessary diagnostic materials. Globally, implementing robust inventory management systems, establishing reliable supply chains, and conducting regular training for laboratory personnel on reagent handling and storage are recognized best practices in managing laboratory reagent stockouts(Needle.Tube, 2024b). For instance, effective inventory management includes labelling, grouping, and regularly auditing stock to prevent shortages and ensure timely replenishment. Additionally, developing standardized procedures for storing, handling, and tracking lab reagents ensures consistency and compliance with regulatory requirements, Regular training for laboratory personnel on reagent handling and storage is also essential to maintain the integrity of reagents and ensure accurate test results(Needle.Tube, 2024b).

In sub-Saharan Africa, effective management of laboratory reagent stockouts is crucial for maintaining uninterrupted diagnostic services. Laboratory reagent management practices often

include proper labelling, storage, and inventory control to ensure reagent quality and safety, Regular monitoring of expiration dates and adherence to manufacturer guidelines are crucial, Implementing a Laboratory Quality Management System (LQMS) can enhance efficiency and minimize errors(Befekadu et al., 2020). Additionally, the Laboratory Network Approach is being implemented regionally to optimize laboratory systems. This strategy emphasizes enhancing procurement processes and supply chain management, resulting in more efficient service delivery and better health outcomes. By fostering training initiatives and close collaboration (Kalyesubula-Kibuuka & Silva, 2018).

In Uganda, effective management of laboratory reagent stockouts has been addressed through initiatives like the Laboratory Supervision Performance Assessment and Recognition Strategy (Lab-SPARS). This program aims to enhance stock and storage management practices across health facilities, support the implementation of updated laboratory commodity management procedures, and improve the utilization of resources. By focusing on these areas, Lab-SPARS seeks to reduce stockouts and ensure a consistent supply of essential laboratory reagents(MOH, 2017).

Additionally, the Ministry of Health's Pharmacy department conducts national monitoring of health commodity availability through monthly Facility Tracer Medicines Stock Status Reports, compiled using DHIS2 (HMIS 105 Section 6). These reports cover thousands of public and PNFP health facilities across the country, including regional referral hospitals such as Mbale RRH and Entebbe RRH, which routinely submit stock status data. The reports assess indicators such as stock on hand, quantity consumed, days out of stock, and Months of Stock (MOS) categorised as Out-of-Stock, Under-Stocked, Appropriately Stocked, or Overstocked. For example, the September 2021 report recorded 64% (n = 4,198) facility reporting, although complete reporting for all tracer commodities remained low at 9%, highlighting persistent gaps in data quality and consistency within national monitoring systems (MOH, 2021).

Furthermore, a study on improving HIV testing kits inventory management in high-volume laboratories highlighted the importance of effective inventory systems. The study found that poor inventory management led to significant stockouts of HIV test kits in government facilities, underscoring the need for robust inventory practices to ensure the continuous availability of essential testing supplies(Atim et al., 2024). These initiatives and studies underscore the importance of robust inventory management and proactive monitoring in mitigating laboratory reagent stockouts in Uganda.

2.4 Prevalence of Laboratory Reagent Stockouts in Hospitals

2.4.1 Factors associated with Laboratory Reagent Stockouts in Hospitals

Laboratory reagent stockouts in referral hospitals are primarily caused by supply chain disruptions, financial constraints, inadequate inventory management, theft, and the use of expired reagents.

Supply Chain Challenges: Supply chain inefficiencies are a major contributor to laboratory reagent stockouts. Issues such as procurement inefficiencies, supplier delays, and logistical challenges can disrupt the timely delivery of essential reagents. A study assessing Uganda's health supply chain system found that 40% of stockouts were due to delivery gaps or delayed deliveries, while 35% resulted from discrepancies between orders and deliveries(Lugada et al., 2022).

Inadequate Inventory Management and Forecasting: Effective inventory management is crucial for preventing stockouts, however Poor practices, such as inaccurate data recording and lack of regular audits, contribute to reagent shortages(Needle.Tube, 2024a). Proper storage is essential, inadequate conditions can lead to reagent degradation, necessitating disposal and further depleting inventory(Needle.Tube, 2024d). Additionally, a study in Burundi revealed major shortcomings in stock management practices, with 38% of facilities failing to update stock cards and 75% lacking daily consumption sheets, also deficiencies in organizing, storing, and establishing appropriate stock levels for reagents and consumables.

Funding Constraints and Budget Allocation Issues: Limited financial resources hinder hospitals' ability to procure necessary reagents promptly, exacerbating stockouts(Needle.Tube, 2024c). The Ministry of Health acknowledged that budgetary constraints limit the provision of adequate reagents for example Hepatitis B testing, leading to shortages across various health facilities(NewVision, 2020). Additionally, funding gaps, and reliance on donor support(Mubangizi, 2022) can lead to inconsistent procurement and supply of essential reagents.

Poor Coordination and Communication Among Stakeholders: A study assessing compliance with the Uganda Ministry of Health's redistribution strategy for EMHS in Mbale district found challenges in coordination among public health facilities, leading to inefficiencies in stock management(Kyalisiima et al., 2023).

Limited Utilization of M&E Data: An assessment of laboratory diagnostics performance across 100 Ugandan laboratories indicated that 66.7% of hub laboratories referred specimens due to lack of reagents(Namuhani et al., 2021) suggesting gaps in utilizing M&E data to anticipate and mitigate such shortages.

Human Resource Challenges: A study on Uganda's laboratory human resources highlighted constraints such as inadequate staffing and training, adversely affecting the performance of laboratory services(Kiwanuka et al., 2020).

Rampant Theft: Stockouts are also linked to theft essential diagnostic supplies.The unauthorized taking of medical products, including reagents, leads to unexpected shortages and financial losses(Okaba, 2023).

Expired Reagents: Expired reagents contribute to stockouts, as they must be discarded, reducing available supplies, using expired reagents can compromise test accuracy and patient safety(Improve, 2024)

Failure to address these challenges will continue to delay diagnostic services, increase operational inefficiencies, raise healthcare costs, and negatively impact patient outcomes. The health system will also struggle to make informed decisions based on incomplete diagnostic data, further compromising healthcare quality.

2.5 Consequences of Laboratory Reagent Stockouts

Laboratory reagent stockouts in referral hospitals can have profound implications across various facets of healthcare delivery.

Impact on Healthcare Service Delivery: The unavailability of essential laboratory reagents leads to significant disruptions in healthcare services. Without the necessary reagents, laboratories are unable to perform critical diagnostic tests, resulting in delayed diagnoses and potential misdiagnoses. This delay can compromise treatment decisions, as clinicians may lack the necessary information to make informed choices. A report highlights that stockouts can disrupt the delivery of care and compromise patient safety (Needle.Tube, 2024e) .

Economic and Financial Implications: Stockouts of laboratory reagents can lead to increased healthcare costs. Healthcare providers may need to resort to alternative, often more expensive, diagnostic approaches or outsource tests to external laboratories, incurring additional expenses.

Moreover, inefficiencies arising from stockouts, such as repeated patient visits and extended hospital stays due to delayed diagnoses, further escalate costs. Implementing robust inventory management systems and diversifying supply sources are recommended strategies to mitigate the impact of reagent supply chain disruptions on hospital operations (Needle.Tube, 2024f).

Patient Outcomes and Public Health Risks: The absence of essential laboratory reagents adversely affects patient outcomes. Delayed or missed diagnoses can lead to disease progression, increased morbidity, and, in severe cases, mortality. For instance, the inability to promptly diagnose infections or monitor chronic conditions due to reagent shortages can result in poor patient prognoses. A study notes that laboratory supply shortages have created a healthcare crisis, impacting the practice of laboratory medicine and, consequently, patient care(Lee Hilborne, 2022)

2.6 'Existing M & E frameworks for laboratory reagents in hospitals in Uganda

The Ministry of Health (MoH) in Uganda has established national monitoring and evaluation (M&E) frameworks to guide the performance and continuity of laboratory services, including the management of essential laboratory reagents. The Monitoring and Evaluation Plan for Implementation of the Ministry of Health Strategic Plan 2020/21–2024/25 provides an overarching framework for tracking health sector performance indicators, including commodity availability, service delivery outputs, and accountability mechanisms across health facilities. Within this framework, routine reporting, supervision, and data use are emphasized as key approaches for improving decision-making and ensuring uninterrupted laboratory operations (MOH, 2022).

In addition, the National Health Laboratory Services Strategic Plan III (2021–2025) offers a laboratory-specific policy direction aimed at strengthening diagnostic systems through improved infrastructure, workforce capacity, quality assurance, and supply chain coordination. The strategic plan highlights the importance of timely quantification, stock monitoring, and the integration of laboratory logistics information into national reporting systems as essential components of preventing reagent stockouts and enhancing service readiness at referral hospitals (MOH, 2023). Together, these frameworks provide the national policy foundation within which monitoring and evaluation practices for laboratory reagent stock management are implemented in Uganda.

Furthermore, laboratory reagent management in regional referral hospitals operates within the broader national Essential Medicines and Health Supplies (EMHS) supply chain system coordinated through hospital Pharmacy Departments. The Uganda EMHS Management Manual provides guidance on quantification, requisitioning, storage, redistribution, and accountability mechanisms that are critical for monitoring reagent availability and preventing stockouts (MOH, 2018). This is reinforced by the Uganda National Health Laboratory Services Policy, which emphasizes uninterrupted diagnostic service delivery through strengthened laboratory commodity management systems (MOH, 2009).

2.7 Identified Gaps in M&E of Laboratory Reagent Stockouts management

Effective Monitoring and Evaluation (M&E) are crucial for ensuring the continuous availability of laboratory reagents in Uganda's healthcare system. However, several gaps hinder the efficiency of current M&E practices, leading to challenges in managing reagent stockouts.

Limited Research on Laboratory Reagent Stockouts and M&E Implementation: There is a notable scarcity of comprehensive studies focusing specifically on laboratory reagent stockouts and the effectiveness of M&E systems in mitigating these shortages. While some research has addressed stockouts of medical commodities, such as malaria diagnostics and treatments, these studies often do not delve into the specific challenges associated with laboratory reagents. This lack of targeted research limits the understanding of the root causes of reagent stockouts and the development of tailored interventions(Zalwango et al., 2023).

Gaps in Data Accuracy, Timeliness, and Reliability in Uganda's Laboratory Supply Chain: Accurate and timely data are essential for effective M&E; however, Uganda's laboratory supply chain faces significant challenges in this area. Issues such as delayed reporting, incomplete data entries, and discrepancies between reported and actual stock levels compromise the reliability of information used for decision-making. For instance, assessments have highlighted serious concerns regarding the timeliness of orders and the accuracy of data within the Electronic Logistics Management Information System (eLMIS), which is critical for managing laboratory supplies(Lugada et al., 2022).

Addressing these gaps is essential for strengthening the M&E of laboratory reagent stockouts in Uganda. Enhancing research efforts, improving data management practices, and fostering

better integration between facility and national M&E systems will contribute to more reliable laboratory services and better healthcare outcomes.

2.8 Strategies for Improving M&E Practices in Laboratory Reagent Management

Effective M&E practices are essential for ensuring the availability and proper utilization of laboratory reagents. Implementing the following strategies can enhance M&E in laboratory reagent management:

Strengthening Inventory Management Systems Using Real-Time Data Analytics

Implementing real-time data analytics in inventory management allows laboratories to monitor reagent usage patterns, predict future needs, and prevent stockouts. By utilizing electronic inventory management systems, laboratories can track reagent levels accurately and make informed decisions regarding procurement and distribution. Regular audits and staff training further support effective inventory control (Needle.Tube, 2024a).

Enhancing Funding Mechanisms and Government Intervention

Adequate funding and proactive government policies are crucial for maintaining a consistent supply of laboratory reagents. Governments can allocate sufficient budgets for laboratory services, establish efficient procurement processes, and implement policies that prioritize the availability of essential reagents. Collaborations with international partners and donors can also supplement funding and provide technical assistance(Coulibaly et al., 2024).

Capacity Building for Healthcare Workers in Stock Management

Training healthcare workers in effective stock management practices ensures the proper handling and utilization of laboratory reagents. Educational programs can focus on inventory control, storage conditions, and usage monitoring. Empowering staff with these skills reduces wastage, prevents stockouts, and enhances the overall efficiency of laboratory operations(Coulibaly et al., 2024).

Leveraging Technology for Automated M&E Processes

Integrating technology into M&E processes streamlines data collection, analysis, and reporting. Automated systems can provide real-time insights into reagent usage, stock levels,

and supply chain performance. Tools like the Monitoring and Evaluation Systems Assessment Tool (M&ESAT) offer systematic approaches to assess and improve M&E systems(Huf et al., 2022).

Conclusion

Laboratory reagents are essential for accurate diagnostics in hospitals. Stockouts, caused by supply chain inefficiencies, financial constraints, and weak inventory management, disrupt healthcare service delivery and compromise patient outcomes(WHO, 2023b)

Effective M&E systems ensure accurate stock tracking and timely reporting. However, Uganda faces challenges such as unreliable data and weak system integration. Strengthening M&E through real-time analytics, funding, and automation can improve reagent availability(Atim et al., 2024).

The literature review identified key gaps in laboratory reagent stock management, which guid ed the study to focus on improving M&E practices. It highlights the need for data-driven solutions and policy recommendations to enhance supply chain resilience

CHAPTER THREE

3.0 Statement of the problem, Justification, conceptual framework, Research questions.

3.1 Problem Statement

Many public hospitals in Uganda face frequent stockouts of laboratory reagents, disrupting diagnostic services and limiting their ability to perform essential tests (MOH, 2009). A 2018 survey revealed that over 90% of facilities experience stockouts, with critical reagents missing during high-demand periods(GHSC-PSM, 2018), and according to Lugada 84% of health facilities reported stockouts in 2022, the primary causes included sudden increases in demand (59%), delivery gaps or delayed deliveries (40%), and discrepancies between orders and deliveries (35%) resulting in significant delays in patient care(Lugada et al., 2022). A study by (Namuhani et al., 2021)further highlighted that laboratories are forced to refer specimens for tests due to reagent shortages, increasing inefficiencies. Patients relying on regional referral hospitals for diagnostic services are the most affected, as stockouts delay test results, compromise treatment timelines, and negatively impact health outcomes.

Reagent stockouts in referral hospital laboratories arise from systemic and operational challenges such as weak forecasting, supply expiry, funding constraints, delayed NMS deliveries, and compliance gaps (Kyalisiima et al., 2023; Ugandaradionetwork, 2017). In Mbale Regional Referral Hospital, these factors have contributed to recurrent shortages, while in Entebbe Regional Referral Hospital, stockouts are further linked to low staffing levels, budgetary limitations, poor storage practices, and high rates of expiry(Nexusmedia, 2024; Nilepost, 2024). In response, the Ministry of Health and National Medical Stores conduct annual quantification, implement redistribution strategies, and receive partner support from initiatives such as the Global Fund, PEPFAR, and CDC to strengthen laboratory capacity(NMS, 2020). Uganda has also developed key policies, manuals, and M&E frameworks, including the Uganda National Health Laboratory Services Policy(MOH, 2009), the EMHS Management Manual (MOH, 2018), and introduced M&E frameworks for instance, National Health Laboratory Services Strategic Plan (NHLSSP) M&E Framework (2021–2025) - IHP+ common M&E Framework(MOH, 2022) to guide reagent stock management. Existing studies on implementation of M&E practices in similar contexts have emphasized their potential to influence performance(Shuna & Kithandi, 2024).

Despite the establishment of Monitoring and Evaluation frameworks by Uganda's Ministry of Health and the nationwide adoption of DHIS2 for timely and comprehensive reporting of monthly facility-level data(MOH, 2022), there is limited evidence of effective use of these

systems at the hospital level particularly within Regional Referral Hospital (RRH) laboratories. This is due to the lack of clear guidelines and protocols to support the execution of M&E practices for managing laboratory reagent stockouts, which has contributed to limited stakeholder knowledge (Kiwanuka et al., 2020; Kyalisiima et al., 2023). As a result, documentation is often inaccurate, reporting is incomplete, and decision-making is compromised (Kiwanuka et al., 2020). Furthermore, although significant efforts have focused on system deployment, there has been little formal evaluation of their functionality or impact, leaving critical gaps in the ability to assess and improve laboratory services effectively.

The Uganda National Health Laboratory Services Policy emphasizes the need for a robust M&E system to ensure quality laboratory services. However, it acknowledges gaps in the practical application and documentation of these M&E activities, which hampers the ability to monitor performance effectively(MOH, 2009). This gap in research limits the availability of comprehensive evidence needed by decision-makers to enhance and refine existing strategies.

This study aimed to bridge this knowledge gap by examining how M&E practices are applied in managing laboratory reagent stockouts in selected Regional Referral Hospitals in Uganda. A comparative analysis between Mbale and Entebbe hospitals was conducted to assess differences in the integration and consistency of M&E frameworks.

By addressing the identified knowledge gap, the research provides insights that can guide policymakers and stakeholders in developing practical strategies to improve the effectiveness of M&E practices in mitigating laboratory reagent stockouts.

3.2 Study Justification and Significance

The management of laboratory reagent stockouts in Uganda's regional referral hospitals is crucial for quality healthcare, as these reagents are vital for accurate diagnosis and treatment. The National Health Laboratory Services Strategic Plan III (2021-2025) highlights challenges in Uganda's laboratory services, particularly reagent stockouts and the need for improved monitoring and evaluation practices(MOH, 2022). The 2023 study on HIV testing kits inventory management underscores gaps in inventory systems and interventions to address stockouts(Atim et al., 2024). Similarly, the Joint clinical research center (JCRC) Impact Story (2022) emphasizes strengthening laboratory systems and the critical role of M&E in ensuring reagent availability(Matama, 2022). Together, these sources illustrate the interconnected challenges and solutions in Uganda's laboratory systems. Addressing these gaps through

focused research on M&E practices in referral hospitals can lead to improved reagent management and enhanced healthcare outcomes in Uganda.

This study provides context-specific and up-to-date evidence on laboratory reagent stockouts, Monitoring and Evaluation (M&E) practices, as well as the facilitators and barriers influencing these practices in Ugandan referral hospitals. It also offers practical strategies to enhance M&E practices. The findings inform policymakers and decision-makers in developing effective strategies for strengthening laboratory stock management in the country.

3.3 Conceptual framework

This study adopted a modified version of the WHO Health System Framework to guide the assessment of monitoring and evaluation (M&E) practices related to the management of laboratory reagent stockouts in Regional Referral Hospitals (RRHs) in Uganda. The conceptual framework acknowledges that stockout management is influenced by the interaction of three key domains: systemic factors, operational factors, and behavioural factors. These domains collectively determine the presence, implementation, and characteristics of M&E practices.

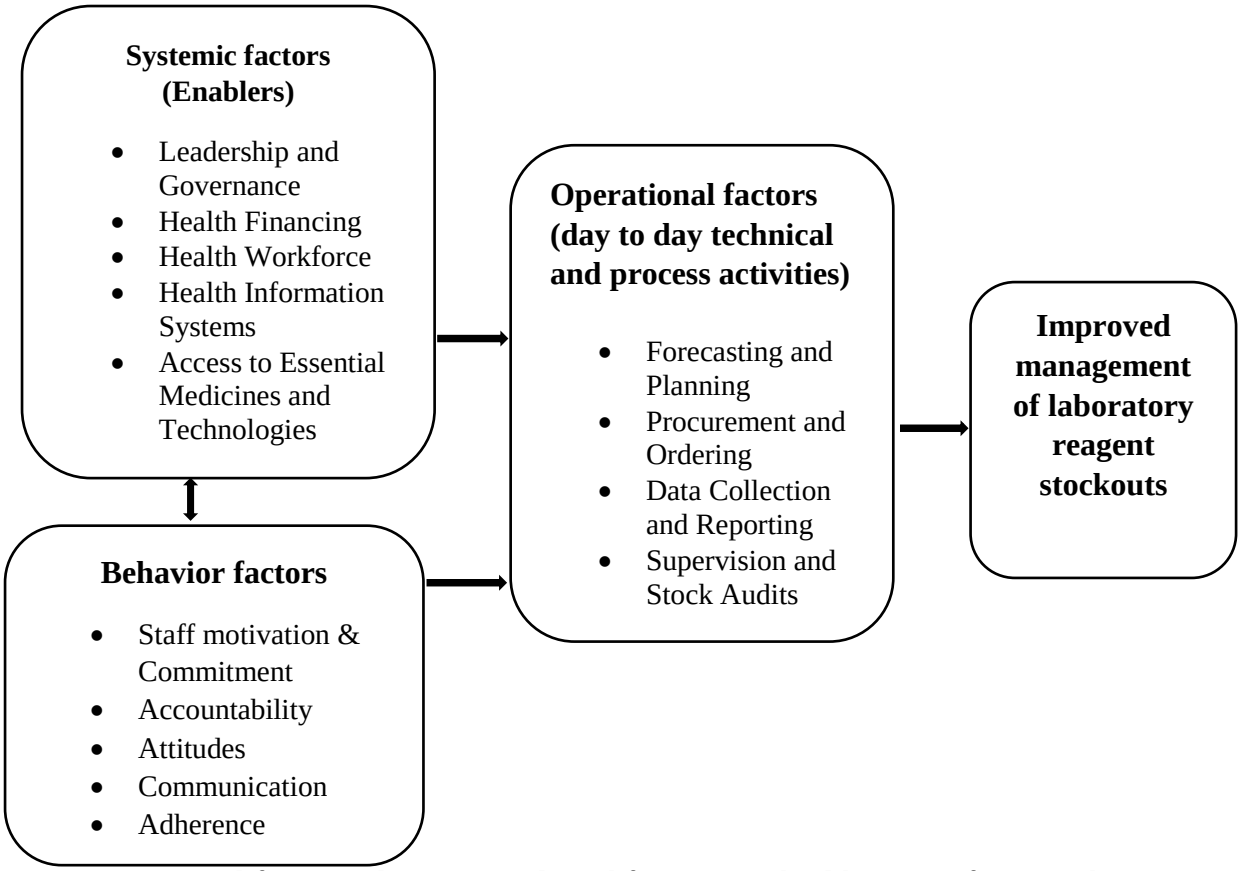


Fig. 1. Conceptual framework, Source, adapted from WHO health system framework(WHO, 2010)

This conceptual framework illustrates that monitoring and evaluation (M&E) practices related to the management of laboratory reagent stockouts are shaped by the combined influence of systemic enablers, technical processes, and human behaviours. Systemic factors such as leadership, financing, staffing, HIS, and supply systems establish the necessary foundation for implementing M&E activities. Operational practices such as forecasting, data collection, and auditing reflect the execution of M&E functions within RRHs. However, the behaviours of personnel whether they are motivated, accountable, and responsive determines how consistently these systems and practices are applied.

Narrative

Only when these three domains are aligned, strong system structures, operational practices, and supportive behaviours, can the outcome of improved reagent stockout management be realized.

Systemic Factors (Enabling environment): These represent the foundational structures and institutional arrangements that support M&E implementation. These are adapted directly from the WHO's six health system building blocks which include; *Leadership and Governance* Provides policy guidance, oversight, enforcement of accountability, and coordination of M&E activities related to reagent stock management. *Health Financing* ensures the availability of funds for reagent procurement, M&E functions (training, supervision), and infrastructure support. *Health Workforce* refers to the availability, competency, and deployment of skilled personnel responsible for inventory tracking, stock audits, and reporting. *Health Information Systems (HIS)* encompasses tools and systems (e.g., eLMIS, stock cards) that support timely and accurate data collection, analysis, and reporting. *Access to Essential Medicines and Technologies* focuses on procurement systems, timely supply and delivery of reagents, storage, and quality assurance mechanisms. *Service Delivery* reflects the continuity and efficiency of laboratory services and how they are sustained through uninterrupted reagent availability. These systemic enablers influence both the capacity and quality of operational practices and staff behaviours in stockout management.

Operational Factors Refer to the day-to-day technical processes involved in laboratory reagent stock management. *Forecasting and Planning* estimates reagent needs based on historical consumption data and service volumes. *Procurement and Ordering* initiates timely and evidence-based requisitions and following up on delivery timelines. *Data Collection and Reporting* means recording, updating, and submitting inventory reports through tools such as

eLMIS, stock cards, reports. *Supervision and Stock Audits* refers to conducting regular inventory reviews, spot checks, and supervisory visits. *Use of M&E Data for Decision-Making* focuses on applying stock data for timely reordering, redistribution, or escalation. These processes are essential in identifying, addressing, and preventing reagent stockouts within RRHs.

Behavioural Factors (Staff-Level Influences) are the attitudes, motivations, and interpersonal behaviours of staff that affect how M&E tools and processes are used. These include: *Motivation and Commitment* refers to the Willingness to engage in routine stock tracking and M&E activities. *Accountability* encompasses Personal responsibility for maintaining accurate records and addressing supply issues. *Attitudes* refers to the Perceptions of the value and importance of timely reporting and data use. *Communication and Teamwork:* ensures collaboration between departments and openness in sharing stock challenges. *Adherence to SOPs* refers to consistent application of standard procedures in managing reagents and reporting. These behavioural components can either support or undermine the execution of otherwise well-designed systems and processes.

This integrated understanding will guide data collection and analysis throughout the study, enabling a holistic assessment of how M&E practices are being applied and their relationship to stockout trends in Regional Referral Hospitals.

3.4 Research questions

1. What is the level of stock out of laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda?
2. What monitoring and evaluation practices are used in managing laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda?
3. What are the facilitators and barriers to implementation of monitoring and evaluation practices in managing laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda?

CHAPTER FOUR

4.0 STUDY OBJECTIVES

4.1 General objective

To investigate stock out of laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda, monitoring and Evaluation practices, and the facilitators and barriers to their implementation.

4.2 Specific objectives

1. To assess the level of stock out of laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda.
2. To describe the monitoring and evaluation practices used in managing laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda.
3. To explore the facilitators and barriers to implementation of monitoring and evaluation practices in managing laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda.

CHAPTER FIVE
5.0 MATERIALS AND METHODS

5.1 Study area

Mbale Regional Referral Hospital is a government owned and funded hospital. It is located 250km east of Kampala in the Centre of Mbale City. The Hospital serves a population of over 4.6 million people in 16 districts of Busia, Tororo, Butaleja, Pallisa, Budaka, Mbale, Bududa, Sironko, Manafwa, Namisindwa, Butebo, Kapchorwa, Kibuku, Bukwo, Kween and Bulambuli. Started 1924 as a health Centre and has since grown to a 450-bed capacity Regional Referral hospital. As a regional referral hospital, MRRH offers a wide range of medical services, including surgical interventions, emergency care, obstetrics and gynaecology, paediatrics, and HIV/AIDS treatment.

Entebbe Regional Referral Hospital a government owned and funded hospital located in the central business district of Entebbe, Wakiso District, approximately 36 kilometres southwest of the Ugandan capital city, Kampala. It closed the outpatient, dental, optical, maternal, and child care departments in March 2020 to focus on the effective management of COVID-19 patients and reopened for service in March 2021(Komasawa et al., 2023; Ugandaradionetwork, 2022).Before its closure, the hospital served a population of over one million people from within Entebbe municipality, Katabi town council, Buvuma and Kalangala districts but now after reopening, it serves a catchment population of 3.7 million people with most patients come from the districts of Wakiso, Kampala, Mpigi, Nakaseke, Kalangala, and Butambala. Originally constructed by British colonialists in the 20th century, the hospital underwent significant renovations and expansion, increasing its capacity from 100 to 200 beds. ERRH provides both public, free-service healthcare and private, fee-for-service options. The hospital offers a variety of medical services, including paediatrics, radiology, laboratory, maternity, immunization, general surgery, internal medicine, orthopaedics, and operating rooms. It serves also as a referral centre for lower-level health facilities.

The study was conducted at Entebbe and Mbale Regional Referral Hospitals (RRHs) in Uganda. These hospitals were purposively selected to represent the best- and worst-performing regional referral hospitals in the country. This ranking was based on the overall hospital performance indicators (outputs, quality, and efficiency), since no established laboratory-specific performance ranking system or published benchmarking evidence was available to

guide hospital selection. According to the FY 2023–2024 Annual Health Sector Performance Report, Entebbe RRH ranked among the lowest-performing facilities, while Mbale RRH ranked among the highest(MOH, 2024). Regional referral hospitals were chosen for this study because they manage a high volume of laboratory stock, given the large populations they serve, and they also provide supervisory support to lower-level health facilities across the country.

5.2 Study design

This study adopted a concurrent mixed-methods design. It involved secondary data analysis of hospital laboratory records, including an inventory review to examine the frequency and duration of stockouts between January 2023 and September 2025. A desk review was conducted to assess the use and completeness of stock management tools such as stock cards, Order/Requisition forms, and the electronic Logistics Management Information System (eLMIS) in these hospitals, its Electronic Afya(E-AFYA) System, ASLM-Laboratory Information System (A-LIS). Concurrently, qualitative data were collected through Key Informant Interviews (KIIs) with relevant Laboratory personnel to obtain in-depth insights into existing Monitoring and Evaluation practices, challenges, and contextual factors influencing stockouts.

This integrated approach enhanced the validity and depth of the findings. Quantitative and qualitative data were collected simultaneously and analyzed separately, with their results integrated during interpretation. Specifically, the KIIs provided contextual explanations for trends observed in the inventory data and illuminated how M&E practices influence stock documentation and reporting. In turn, the quantitative data grounded the qualitative insights in measurable patterns of stockouts. This approach facilitated a comprehensive assessment of how M&E practices are applied in the management of laboratory reagent stockouts.

Because the study was conducted in two Regional Referral Hospitals, data were analyzed collectively, with occasional disaggregation by facility and time for descriptive comparison to identify variations in documentation, monitoring processes, use of digital systems, and stock management performance.

5.3 Study Population

This study targeted key personnel involved in laboratory reagent stock management within Mbale and Entebbe Regional Referral Hospitals in Uganda. The participants included

laboratory staff who handle daily reagent usage and inventory tracking, laboratory logistics or store personnel, who coordinate reagent storage, distribution, and supply chain logistics. Additionally, clinicians who rely on timely laboratory diagnostics for patient care were included to provide insights into the impact of stockouts on clinical decision-making and service delivery.

5.4 Inclusion and exclusion criteria

Inclusion criteria: The study included laboratory personnel, laboratory logistics officers or store managers, and clinicians who are currently serving in these roles within the selected hospital laboratories. Participants must have direct experience in laboratory reagent stock management, inventory control, or clinical service delivery that relies on laboratory diagnostics.

Exclusion Criteria: Laboratory staff who were not working at the facility during the assessment period were excluded.

5.5 Sample size

5.5.1 Key informant interview

Interviews were conducted with laboratory staff, store or logistics personnel, and clinicians. A total of nineteen (19) key informants participated, selected from the two Regional Referral Hospitals. The final number of participants was determined by the principle of data saturation, whereby interviews continued until no new significant information or emerging themes were identified. Saturation was assessed across the combined interviews from both hospitals rather than separately within each facility, since the study focused on identifying overall themes in M&E practices for laboratory reagent stockout management. Participants were purposively selected based on their direct involvement in laboratory reagent management and Monitoring and Evaluation (M&E) practices. The study achieved thematic saturation, that is, when no new insights emerged from additional interviews within this expert group, whose specialized knowledge and active participation in laboratory reagent stock management and M&E processes provided sufficient depth and breadth of information to comprehensively explore existing practices, as well as the contextual facilitators and barriers related to laboratory reagent stockouts.

5.6 Sampling procedure

This study employed a purposive sampling approach for both the qualitative and quantitative components, ensuring that information was obtained from the most relevant and knowledgeable sources to address the study objectives.

Table 1: Summary of Data Collected per Study Objectives

Objectives	Methods	Data Source(s)	Type of Data Collected	Data Collection Tool(s)	Analysis Approach
To assess the level of stock out of laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda.	Document review	Manual stock cards. Order/requisition forms. E-AFYA	Stockout frequency. Stockout duration. Stockout patterns. Use of stock management tools. Completeness and accuracy of documentation, reporting practices.	Structured Checklist	Descriptive statistics (frequency, duration) Chi-square.
To assess the level of stock out of laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda	Structured Observation during document review	Stock cards, requisitions tock cards, requisition forms, delivery notes, E-AFYA system	Missing documentation, incomplete records, adherence to stock management	Structured Secondary Data/Observation Checklist	Descriptive summaries integrated into thematic findings
To describe the monitoring and evaluation practices used in managing laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda.	Key Informant Interview (KII)	Key Informant Interviews with laboratory staff, stores/logistics personnel and clinicians	Existing M&E practices for reagent stock management	Semi-structured interview guide	Thematic analysis
To explore the facilitators and barriers to implementation of monitoring and evaluation practices in managing laboratory reagents in in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda.	Key Informant Interview (KII)	Key Informant Interviews with laboratory staff, stores/logistics personnel and clinicians	Facilitators, barriers to M&E implementation	Semi-structured interview guide	Thematic analysis

5.7 Study variables

In this study, a stockout was defined as the unavailability of critical laboratory reagents at the time they were required for diagnostic use, as documented in stock cards, order/requisition forms, or electronic inventory systems such as E-AFYA and ALIS. Stockouts disrupt testing services, cause delays in diagnosis, and may compromise patient care. These occurrences were influenced by factors including supply chain inefficiencies, inadequate forecasting, procurement delays, and suboptimal inventory management.

The study focused on reagents that experienced documented stockouts between January 2023 and September 2025. This purposive focus allowed the identification of reagents most affected by stockouts across Laboratory departments, the analysis of duration, frequency, patterns and contributing factors to these shortages, and the generation of practical, evidence-based insights into challenges affecting reagent availability.

Monitoring and Evaluation (M&E) practices were defined as the systematic processes, tools, and activities used to track, assess, and improve laboratory reagent management. The assessment of M&E practices in this study was guided by a conceptual framework adapted from the WHO Health System Framework, focusing on three interconnected domains: systemic, operational, and behavioural factors. Systemic factors, including leadership, financing, staffing, and information systems, were examined to understand the enabling environment for M&E implementation. Operational factors, such as forecasting, procurement, data reporting, supervision, and the use of M&E data, were assessed to evaluate the application of technical M&E processes in laboratory stock management. Behavioural factors, including staff motivation, accountability, teamwork, and adherence to standard procedures, were explored to determine how human elements influence the consistency and quality of M&E practices. Together, these domains provided a comprehensive understanding of how M&E systems function in practice and their role in mitigating laboratory reagent stockouts.

5.8 Data collection

5.8.1 Data Collection tools and procedures

5.8.1.1 Key informant interviews:

To address Study Objective 2 (*to describe the Monitoring and Evaluation [M&E] practices used in managing laboratory reagents*) and Study Objective 3 (*to explore the facilitators and*

barriers to the implementation of M&E practices), qualitative data were collected through Key Informant Interviews with purposively selected participants directly involved in laboratory reagent stock management and use. The interviews were conducted as one-on-one, in-depth sessions at each respondent's workplace or in a private, quiet setting within the Laboratory to ensure confidentiality and minimize disruption. Each interview lasted approximately 30 to 60 minutes. Twenty key informants were initially targeted based on their roles in reagent stock management or clinical reliance on laboratory services but due to data saturation, only 19 were interviewed. A semi-structured KII guide containing open-ended questions aligned with the study objectives was used to collect data.

Prior to each interview, written informed consent was obtained from participants, and the purpose of the interview, participant rights (including the right to withdraw at any time), and confidentiality measures were clearly explained. During the interviews, participants' permission was sought to audio-record the discussion to ensure completeness and accuracy of the responses. Field notes were also taken to capture non-verbal cues and contextual information not recorded in the audio.

5.8.1.2 Secondary Data Review

To address Study Objective 1 (to assess the level of stockouts of laboratory reagents in Entebbe Regional Referral Hospital and Mbale Regional Referral Hospital), a quantitative secondary data review was conducted. This component provided objective evidence on stockout patterns and frequencies over the study period. Secondary data were extracted from routine hospital stock management records, including:

- **Stock cards**, which track receipts, issues, and balances of individual reagents.
- **Order/requisition forms**, which summarize reagents available in the laboratory sections, those requested from the laboratory store, those issued, and those not issued due to stock unavailability per request.
- **Electronic inventory management systems**, such as E-AFYA, which records reagent receipts and usage in real time, and A-LIS, which allows laboratory personnel to track reagent usage and trigger order of supplies from the lab sections.

These tools served as the primary sources of data on reagent movement and stock status within hospital laboratories and department-specific units. The review specifically focused on

reagents that experienced one or more stockouts between January 2023 and September 2025 and also the use and completeness of stock management tools. A structured data extraction checklist was used to guide the review and ensure consistency.

Prior to data collection, permissions were obtained from hospital administration and laboratory managers to access stock records. The researcher visited each facility and manually extracted relevant data from physical tools (stock cards and order/requisition forms) and electronically (E-AFYA and A-LIS, where applicable). Only data on reagents with documented stockouts during January 2023 - September 2025 and with stockout and restock dates were collected. Extracted data were entered into Microsoft Excel to support structured entry, cleaning, and preparation for analysis. Periodic data quality checks were conducted to ensure completeness and accuracy.

In addition, structured observation of stock management practices and documentation completeness was conducted concurrently during the secondary data review using the same data extraction checklist. This observation was not treated as an independent data collection method but rather as a supplementary component of the document review process, providing contextual, non-numeric insights that were later integrated into the qualitative findings under Objective 3.

5.9 Quality control and assurance

5.9.1 Training of research assistants

No research assistants were engaged in this study. All data collection activities, including secondary data extraction and key informant interviews, were conducted directly by the researcher. This approach ensured close supervision of the entire process and enhanced consistency, accuracy, and adherence to ethicall standards. To maintain data integrity, the researcher implemented rigorous quality assurance measures throughout data collection. These included cross-verifying extracted data, ensuring completeness of records, and promptly addressing any inconsistencies identified. For qualitative data, all interviews were personally audio-recorded and transcribed by the researcher to maintain uniformity and minimize interpretation bias. This hands-on approach strengthened the reliability and validity of both the quantitative and qualitative components of the study.

5.9.2 Pre-testing data collection tools

Prior to the main data collection, the data collection tools were pre-tested in two hospital laboratories that also experience reagent stockouts and have established monitoring and evaluation practices. The pre-test aimed to assess the tools' effectiveness, usability, and accuracy in capturing relevant information. This process helped identify ambiguities, inconsistencies, and practical challenges in data collection. Based on the pre-test findings, necessary revisions were made to enhance the clarity and functionality of the instruments before their final use in the study.

5.9.3 Field editing data

Immediately after each day of data collection, the researcher conducted preliminary checks on the completed data collection tools. This process helped identify and correct any errors, omissions, or inconsistencies while the information was still recent and accessible. Ambiguous responses were clarified, and incomplete entries were verified to ensure accuracy, legibility, and consistency before data entry and analysis.

5.9.4 Missing data

For the quantitative secondary data review, the researcher cross-verified stock cards, requisition/order forms, and the E-AFYA system (for Mbale RRH) to retrieve missing values where possible. Only stockout episodes with complete stockout and restocking dates, as well as sufficient supporting information, were included in the final analysis. Incomplete entries or missing data were interpreted as evidence of weak documentation practices and gaps in routine monitoring and evaluation systems.

For the qualitative data from key informant interviews, unclear information was addressed by reviewing field notes and audio recordings to verify the accuracy of transcripts. In instances where ambiguities persisted, the researcher interpreted meaning using contextual clues from related interview responses or, where appropriate, excluded such data from specific thematic analyses to maintain accuracy and coherence.

5.10 Data management and Analysis

5.10.1 Data management

Data management in this study involved the systematic collection, organization, storage, protection, and preparation of both qualitative and quantitative data for analysis and reporting. Appropriate procedures were implemented to ensure data integrity, confidentiality, and adherence to ethical standards.

For the qualitative data (Key Informant Interviews), audio recordings of the interviews were securely stored on a password-protected laptop accessible only to the researcher. The recordings were transcribed verbatim in Microsoft Word, saved using anonymous codes, and cross-checked for accuracy against the original recordings. Field notes were digitized and stored alongside the transcripts to provide contextual support during analysis. All identifying information was removed to maintain participant confidentiality.

For the quantitative data (Document Review), information extracted from stock cards, order/requisition forms, and E-AFYA system was entered into Microsoft Excel. After data cleaning and validation, the final dataset was used for statistical analysis in Microsoft excel. Hard copies of checklists and data collection tools were kept in a locked cabinet throughout the study and securely destroyed after data analysis.

Electronic data were backed up regularly on a secure external hard drive with access restricted to the researcher. Password protection and encryption were employed to prevent unauthorized access or data loss. All data will be retained for five years, in accordance with institutional policy, after which they will be permanently deleted or destroyed in a secure manner.

5.10.2 Data analysis

5.10.2.1 Analysis of Key Informant Interview Data

The qualitative data collected through the Key Informant Interviews were analyzed using a primarily inductive thematic analysis approach, in which themes emerged from participants' narratives. However, the study's conceptual framework informed the development of the interview guide and provided an interpretive lens for organizing and discussing the emergent themes in relation to monitoring and evaluation practices.

First, the audio recordings of all interviews were transcribed verbatim to accurately capture participants' responses. The transcripts were reviewed alongside field notes to verify accuracy,

add contextual details, and ensure completeness of the responses. Although the study initially considered using qualitative data analysis software, the transcripts were ultimately analyzed using manual thematic coding. A coding framework was developed in Microsoft Word, and codes were assigned systematically to text segments. Duplicate codes were avoided, and related codes were later grouped into sub-themes and overarching themes to identify patterns across the data.

The thematic analysis began with initial open coding, during which the researcher read each transcript line by line and assigned descriptive codes to meaningful segments of text. These initial codes captured recurring ideas, expressions, and issues raised by participants in relation to the study objectives particularly those concerning monitoring and evaluation practices, stock management challenges, and implementation barriers and facilitators.

Similar or related codes were then grouped into basic themes, reflecting broader patterns within the data. These basic themes were subsequently organized into organizing themes, which clustered related ideas into mid-level categories aligned with the study's conceptual framework specifically, systemic, operational, and behavioural factors and the WHO Health System Framework components.

Finally, the organizing themes were synthesized into global themes, representing the overarching insights and narratives derived from the interviews. These global themes addressed key research questions on how monitoring and evaluation practices were implemented, the factors influencing their success or failure, and their effect on laboratory reagent stockout management.

Throughout the analysis, the researcher-maintained reflexivity by keeping a reflective journal to document analytical decisions and interpretations. The findings from the Key Informant Interviews were triangulated with quantitative data from the secondary data review to provide a comprehensive understanding of stockout dynamics. The final thematic results are presented in narrative form, supported by direct quotations from participants to illustrate their perspectives and experiences.

Additionally, non-numeric data obtained through structured observation during the document review were incorporated into the thematic analysis. These observations were used to complement and enrich the qualitative findings, particularly in relation to documentation practices and adherence to stock management procedures.

5.10.2.2 Secondary Data Analysis

The secondary (quantitative) data obtained from hospital inventory records were analyzed to assess the level, frequency, and duration of laboratory reagent stockouts in Entebbe and Mbale Regional Referral Hospitals for the period January 2023 to September 2025. This analysis addressed Study Objective 1, which sought to assess the level of stockouts of laboratory reagents in the two hospitals.

After extraction, the data were entered into Microsoft Excel to ensure structured and consistent entry. Following data cleaning and statistical analysis in Microsoft Excel.

Descriptive statistics were generated using Microsoft Excel, including frequencies and percentages to describe the number of reagents that experienced stockouts and their frequency, as well as means and standard deviations to summarize stockout durations and stock level variability. Inferential statistics were conducted using Separate chi-square tests for each laboratory section using 2×2 contingency tables comparing Entebbe and Mbale RRHs. Trends in stockouts across years, hospitals and laboratory sections were visualized using tables, graphs, and charts. These results facilitated comparisons between laboratory sections, across years, and between the two hospitals.

Although the original study period was designed to cover the years 2023–2024. However, during data extraction, inconsistencies in documentation were noted in several laboratory stock records. To improve data completeness and trend reliability, the period was extended to include January 2023 to September 2025. This allowed inclusion of more recent stockout episodes and enhanced representativeness of the findings.

During secondary data analysis, all extracted stock management records were organized according to four standard laboratory sections to ensure comparability between the two hospitals. Although Mbale RRH had a wider range of laboratory units and Entebbe RRH had fewer, the study adopted the four most commonly recognized sections used in hospital laboratories. These included Biochemistry, Immunology/Serology, Microbiology/Parasitology, and Hematology. Stockout and restock entries were grouped under these categories to standardize the dataset and to facilitate section-level analysis of stockout frequencies and durations.

5.11 Ethical Considerations

Ethical approval for conducting the study was obtained from the Higher Degrees Research and Ethics Committee (HDREC) at Makerere University School of Public Health. See Annex 81. Administrative permission to access the necessary data was granted by the administrations of the Entebbe and Mbale regional referral hospitals. See Annex 83 and 84 respectively. Participants signed informed consent forms before taking part in the study. They were informed of their right to withdraw at any time or to refuse to answer specific questions without any repercussions. Participants were also briefed on their roles, as well as the potential risks and benefits of the study. Confidentiality was maintained by assigning codes to audio recordings and transcripts to ensure that all participants' responses remained confidential.

CHAPTER SIX

6.0 RESULTS

6.1 Quantitative Results

This section presents the quantitative findings on the level, frequency, and duration of laboratory reagent stockouts across Entebbe and Mbale Regional Referral Hospitals.

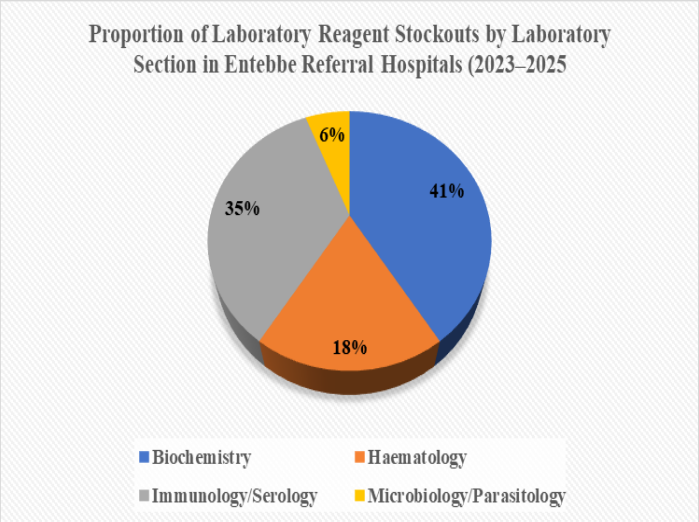
6.1.1 Laboratory Reagent Stockouts

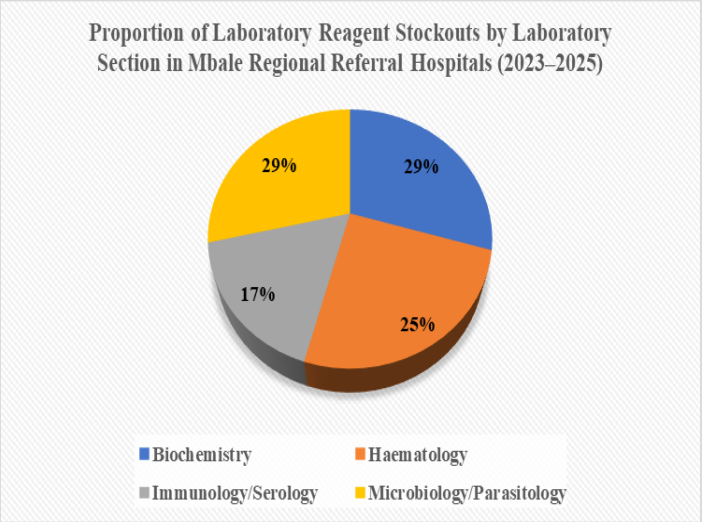
6.1.1.1 Level of stockout

The level of stockout refers to the extent of reagents that experienced stockouts during the study period. In this study, only reagents that experienced stockouts and had complete stockout and restock information were included.

Across both hospitals, the majority of stockouts occurred in Biochemistry sections. Entebbe RRH recorded the highest proportion in Biochemistry (41%) followed by Immunology/Serology (35%), followed by Hematology (18%), and Microbiology/Parasitology (6%). Mbale RRH showed an equal burden in Biochemistry and Microbiology/Parasitology each 29%), Hematology (25%) and Immunology/Serology (17 %), of stockouts. See Fig 2

Fig 2: Proportion of Laboratory Reagent Stockouts by Laboratory Section in Entebbe and Mbale Regional Referral Hospitals (2023–2025).





A total of 171 reagents that experienced stockouts and had complete stockout and restock information were included in the analysis. Of these, 105 reagents were from Mbale Regional Referral Hospital and 66 from Entebbe Regional Referral Hospital.

Across laboratory sections, Biochemistry accounted for the largest number of reagents monitored in both hospitals (27 in Entebbe and 31 in Mbale), then, Haematology (12 and 26, respectively), Immunology/Serology (23 and 18) and Microbiology/Parasitology (4 in Entebbe and 30 in Mbale).

Microbiology/Parasitology and Immunology/Serology demonstrated clear hospital-level differences in stockout. For Microbiology/Parasitology (11.8% vs 88.2%; $\chi 2 = 12.88$, df = 1, $P < 0.0003$) and Immunology/Serology (56.1% vs 43.9%; $\chi 2 = 6.95$, df = 1, $P < 0.008$). In contrast, no meaningful variation was observed for Hematology (31.6% vs 68.4%; $\chi 2 = 1.03$, df = 1, $P = 0.313$) and Biochemistry (46.6% vs 53.4%; $\chi 2 = 2.35$, df = 1, $P = 0.126$)

Table 2: Distribution of Reagents that experienced stockouts by Hospital and Laboratory Section, with Chi-square Test Results (2023–2025)

Laboratory Section	**Entebbe RRH (n=66) n (%)**	**Mbale RRH (n=105) n (%)**	**Total (n=171) n (%)**	**Chi-square (χ^2)**
Biochemistry	27 (46.6)	31 (53.4)	58 (100)	$\chi 2 = 2.35$, df = 1, $P = 0.126$
Haematology	12 (31.6)	26 (68.4)	38 (100)	$\chi 2 = 1.03$, df = 1, $P = 0.313$
Immunology/Serology	23 (56.1)	18 (43.9)	41 (100)	$\chi 2 = 6.95$, df = 1, $P < 0.008$
Microbiology/Parasitology	4 (11.8)	30 (88.2)	34 (100)	$\chi 2 = 12.88$, df = 1, $P < 0.0003$

Note: Percentages are calculated within Laboratory Section Rows. The denominator represents the total number of reagents that experienced stockouts in each Laboratory section during the study period. The Chi Square is calculated using the Number of Reagents Stocked out.

6 .1.1.2 Frequency of stockouts

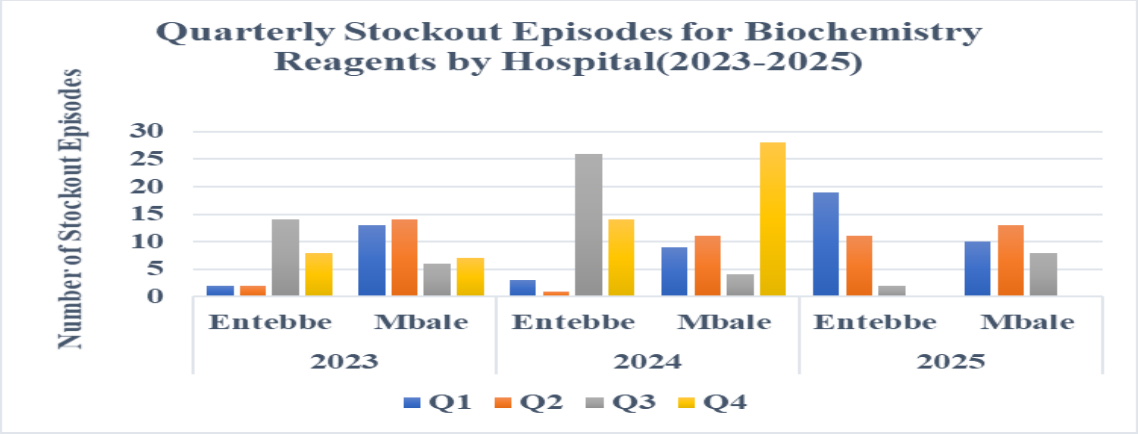
The frequency of stockouts refers to how often individual reagents experienced stock unavailability during the study period.

Overall, a total of 848 stockout episodes were recorded across the two hospitals during the study period. Mbale Regional Referral Hospital accounted for 369 episodes (43.5%) with 112 stockouts in 2023, increasing steadily to 125 in 2024 and 132 in 2025, while Entebbe Regional Referral Hospital recorded 479 episodes (56.5%) with 155 stockouts episodes in 2023, which increased to 205 in 2024 and slightly decreased to 119 in 2025 over a period of 2 years and 9

months. Analysis of quarterly stockout episodes from 2023 to 2025 shows noticeable variation across laboratory sections and between the two hospitals. See figures 3,4,5,6

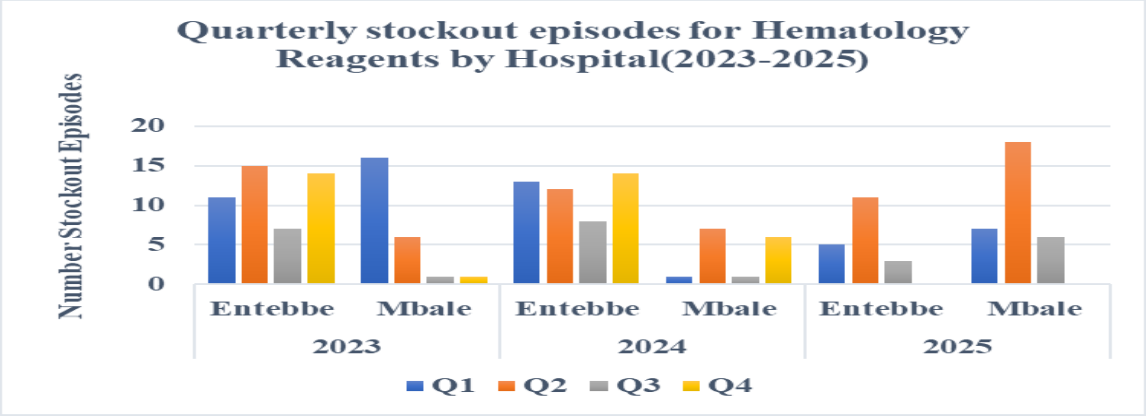
In 2023, Entebbe recorded the highest biochemistry stockout episodes in Q3 (14), while Mbale peaked in Q2 (14). In 2024, stockouts increased markedly, with Entebbe peaking in Q3 (26) and Mbale in Q4 (28). In 2025, Entebbe recorded the highest episodes in Q1 (19), whereas Mbale peaked in Q2 (13), with lower counts observed in subsequent quarters.

Fig 3: Quarterly Stockout Episodes for Biochemistry Reagents by Hospital (2023–2025)



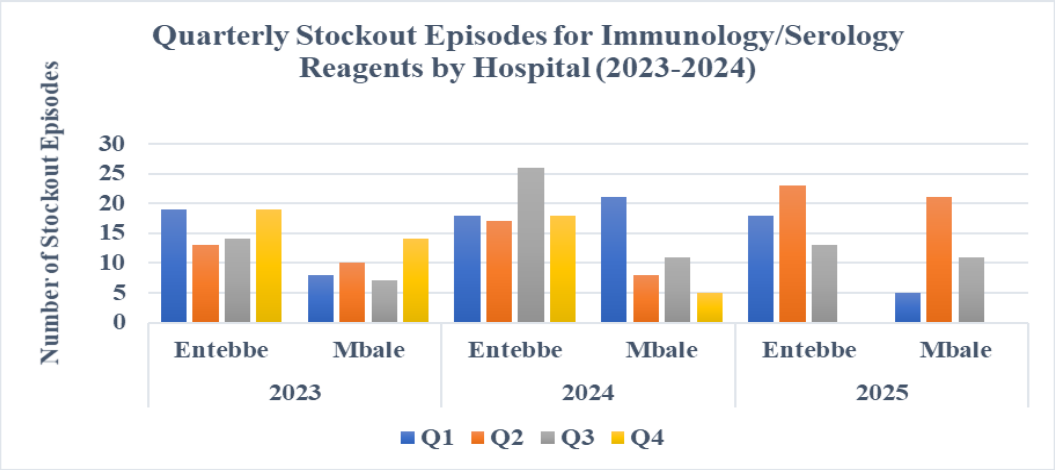
In 2023, Entebbe recorded the highest hematology stockout episodes in Q2 (15) and Q4 (14), while Mbale peaked in Q1 (16) with minimal episodes in Q3 and Q4 (1 each). In 2024, Entebbe again peaked in Q4 (14), whereas Mbale recorded low episodes across quarters, highest in Q2 (7); in 2025, Mbale peaked sharply in Q2 (18) compared to Entebbe's highest in Q2 (11).

Fig 4: Quarterly Stockout Episodes for Hematology Reagents by Hospital (2023–2025)



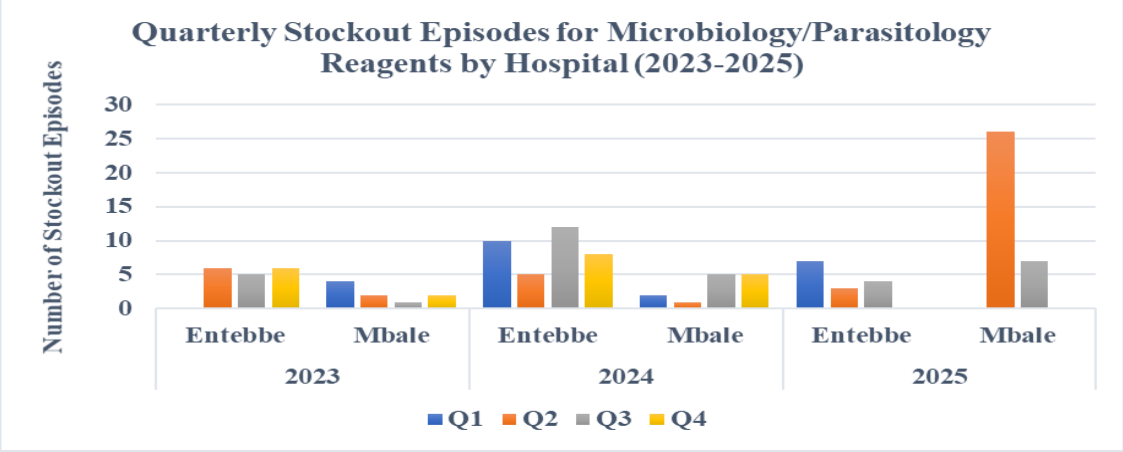
Across 2023–2025, both hospitals showed consistently high Immunology stockouts. In 2023, Entebbe recorded higher immunology/serology stockout episodes than Mbale across all quarters, peaking in Q1 and Q4 (18 each), while Mbale peaked in Q4 (14). In 2024–2025, Entebbe peaked in Q3 of 2024 (26) and Q2 of 2025 (23), whereas Mbale recorded its highest episodes in Q1 of 2024 (21) and Q2 of 2025 (21).

Fig 5: Quarterly Stockout Episodes for Immunology/Serology Reagents by Hospital (2023–2025)



Microbiology stockouts were generally low. In 2023, Entebbe recorded microbiology/parasitology stockout episodes mainly in Q2 and Q4 (6 each), while Mbale reported fewer episodes, peaking in Q1 (4). In 2024, Entebbe peaked in Q3 (12) compared to Mbale's highest in Q3 and Q4 (5 each), while in 2025 Mbale recorded a sharp peak in Q2 (26) compared to Entebbe's highest in Q1 (7).

Fig 6: Quarterly Stockout Episodes for Microbiology/Parasitology Reagents by Hospital (2023–2025)



6.1.1.3 Duration of stockouts

The duration of stockouts refers to the length of time a reagent remained unavailable from the date it went out of stock to the date it was restocked. which helps assess the severity and management efficiency like addressing shortages and restoring stock availability.

Between 2023 and 2025, a total of 848 stockout episodes were recorded, with Entebbe reporting 479 and Mbale 369. The overall average duration across both hospitals was 26.3 days (SD 37.5), with a minimum of 0 days and a maximum of 379 days. Entebbe had an overall mean duration of 18.9 days (SD 31.5; range 0–302), while Mbale recorded a mean of 35.9 days (SD 42.2; range 0–379). Across laboratory sections, Biochemistry had the highest cumulative mean duration (Entebbe: 33.7 days, SD 42.5; Mbale: 45.7 days, SD 41.1), followed by Immunology/Serology (Entebbe: 15.1 days, SD 28.2; Mbale: 23.2 days, SD 27.6). Hematology showed moderate durations (Entebbe: 15.4 days, SD 20.0; Mbale: 22.8 days, SD 21.6), while Microbiology/Parasitology had the lowest mean durations (Entebbe: 9.0 days, SD 14.2; Mbale: 33.5 days, SD 47.3). Summary statistics by year, section, and hospital are presented in Table 3

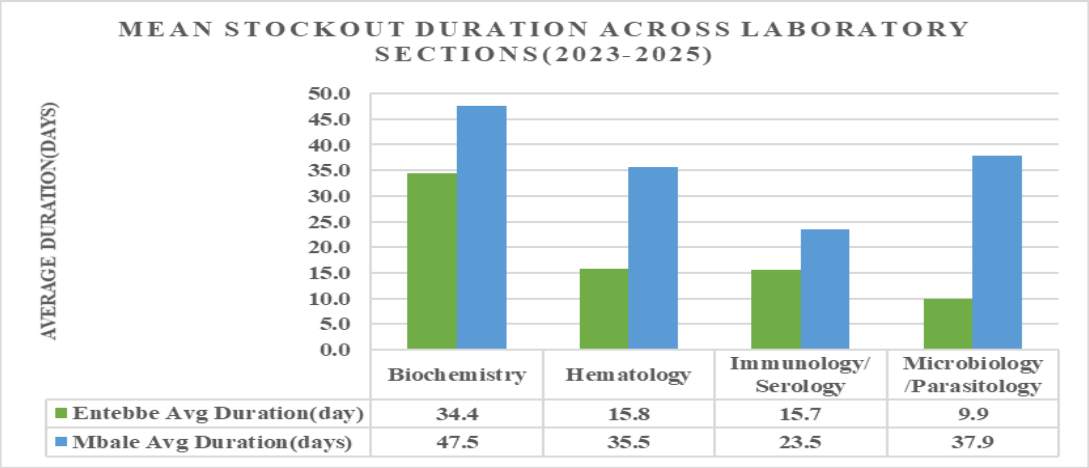
Table 3: Summary of Stockout Episode Durations by Year, Laboratory Section, and Hospital (2023–2025)

	ENTEBBE RRH			MBALE RRH		
Category	**Stockout Episodes**	**Mean Duration in Days(SD)**	**Min-Max Duration in Days**	**Stockout Episodes**	**Mean Duration in days(SD)**	**Min-Max Duration in days**
2023	155	18.5(35.7)	0-302	112	32.5)39.0)	0-152
Biochemistry	26	37.3(50.5)	1-159	40	56.2(49.0)	0-152
Hematology	47	14.6(18.1)	0-66	24	26.5(25.8)	0-97
Immunology/Serology	65	16.6(40.2)	0-302	39	16.8(23.1)	0-107
Microbiology/Parasitology	17	7.8(12.8)	0-54	9	11.1(17.8)	0-57
2024	205	22.2(32.6)	0-255	125	47.8(55.2)	0-379
Biochemistry	44	40.9(44.3)	0-255	52	52.1(50.2)	0-228
Hematology	47	17.9(26.9)	0-133	15	80.1(62.0)	1-175
Immunology/Serology	79	18.6(28.8)	0-154	45	30.1(29.5)	0-107
Microbiology/Parasitology	35	12.3(20.2)	0-115	13	54.8(102.4)	1-379
2025	119	13.8(21.5)	0-144	132	27.7(25.1)	0-122
Biochemistry	32	22.9(32.6)	0-144	31	28.7(24.0)	1-105
Hematology	19	13.7(14.9)	0-67	31	21.0(19.1)	0-59
Immunology/Serology	54	10.2(15.5)	0-94	37	22.7(30.2)	0-122
Microbiology/Parasitology	14	6.7(7.6)	0-27	33	38.5(21.7)	0-52
	479	**18.9(31.5)**	**0-302**	**369**	**35.9(42.2)**	**0-379**
Overall	**848**	**26.3(37.5)**	**0-379**			

The analysis showed variation in mean stockout durations across laboratory sections in both hospitals during 2023–2025. Biochemistry recorded the highest average durations in both Entebbe (34.4 days) and Mbale (47.5 days). Hematology and Immunology/Serology exhibited

moderate durations, while Microbiology/Parasitology registered the lowest averages for both facilities. Overall, Mbale RRH consistently reported longer mean durations across all laboratory sections compared to Entebbe RRH.

Fig 7: Comparison of Average Reagent Stockout Durations Across Laboratory Sections in Entebbe and Mbale Regional Referral Hospitals (2023–2025)



6.2 Qualitative results

This section presents the qualitative findings from Key Informant Interviews (KIIs) conducted among laboratory staff in Entebbe Regional Referral Hospital (ERRH) and Mbale Regional Referral Hospital (MRRH). The analysis was guided by thematic analysis following(Braun & Clarke, 2006) approach. Themes were organized according to Objectives. Ten major themes emerged, 7 themes from objective two: (1) Stock Monitoring Tools and Systems (2) Routine Inventory Practices (3) Reporting, Communication, and Accountability Mechanisms (4) Data Management and Record Keeping (5) Audits and Quality Assurance (6) Data Use and Decision Making (7) Roles and Capacity Building and 3 themes from objective three; (8) Facilitators to M&E Implementation (9) Barriers to M&E Implementation (10) Recommendations and Suggestions.

In addition to Key Informant Interviews, qualitative findings were supplemented by non-numeric observations made during the secondary data review using a structured checklist. These observations were integrated into the thematic analysis to provide contextual insights into documentation practices and adherence to stock management procedures.

6.2.1 Participant Characteristics

A total of 19 respondents were interviewed, comprising staff from Entebbe Regional Referral Hospital (n=9) and Mbale Regional Referral Hospital (n=10). More than half of the participants were laboratory technologists (n=11, 57.9%), with five from Entebbe and six from Mbale. The remaining participants included clinicians (n=3, 15.8%; Entebbe n=2, Mbale n=1), laboratory store logistics officers (n=3, 15.8%; Entebbe n=1, Mbale n=2), and laboratory managers (n=2, 10.5%; one from each hospital).

Overall, the respondents had an average of 5 years of professional experience, with those from Entebbe averaging 5.3 years and those from Mbale averaging 6.4 years. In terms of gender distribution, 14 participants (73.7%) were male, seven from each hospital while five (26.3%) were female, with two from Entebbe and three from Mbale. These characteristics are summarized in Table 3.

Table 4: Summary of participant characteristics

Category	**Representatives**		
	Overall	Entebbe RRH	Mbale RRH
Participant categories	n=19	n=9	n=10
Lab technologists	11	5	6
Lab managers	2	1	1
Hospital clinicians	3	2	1
Lab store logistics officers	3	1	2
Gender	n=19	n=9	n=10
Male	14 (73.7%)	7(77.8%)	7(70%)
Female	5 (26.3%)	2(22.2%)	3(30%)
Average years of experience in the field	5.9years (SD; 3.13)	5.3years (SD; 3.04)	6.4years (SD; 3.28)

6.2.2 Existing Monitoring and Evaluation Practices

6.2.2.1 Stock Monitoring Tools and Systems

Across both hospitals, participants reported using both manual and electronic systems to capture and track laboratory reagents. Laboratory personnel reported routinely recording data on quantities received, quantities issued, stock balances, stockout dates, and restock dates using stock cards, order and requisition forms, and electronic systems such as E-AFYA and ALIS. These data were intended to support routine monitoring, reporting, forecasting, and supervisory review. However, inconsistencies in updating records, missing entries affected the completeness and reliability of captured data. Manual tools remain widely used, especially in laboratory departments/sections (Immunology/Serology and Biochemistry, Immunology/parasitology, Hematology) where electronic systems are not yet fully implemented especially in Entebbe regional referral hospital.

> *"We use stock cards… each item we have here we create a stock card." (ERRH 7-Lab staff)*

> *"We still rely on stock cards to confirm balances when the system fails." (MRRH 1-Lab Staff)*

However, several staff members from Mbale reported progress toward digital inventory systems such as EAFYA and ALIS, which allow real-time tracking of reagent movement and automatic stock deductions.

> *"We are using EAFYA and ALIS to monitor stock; it deducts automatically and we can trace who received what." (MRRH 4-Lab staff)*

6.2.2.2 Routine Inventory Practices

Both hospitals employ structured methods for stock tracking. A common approach is the color-coded 5S system, where green indicates adequate stock, yellow signals low levels, and red alerts stockout.

> *"We color-code reagents, green adequate, yellow medium, red reorder." (ERRH 8 - Lab staff)*

The study found that laboratories consistently applied the First-Expiry-First-Out (FEFO) principle to minimize wastage and expiry of reagents. Staff emphasized the importance of tracking expiry dates and maintaining buffer stocks.

> *"We identify those that are going to expire shortly and use them first… when we reach the buffer, we notify the logistics person."* (*ERRH 2 - Lab Staff)*

Additionally, routine physical stock counts and the First-In-First-Out (FIFO) principle are applied to minimize reagent expiries and wastage.

> *"We use FIFO… what comes in first goes out first." (ERRH 7- Lab staff)*

> *"Every month we do physical counts to see what's available." (MRRH 6-Lab staff)*

Respondents noted adherence to storage guidelines, ensuring temperature control and separation of reagents according to their requirements to manage wastage.

> *"Those that need 2-8 degrees are kept in refrigerators; others stay at room temperature."* (*ERRH 2-Lab Staff)*

6.2.2.3 Reporting, Communication, and Accountability Mechanisms

Reporting routines were described as monthly and hierarchical. Each section compiles reports that are reviewed by the quality assurance officer or laboratory manager before submission.

"Each section submits its monthly report, which the Quality Manager compiles into a general report." (MRRH 5-Lab staff)

Findings showed a clear reporting hierarchy, to enhance accountability, requests and disbursements follow multi-level approvals typically involving section heads, lab managers, and hospital administration which facilitated prompt responses to stockout alerts.

"The section head informs the lab manager who communicates to the administrator or director." (*ERRH 2-Lab Staff)*

"Requests must first be approved by administration and then by the lab manager before release" (MRRH 8-Lab staff)

Effective communication was highlighted as a critical element in reagent management. Participants mentioned regular meetings and the use of WhatsApp groups, noticeboards to share urgent updates on stockouts and replenishment

"We share updates on stockouts through our lab WhatsApp group." (*ERRH 9-Lab Staff)*

"We have weekly and monthly meetings where we discuss what is in stock, what is missing, and what needs to be ordered." (ERRH 5-Lab Staff)

"In our meetings, the in-charge updates us on supplies and reminds us to submit reports on time." (MRRH 4-Lab Staff)

Also, clinicians are informed about available tests through noticeboards and online platforms.

"They pin lists of tests available and those out of stock; we also share on WhatsApp." (MRRH 10-Clinician)

6.2.2.4 Data Management and Record Keeping

The study found that laboratory records were stored in both hardcopy and softcopy formats for accountability and reference.

"We have files that contain reagent lists and soft copies stored in the lab email." (ERRH 2-Lab Staff)

6.2.2.5 Audits and Quality Assurance

Participants highlighted that audits were conducted quarterly or semi-annually by internal auditors or during external supervision visits.

> *"Audits are quarterly or after six months by internal auditors." (ERRH 2-Lab Staff)*

Participants also noted that periodic audits and feedback sessions by external agencies such as the Central Public Health Laboratories (CPHL) contribute to continuous improvement of inventory monitoring and enhance accuracy.

> *"External auditors come from CPHL during accreditation to assess inventory accuracy." (MRRH 5- Lab staff)*

6.2.2.6 Data Use and Decision Making

Findings revealed that both hospitals rely on stock data for forecasting and procurement planning. Data from consumption trends guide budgeting and ordering decisions.

> *"We analyze data monthly to see consumption and plan orders for the next quarter." (MRRH 8- Lab staff)*

> *"The data helps us forecast how much to order in the next cycle." (MRRH 1-Lab Staff)*

6.2.2.7 Staff Roles and Capacity Building

The researcher noted that the laboratories had assigned logistics officers responsible for requisition, documentation, and coordination.

> *"We have a logistics officer who handles budgeting, requisition, and managing the mini store." (ERRH 3-Lab Staff)*

> *"We have a logistics officer whose main duty is to monitor and document reagent stock." (MRRH 1-Lab Staff)*

Continuous professional development through CMEs, Lab SPARS sessions, and internal mentorship was emphasized as critical to improving M&E competency.

> *"The logistics officer goes for external training and conducts CMEs for others." (ERRH 2-Lab Staff)*
>
> *"We have quarterly trainings and Lab SPARS sessions for logistics officers." (MRRH 6-Lab Staff)*

6.2.3 Facilitators to M&E Implementation

Leadership and governance support

The study found that active leadership involvement and effective governance structures significantly facilitated the implementation of M&E practices. Supportive managers encouraged accountability and timely communication, ensuring that reagent stock levels were regularly monitored and reported. Regular supervisory visits and clear reporting lines strengthened compliance with M&E guidelines. The researcher noted that consistent leadership oversight provided a strong foundation for accountability and helped maintain operational stability even during reagent shortages.

> *"Administration plays a key role… they review data and address gaps identified." (MRRH 8- Lab Staff*
>
> *"Our lab manager is proactive and ensures emergency orders are honored quickly; Our logistics officer is proactive; once he foresees a stockout, he lobbies from other facilities." (ERRH 3-Lab Staff)*
>
> *The in-charges monitor every section closely; they check reports and follow up on any gaps" (MRRH 8- Lab Staff)*

Use of electronic system

The introduction of electronic systems such as EAFYA and ALIS has reduced paperwork and increased accuracy, further strengthening monitoring.

> *"The electronic system has made it easier to monitor data." (ERRH 9- Lab Staff)*
>
> *"We used to have stock cards, but the system now captures that information and generates reports." (MRRH 8-Lab Staff)*
>
> *"We encourage everyone to use the same system so reports are consistent." (ERRH 5-Lab Staff)*

Collaborations, partnerships and external support

Inter-facility collaboration emerged as a major facilitator in sustaining service delivery during reagent shortages. Participants reported that donor support, redistribution of reagents between hospitals or nearby facilities mitigated the impact of delayed deliveries particularly through the hub system. This enabled resource sharing and minimized the impact of shortages.

"Before going to NMS, we first check with other regional hospitals and redistribute supplies." (MRRH 8-Lab Staff)

"If a reagent is out, we redistribute from nearby facilities through the hub system." (ERRH 2-Lab Staff)

"Global Fund supports reagents procurement; Baylor supports stock monitoring." (MRRH 1-Lab Staff)

"If one facility runs out, we call nearby facilities or partners to assist." (MRRH 1-Lab Staff)

Teamwork, communication and feedback channels

Effective teamwork and communication enhanced coordination and accountability. These were cited as drivers of smooth monitoring processes. Effective interdepartmental communication reduced disruptions in laboratory service delivery and enhanced data flow for M&E reporting.

"We communicate through WhatsApp and meetings to share stock updates." (MRRH 2-Lab Staff)

"Regular meetings and WhatsApp groups foster communication." (MRRH 1-Lab Staff)

Accountability mechanisms

Accountability mechanisms were emphasized through strict adherence to standard operating procedures (SOPs) and requisition logs. Mechanisms like routine stock audits, supervisory reviews by laboratory managers, sign-off procedures on stock cards and requisition forms, internal reporting lines to hospital management.

"Some people come to the store without approval; I send them back." (ERRH 7- Lab staff)

"Requisitions must be endorsed by section heads before items are issued." (MRRH 2-Lab Staff)

Staff Motivation, Training, and Mentorship

Staff motivation, supported by training and mentorship, was a strong enabler for implementing M&E practices. Continuous professional development sessions, supervision, and feedback from managers enhanced technical competence and commitment. The researcher observed that

motivated and well-trained staff were more likely to adhere to reporting procedures and accurately document stock levels. also, availability of reagents was linked to motivation levels, as staff felt more efficient when adequately equipped.

> *"We have quarterly trainings and mentorship sessions for staff." (MRRH 6-Lab Staff)*

> *"You get motivated once you have what to use; you become demotivated when reagents are not there." (ERRH 3-Lab Staff)*

6.2.4 Barriers to M&E Implementation

Despite these facilitators, several barriers hinder full implementation of M&E practices.

Human resource constraints

The study established that inadequate staffing levels significantly hindered effective monitoring and evaluation of laboratory reagents. Participants reported that the shortage of qualified personnel led to delays in data entry, stock updates, and supervision of inventory processes. In some cases, laboratories relied on volunteers to fill critical gaps, which affected consistency and accountability in record keeping.

> *"We are only ten staff instead of thirty-seven; it's a big challenge." (MRRH 8- Lab staff)*

> *"We are supposed to be 30 but are only nine; staffing is below 30%." (ERRH 3-Lab Staff)*

> *"Staffing levels are below requirement; reliance on volunteers." (MRRH 1- Lab staff)*

Workload and Fatigue

Participants reported that heavy workloads, role overlap, and multitasking placed significant strain on staff, particularly logistics personnel who were required to balance multiple responsibilities. These demands contributed to fatigue and burnout, reducing the time and attention available for monitoring and evaluation activities and leading to delays or inconsistencies in reporting practices.

> *"The logistics officer is also a lab technologist, so sometimes he is busy running tests and delays to update the stock cards." (ERRH 6-Lab Staff)*

"He has a lot that he juggles… logistics, bench work, and supply pickup." (MRRH 8-Lab Staff)

"some are overworked." (ERRH 8-Lab staff)

Electronic Systems Not Yet Fully Operational

Despite the advancements, participants noted that electronic systems are not yet fully operational in all sections. The study found that although both referral hospitals have adopted electronic systems for stock monitoring and reporting such as EAFYA, ALIS, and DHIS2, these systems are not yet fully operational across all laboratory sections. For-instance Entebbe RRH laboratory hasn't rolled out the use of EFYA system at the lab level yet. Participants described a situation where digital tools are in place but often function alongside traditional manual stock cards. This partial implementation has resulted in dependence on manual documentation whenever electronic platforms fail or are inaccessible due to power or network interruptions. While some staff appreciated the efficiency and transparency of electronic systems, others expressed challenges related to incomplete roll-out, limited access to digital infrastructure, and inadequate technical support.

"Electronic tools like E-logistics are mainly used at the main store level; at the lab section, we still use paper-based forms." (ERRH 2-Lab Staff)

"We are using EAFYA and ALIS to monitor stock; it deducts automatically and we can trace who received what though some sections still use stock cards." (MRRH 4-Lab Staff)

"Sometimes the system jams, and we have to revert to manual recording." (MRRH 2-Lab Staff)

Findings from structured observation further confirmed that the EAFYA system used for inventory management across the hospital was only effective in the main hospital store and had limited or no integration at the laboratory level in Entebbe RRH and recently integrated fully in Mbale RRH on 1st may 2025 but adherence is still a challenge.

Limited Training and Capacity building

The study revealed that limited and irregular training opportunities constrained staff competence in monitoring and evaluation practices related to reagent management. Participants noted that most laboratory personnel had not received formal instruction on stock management,

relying instead on self-learning or on-the-job experience. The absence of structured capacity-building programs weakened staff confidence and consistency in applying M&E procedures.

> *"There is no clear plan for training; I just learn online." (ERRH 7- Lab staff)*
>
> *"Staff haven't received formal training specifically for stock management." (MRRH 1-Lab staff)*
>
> *"Only the lab manager and quality officer have been trained on the system, the rest of us learn by observing." (MRRH 6-Lab Staff)*
>
> *"We have new systems but no refresher training, people forget the procedures." (ERRH 8-Lab Staff)*

Technical and infrastructure challenges

The study identified persistent technical and infrastructural challenges that disrupted the reliability of electronic monitoring systems. Frequent power outages and unstable internet connectivity interfered with data entry, delayed stock updates, and forced staff to revert to manual documentation methods. These interruptions compromised the timeliness and accuracy of monitoring and evaluation processes.

> *"Power outages and internet downtime affect our system updates." (ERRH 6-Clinician)*
>
> *"Sometimes the system is down due to network or power fluctuation." (MRRH 5- Lab staff)*

In addition, limited availability of computers within laboratory sections further constrained timely and consistent data entry for monitoring and evaluation activities.

> *"If every section had a computer, data entry would be easier." (ERRH 5-Lab staff)*

Structured observation data confirmed that in Entebbe RRH, the laboratory store did not have a computer to requisition stock from the main hospital store, NMS, and the EAFYA system rolled out by the Ministry of Health was not being utilized.

Data Quality and Documentation gaps

The study revealed persistent gaps in documentation and data accuracy within laboratory reagent management systems. Participants noted that while both manual and electronic records were maintained, inconsistencies frequently occurred due to incomplete data entry, human

error, and lack of standardized documentation frameworks. The absence of dedicated personnel, computers for data management further contributed to these discrepancies, reducing the reliability of stock reports used for decision-making and procurement planning.

> "*Our data is not accurate because we don't have a data person." (ERRH 8- Lab staff)*
>
> *"Activities are carried out but not systematically documented; We use DHIS2 to report weekly on the stocks available, but sometimes the data doesn't reflect the true stock on the ground; The issued kits don't always match what's consumed, and it affects planning " (MRRH 1- Lab staff)*
>
> *"There is no clear plan for documentation; some people record, others don't, so we end up with incomplete information." (ERRH 6-Lab Staff)*

Structured observations during document review revealed that some reagents received from the NMS or other delivery companies (e.g., Baylor) lacked entries on stock cards, and some had no stock cards at all. Also, most stock cards had incomplete records where reagents don't have complete annual records of its consumption documented. Requisition forms frequently had missing information, such as approval signatures, names, or requisition dates, and often did not indicate whether the requested reagents were issued to the laboratory sections. In some cases, laboratory technologists bypassed protocol and collected reagents directly from the store without requisition forms.

Furthermore, Data storage files were often scattered or missing, making record-keeping and tracking stock movements difficult. While Entebbe RRH demonstrated relatively better organisation of its storage files, updates were not consistently made in a timely manner

Staff attitude and misconception

The study revealed that staff attitudes negatively affected adherence to monitoring and evaluation practices. Participants reported that low motivation, and misconceptions about the purpose of monitoring led to inconsistent reporting and data entry. Some staff viewed monitoring activities as an additional burden, while others perceived them as tools of supervision or mistrust, leading to reluctance in compliance.

> *"Some staff find data entry time-consuming and avoid it when the system is slow." (MRRH 6-Lab Staff)*

"Some staff think monitoring implies suspicion; some keep stock-outs quiet." (MRRH 1-Lab Staff)

Governance and Accountability Gaps

Although governance frameworks and SOPs existed in most laboratories, adherence to these guidelines was inconsistent. Lapses in supervision and enforcement of accountability measures resulted in documentation errors and weak follow-up mechanisms.

"You find SOPs displayed, but when work gets too much, people skip some steps." (*MRRH 6-Lab Staff)*

"Requisitions should go through proper channels, sometimes staff bypass the store system when roles are not well defined." (MRRH 5-Lab Staff)

Funding and resource constraints

Limited funding was reported to hinder timely procurement of reagents and maintenance of monitoring systems in the laboratories. In addition, the hospitals have limited funds beyond government supply.

"The funds allocated to NMS are not enough; once used up, we are done." (ERRH 3-Lab Staff)

"There will never be enough money… government gives less than what you request." (ERRH 4-Lab staff)

Communication gaps

The researcher noted that, despite improvements in communication, some participants noted lapses in coordination between clinical and laboratory departments, which sometimes led to confusion about test availability and delayed patient management. These breakdowns in communication contributed to inefficient use of reagents and hindered the timely sharing of stock information for planning purposes. In addition, some respondents highlighted the need for internal communication tools to facilitate faster and more efficient communication within the laboratory sections, the laboratory store, clinicians and with other laboratory leadership offices.

"We don't have a phone to reach the logistics officer easily." (MRRH 8-Lab Staff)

Causes of stockouts

Respondents reported that delayed deliveries, inadequate forecasting, inconsistencies in quantification, and limited funding, theft were major causes of reagent stockouts. The "push" supply system often delivered reagents that did not match facility needs, resulting in shortages or wastage. These inefficiencies disrupted monitoring and evaluation by causing data inaccuracies, complicating stock tracking, creating operational strain on staff, and impairing timely feedback for decision-making. In addition, Overreliance on partners threatens sustainability after withdrawal.

> *"One of the causes is poor quantification; sometimes the orders don't match our needs; They push what is about to expire; then we end up with expired stock or shortages soon after" (MRRH 7-Lab Staff)*

> *"Sometimes NMS brings reagents with only three months' shelf life… most expire before use." (ERRH 2-Lab Staff)*

> *"Sometimes the stockouts happen because we order late or don't follow up quickly." (ERRH 8-Lab Staff)*

> *"When partners withdrew, some machines stopped working due to lack of reagents." (MRRH 5- Lab staff)*

A participant from Mbale Regional Referral Hospital emphasized the clinical consequences of stockouts in the Chemistry section, particularly regarding patient monitoring and management. The respondent noted that the unavailability of essential reagents such as AST and ALT hindered the ability to conduct liver function tests, affecting the care of patients with liver-related conditions, including but not limited to hepatitis B.

> *"We have had a stock out of some chemistry reagents that work out for the precisely liver enzymes, ALT, AST; So, when they are stock out, then we're not able to monitor the performance of that liver; the clinician is not able to look at a good clinical picture" (MRRH 1-Lab staff)*

6.2.5 Participants Suggestions

Improvement of Supply Chain Systems

Participants suggested strengthening coordination with the National Medical Stores (NMS) and streamlining the procurement process to reduce delays and minimize wastage caused by short-expiry deliveries.

> *"I think they should sit down and purchase enough reagents because they usually send us limited numbers according to their plan." (MRRH 3-Lab Staff)*

> *"We need to look into the issue of the push system whereby when it's a few months to expire, the reagents are pushed, which is very dangerous; it causes many reagents to expire unused." (MRRH 7-Lab Staff)*

Enhancement of Staffing and Capacity building

Respondents emphasized the need for additional laboratory personnel and continuous training to reduce workload and improve efficiency.

> *"They have to get more staff; the workload is too much." (ERRH 1-Clinician)*

> *"We need more trained staff to handle logistics and monitoring properly." (MRRH 6-Lab Staff)*

> *"There should be continuous capacity building for all sections to ensure everyone understands stock management." (MRRH 5-Lab Staff)*

Improved communication systems

Improving communication systems within laboratories was highlighted as a practical solution. Participants recommended installing dedicated desk phones or intercoms to facilitate faster coordination among laboratory staff, administrative staff, and clinicians. This would allow clinicians to quickly verify reagent availability before sending patients for tests, addressing uncertainties about reagent stock and thereby reducing delays and preventing wasted patient time.

> *"We need desk phones in the laboratory; walking to the wards or admin block every time wastes time." (ERRH 4-Lab Staff)*

"Communication is sometimes slow; if we had internal phones, we would report stockouts faster." (MRRH 8-Lab Staff)

Participants also recommended holding regular review meetings to discuss stock levels and reporting progress.

"There should be scheduled review meetings for stock records and supervision reports." (MRRH 8-Lab Staff)

Improved Monitoring and Feedback Mechanisms

The study found that participants recommended strengthening feedback loops between laboratory sections, management, and logistics units to promote timely problem-solving and continuous learning.

"The quality officer should give feedback regularly so that we can correct mistakes early." (ERRH 5-Lab Staff)

"After every report, there should be a feedback meeting to discuss stock performance." (MRRH 8-Lab Staff)

Strengthening Partnerships and Resource Sharing

Respondents recommended building stronger collaborations with implementing partners and nearby facilities to enhance reagent availability and sustainability. Participants noted that partnerships had previously supported supervision, staff training, and emergency procurement, and that these collaborations should be sustained.

"Partners used to support supervision and purchase of critical reagents; this should be sustained; we miss that support." MRRH 7-Lab Staff)

CHAPTER SEVEN

7.0 DISCUSSION

7.1 Introduction

This chapter discusses the study findings with emphasis on Monitoring and Evaluation practices used in the management of laboratory reagent stockouts in Entebbe Regional Referral Hospital (ERRH) and Mbale Regional Referral Hospitals (MRRH). The discussion integrates quantitative and qualitative findings to provide a comprehensive understanding of the magnitude, frequency, and duration of reagent stockouts, as well as the monitoring and evaluation practices, facilitators, barriers, and recommendations identified by key informants. The integration aims to interpret the numerical trends through the lived experiences of laboratory personnel while situating the results within the context of national and global evidence. The discussion is organized thematically to reflect the systemic, operational, and behavioral factors influencing reagent management.

7.2 Extent, Frequency, and Duration of Stockouts

Level of Stockouts

The widespread and comparable stockout patterns observed across both hospitals reflect systemic challenges within Uganda's national supply chain. Although the country primarily operates a pull system where facilities quantify needs and place orders weaknesses in quantification skills, delayed requisitions, and untimely deliveries from the National Medical Stores contributed to recurrent shortages. Mbale RRH, with a large catchment and high patient load, is more vulnerable to critical reagent shortages, whereas Entebbe RRH experiences fewer stock depletions due to its location and easier access to supplies. However, proximity to NMS stores did not eliminate stockouts at Entebbe, as key informants highlighted facility-level operational constraints such as delayed ordering, incomplete documentation, limited staffing, funding ceilings, and occasional delivery of short-expiry reagents, which continued to disrupt availability.

These limitations were more pronounced in high-volume diagnostic sections with unpredictable demand, consistent with (Lugada et al., 2022), who noted that sudden surges in patient load can rapidly deplete reagents in high-throughput laboratories.

Stockouts occurred across nearly all laboratory sections, suggesting a system-wide challenge rather than section-specific inefficiencies. This pattern aligns with findings by (Namuhani et al., 2021), who reported 66.7% reagent stockouts and observed that 92% of laboratory tests were not conducted due to reagent shortages highlighting the broader implications for diagnostic continuity and clinical decision-making. Persistent gaps in inventory management, forecasting accuracy, and buffer stock maintenance were evident. Incomplete or inconsistent consumption data, driven by slow transitions to electronic systems and reliance on manual stock records, further constrained effective monitoring and data-driven forecasting.

Additional operational bottlenecks exacerbated stockout conditions. Reporting and data-entry delays, limited staffing, and insufficient training disrupted timely identification and replenishment of depleted reagents. The intermittent use of a centralized push system by partner organizations resulted in the supply of unrequested reagents sometimes with short shelf life distorting consumption patterns and complicating accurate forecasting (USAID | DELIVER PROJECT, 2008).

Frequency of Stockouts

A total of 848 reagent stockout episodes were recorded across Entebbe and Mbale Regional Referral Hospitals from January 2023 to September 2025, demonstrating that shortages were frequent and recurrent rather than isolated events. Entebbe consistently registered more episodes than Mbale, partly due to its reliance on redistribution as a coping strategy. Similar patterns have been noted elsewhere, although at lower magnitudes; for instance, (Boakye et al., 2021) reported a median of nine stockout episodes in Ghana within six months, suggesting that Uganda's regional referral hospitals may face comparatively greater supply chain pressures.

Participants attributed the pronounced spike in 2024 particularly in Entebbe to delayed deliveries and short-expiry consignments from the National Medical Stores (NMS), delays by NMS have previously been documented by(Lugada et al., 2022) Although redistribution from nearby facilities helped sustain operations, it generated additional recorded episodes, thereby inflating the apparent frequency. This aligns with (Lugada et al., 2022), who found that 75% of facilities relied on redistribution to manage stockouts. While such adaptive mechanisms illustrate managerial responsiveness, they also underscore deeper weaknesses within the supply and distribution system.

Mbale showed fewer but gradually increasing stockout episodes, reflecting ongoing inefficiencies in forecasting, quantification, and follow-up. Across both hospitals, the recurring

shortages reflect the weak alignment between facility requisitions, consumption patterns, and centralized supply timelines. National evidence similarly links rigid procurement processes and poor data use to chronic laboratory reagent shortages, calling for strengthened oversight and more responsive procurement systems (Muttamba et al., 2025; Mwangusya 2025). The findings therefore emphasize the need for balanced stock management approaches combining timely restocking, improved communication with NMS, and monitoring of stockout duration as a performance indicator to promote more stable reagent availability in regional referral laboratories.

Duration of Stockouts

Laboratory reagent stockouts in Mbale Hospital tended to last longer than in Entebbe, with the most prolonged disruptions occurring in 2024, indicating systemic supply delays. The observed variability in stock durations reflects inconsistent replenishment practices and delayed responses to shortages. Similar patterns have been reported in Ethiopia and Ghana, where prolonged reagent and medicine stockouts are common; for instance, (Boche et al., 2022) documented an average duration of 58 days in Gambella, Ethiopia, and (Boakye et al., 2021) reported a median stockout of 171 days in Ghana, suggesting that Uganda experiences relatively shorter, though still significant, disruptions. Notably, the longest durations in our study occurred in 2024, mirroring patterns of major supply disruption seen in Ethiopia and Ghana. This suggests that while Uganda may have slightly more responsive stock management, significant delays and systemic supply challenges still exist.

Prolonged stockouts were attributed to bureaucratic procurement processes, technical downtimes, poor forecasting, and inadequate supervision, which delayed timely stock replenishment. Conversely, hospitals with proactive leadership and frequent follow-up managed to limit disruptions by promptly escalating shortages or borrowing from nearby facilities. At Entebbe, outsourcing reagents temporarily mitigated stockouts but did not address underlying supply chain inefficiencies.

These findings highlight the influence of limited hospital autonomy, inadequate data recording, and funding constraints on stockout durations. Strengthening coordination with the National Medical Stores, improving consumption-based forecasting, and enhancing supervisory mechanisms could reduce the frequency and duration of stockouts, thereby increasing resilience in hospital supply chains

7.3 Monitoring Systems, Data Management, and Accountability Mechanisms

Both Entebbe and Mbale RRHs utilized hybrid monitoring systems combining manual stock cards with electronic tools such as EAFYA, ALIS, and DHIS2, reflecting Uganda's transition toward digitalized M&E of laboratory reagents. However, the coexistence of manual and electronic records introduced inconsistencies and duplication, weakening data accuracy and traceability. Observed accountability gaps included incompletely filled stock cards, requisition forms without issuance verification, delivery invoices missing corresponding stock entries, and in some cases, entirely absent stock cards. Similar challenges have been reported regionally: only 38% of stock cards were regularly updated in Burundi (Niyonkuru et al., 2024), data quality was frequently poor in Addis Ababa (Bekele et al., 2022) and in Gambella, Ethiopia, document accuracy averaged 49%, completeness 71%, and timeliness 64% (Boche et al., 2022). In Uganda, 84% of facilities still relied solely on manual records for essential medicines (Lugada et al., 2022).

These documentation irregularities reflect both systemic and operational weaknesses. Poorly completed or missing stock cards undermine data integrity, disrupt consumption-based forecasting, and delay replenishment, directly contributing to reagent shortages. Inaccurate or absent data obscure actual consumption, making future needs difficult to project. This is consistent with (Boakye et al., 2021), who emphasized that stock management practices affect reagent availability, and with (Kabera & Mukanyangezi, 2024) and (Atim et al., 2024), who highlighted that maintaining updated, consolidated inventory tools is critical for effective stock control. Thus, incomplete documentation is not merely an administrative issue but a central factor in prolonged stockouts.

Strengthening M&E requires moving from ad-hoc manual entries toward unified digital platforms, with real-time integration of manual and electronic tools to improve accuracy and reduce restocking delays. Regular audits, staff mentorship, and enforcement of national documentation standards can enhance accountability. Harmonized record-keeping supported by consolidated logistic tracking ensures reliable data, timely decision-making, and sustained reagent availability, forming the backbone of an effective monitoring and evaluation system

7.4 Human Resource, Training, and Operational Efficiency

Human resource constraints were a major factor affecting the implementation of Monitoring and Evaluation practices in laboratory reagent management at Entebbe RRH and Mbale RRH.

Staffing shortages require laboratory technologists to multitask across laboratory, logistics, and requisition roles, leading to delays and incomplete documentation, reporting, and order processing. This posed a moderate limitation to data completeness in this study and weakened routine monitoring and oversight functions, consequently contributing to reagent stockouts. This aligns with regional evidence showing that insufficient staffing and limited supervision undermine laboratory supply chain performance (Muttamba et al., 2025; USAID | DELIVER PROJECT, 2008). Similar findings from Uganda and Ethiopia indicate widespread gaps in staffing and training, which directly weaken M&E reliability (Boche et al., 2022; Kiwanuka et al., 2020).

These staffing gaps create a cycle where delayed documentation produces unreliable consumption data, misaligned procurement, and prolonged stockouts (Kiwanuka et al., 2020; Muttamba et al., 2025). Strengthening human resource capacity through professional development of procurement and logistics staff is essential to improve supply chain performance (Kalu & Chukwura, 2022). Assigning a designated stock focal person also enhances accountability and streamlines tasks (Atim et al., 2024). The findings further show that weaknesses in supply management indirectly affect clinical care through disruptions in diagnostic support (Kalu & Chukwura, 2022).

Limited structured training and reliance on informal, peer-led learning reduce technical confidence and contribute to inconsistencies in stock reporting and LMIS compliance. This gap reinforces inaccuracies in data management and results in systemic underestimation of reagent needs (Boche et al., 2022; Kiwanuka et al., 2020). Sustained capacity building, mentorship, and competency-based training are therefore critical for strengthening logistics and M&E practices (Kalu & Chukwura, 2022). National-level investments in training would improve data quality and enhance the reliability of laboratory M&E systems (USAID | DELIVER PROJECT, 2008).

Staff fatigue, low morale, and perceptions of monitoring as fault-finding further weaken routine reporting and accountability. These behavioral barriers reduce motivation for timely documentation and increase bypassing of requisition procedures, reflecting both capacity and attitudinal gaps (Boche et al., 2022; Muttamba et al., 2025). Addressing these challenges through mentorship, recognition mechanisms, and clearer role delineation can improve accountability and data ownership. Strengthening workforce numbers and skills through continuous professional development is essential to address these operational bottlenecks and

reduce recurrent stockouts (Kalu & Chukwura, 2022; USAID | DELIVER PROJECT, 2008) 2008).

7.5 Governance, Funding, and Sustainability

Governance and funding arrangements influenced the implementation of Monitoring and Evaluation practices in laboratory reagent management at Entebbe and Mbale Regional Referral Hospitals. Although policies and management structures existed, weak oversight, enforcement, and supervision limited accountability and effective use of M&E information. These gaps allowed monitoring weaknesses and stock discrepancies to persist, contributing to reagent stockouts. These weaknesses mirror regional evidence that inadequate leadership and poor-quality management undermine laboratory service delivery (Boche et al., 2022; RegionalCommitteeforAfrica73, 2023). Without strong oversight and structured follow-up, stock imbalances remain undetected and escalate into recurrent shortages.

Systemic policy factors, including inconsistent application of the "push" system, contributed to mismatches between supplied reagents and actual consumption needs. Supplies from government, donors, or IPs often bypassed NMS, limiting facility-level flexibility and creating supply demand misalignments (USAID | DELIVER PROJECT, 2008). Evidence from Zimbabwe shows that donor and IP support strengthens procurement and infrastructure but must prioritize sustainability over temporary relief (Lesego et al., 2024). These irregularities underscore the need for harmonized and sustainable supply mechanisms.

Funding limitations further intensified stock challenges, as both hospitals relied heavily on NMS allocations and intermittent partner support without contingency financing. Delays or withdrawal of partner funding created immediate procurement gaps, reflecting the unsustainability of donor dependence. Regional guidance stresses the importance of domestic financing to safeguard long-term availability of diagnostic commodities (RegionalCommitteeforAfrica73, 2023). Strengthening governance must therefore be paired with technical and managerial capacity building to improve resilience (Mulleta et al., 2021).

Weak governance and underfunding reinforced a cycle of delayed responsiveness, limited procurement autonomy, and poor accountability. Fragmented oversight obscured real stock levels, while rigid budgets prevented timely emergency purchases, prolonging stockouts. Enhancing reagent availability requires stronger governance through routine supervisory reviews, integrated M&E, and hybrid push–pull supply systems. Establishing ring-fenced

laboratory budgets and granting micro-procurement authority would improve sustainability and reduce future disruptions (Lesego et al., 2024; RegionalCommitteeforAfrica73, 2023).

7.6 Implications of the Findings

The study underscores key lessons for Monitoring and Evaluation (M&E) of laboratory reagents. Reagent stockouts result from systemic inefficiencies, operational limitations, and human factors, indicating that M&E should track not only stock levels but also adherence to procedures and workflow bottlenecks. Quantitative data reveal the magnitude and duration of stockouts, while qualitative insights explain underlying causes, emphasizing the need for timely data collection, trained personnel, clear reporting structures, and responsive feedback to ensure sustainable reagent management

For policymakers, the findings emphasize the need for investment in laboratory information systems, supply chain financing, and capacity building. For hospital management, strengthening feedback mechanisms and internal audits will enhance accountability. For staff, continuous mentorship and motivation remain essential for sustaining effective M&E practices

7.7 Study Strengths and Limitations

Strengths

This study had several strengths.

The concurrent mixed-methods design enabled the integration of quantitative stockout trends with qualitative insights from key informants, providing a comprehensive understanding of laboratory reagent stock management.

Triangulation across multiple data sources, including stock records, requisition forms, electronic systems, and staff experiences, enhanced the credibility and robustness of the findings.

Additionally, focusing on two regional referral hospitals generated context-specific evidence to inform improvements in monitoring and evaluation practices within Uganda’s laboratory supply chain.

Limitations

Secondary-data constraints: Quantitative analysis relied on stock cards, requisition, and delivery notes, which were sometimes incomplete or inconsistently recorded. Despite cross-checking records and consulting laboratory staff, missing data may have affected the precision of stockout frequency and duration estimates.

Generalizability: The study focused on two RRHs and 171 reagents with complete records; findings may not generalize to all facilities or to reagents without complete documentation moreover seasonal or very short-term fluctuations may not have been captured fully. However, the study's period of assessment does give a valid depiction of the patterns and challenges encountered by facilities utilizing the pull system.

Qualitative bias: Key informants are subject to social desirability and recall biases; staff may under or over-report behaviors or institutional performance, we tried to address this issue by guaranteeing confidentiality and conducting multiple interviews within the same facility.

National-level perspectives: The study didn't incorporate National-level perspectives limiting triangulation of facility-level findings with insights from central supply chain or policy stakeholders.

CHAPTER EIGHT

8.0 RECOMMENDATIONS AND CONCLUSION

8.1 Conclusion

This study demonstrates that laboratory reagent stockouts at Entebbe RRH and Mbale RRH are driven by interconnected supply-chain, digital, human-resource, and governance constraints. Across the two hospitals, 848 stockout episodes were recorded, with comparable patterns of recurrent shortages but uneven severity, Mbale RRH experiencing longer durations than Entebbe RRH, peaking at 47.8 and 23.5 days respectively. The study concludes that M&E practices at the hospitals such as stock card updates, timely requisitions, consumption reporting, and supervisory reviews are weak, inconsistently applied, and significantly contribute to stockout problems undermining data capture and stock accuracy, delaying replenishment, and weakening overall supply reliability. Facilitators of M&E implementation included committed leadership, trained personnel, and functional digital systems, while barriers included inadequate human resources, weak governance, and limited funding. Strengthening demand-driven procurement, fully digitizing inventory systems, building workforce capacity, and enhancing governance and financing structures, alongside consistent implementation of M&E practices, are therefore essential. Implementing these measures will improve laboratory resilience, ensure continuity of diagnostic services, and ultimately enhance patient outcomes.

8.2 Recommendations

The recommendations below are prioritized and directly linked to the study findings. These are directed to the Ministry of Health, Lab-SPARS, National Medical Stores, Researchers and academic institutions, Regional Referral Hospital administration, laboratory leadership, and relevant implementing partners to strengthen monitoring and evaluation practices and reduce laboratory reagent stockouts.

Supply-chain and procurement

To reduce stockouts, the Ministry of Health and partners should strengthen capacity for accurate forecasting to ensure supplies match actual facility needs and are fairly distributed across hospitals.

Additionally, buffer-stock policies with defined minimums should be established for high-use reagents, such as Immunology and Biochemistry, to prevent service interruptions.

Monitoring, digital systems and data use

Scale E-AFYA system to all laboratory sections at Entebbe RRH and other facilities national wide that are still lagging behind and implement routine data validation to ensure accurate and reliable data.

Invest in resilient laboratory infrastructure by procuring sufficient computers with updated software for data management, installing uninterruptible power supplies or solar backup systems to prevent power outages, and ensuring reliable internet connectivity for timely reporting and monitoring of reagent stocks.

Human resources and capacity building

Build work capacity by establishing dedicated logistics or data officer positions and where possible, Monitoring and Evaluation officer roles at Regional Referral Hospitals to reduce role overlap and ensure timely data entry, ordering, and follow-up. Additionally, implement structured training and mentorship programs, including annual refresher courses and Lab-SPARS-style mentorship, to strengthen staff competencies in inventory management and M&E practices.

Governance, accountability and sustainability

Formalize partnerships with donors by signing transition plans that gradually increase domestic financing and local ownership.

Operational practices and communication.

Introduce internal communication systems, such as desk phones or intercoms, to enhance real-time coordination and improve responsiveness among laboratory departments, clinicians, and administrative staff.

Further research

Expansion of similar assessments to cover all hospital laboratories and incorporate national-level perspectives to strengthen triangulation of facility-level findings.

Develop a standardized framework for ranking laboratory performance in M&E implementation and broader laboratory service indicators to support benchmarking and targeted improvement.

ANNEXES

Annex 1: References

Alabdullah, E. A., Alkhadhrawi, B. A., Alabdullah, H. A., Algargoosh, K. A., & Sakrn, A. M. A. (2024). The Role and Impact of Reference Laboratories in the Primary Health Care System. *International Journal For Multidisciplinary Research*, *6*(3). https://doi.org/10.36948/ijfmr.2024.v06i03.21650

Aqdi, A., Saleh, Y, Bakri,Sayfullah, Atiah I, Fuad, Ali, A, Jabbari, Masmali, Wadia, Ali, A, Amal, Meshni, Ahmed, Hakami, Wejdan, Ali, Alwan, Fadhel, Eissa, Moussa, ahmed, Tawashi, Wasili, Sultan, Mousa, J. (2019). Role of Laboratory Medicine in Disease Diagnosis and Management. https://sjr-publishing.com/wp-content/uploads/2019/03/Role-of-Laboratory-Medicine-in-Disease-Diagnosis-and-Management-1.pdf

Atim, P., Gidudu, S., Bagaya, B. S., Kambugu, A., Sarpong, K., Kafufu, B., Kiwanuka, B., Natukunda, B., Nekesa, E., & Okiror, D. (2024). Improving HIV testing kits inventory management in a high-volume testing laboratory, Uganda, 2023.

Befekadu, A., Cheneke, W., Kebebe, D., & Gudeta, T. (2020). Inventory management performance for laboratory commodities in public hospitals of Jimma zone, Southwest Ethiopia. *Journal of pharmaceutical policy and practice*, *13*, 1-12.

Bekele, A., Gemechu, F., & Ayalew, M. (2022). Assessment of HIV Rapid Test Kits Inventory Management Practice and Challenges in Public Health Facilities of Addis Ababa, Ethiopia. *Integrated Pharmacy Research and Practice*, 85-94. https://doi.org/10.2147/IPRP.S356134

Boakye, G., Gyedu, A., Stewart, M., Donkor, P., Mock, C., & Stewart, B. (2021). Assessment of local supply chains and stock management practices for trauma care resources in Ghana: a comparative small sample cross-sectional study. *BMC Health Services Research*, *21*(1). https://doi.org/10.1186/s12913-021-06063-6

Boche, B., Temam, S., & Kebede, O. (2022). Inventory management performance for laboratory commodities and their challenges in public health facilities of Gambella Regional State, Ethiopia: a mixed cross-sectional study. *Heliyon*, *8*(11). https://doi.org/10.1016/j.heliyon.2022.e11357

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101. http://dx.doi.org/10.1191/1478088706qp063oa

Ciaccio, M. (2024). The Role of Laboratory Medicine in the Clinical Context. In *Clinical and Laboratory Medicine Textbook* (pp. 1-5). Springer. https://doi.org/10.1007/978-3-031-24958-7_1

Coulibaly, S. O., Amri, M., Vuguziga, C., Seydi, A. B.-W., Aine, L. M., Kembabazi, B., Sy, S., & Makubalo, L. E. (2024). World Health Organization African Region national heads of units of diagnostics and laboratory services meetings proceedings. BMC Proceedings,

Eceru, G. w.-P. (2023). Drug stock-outs: An open letter to the PM. *Daily Monitor*. https://www.monitor.co.ug/uganda/oped/commentary/drug-stock-outs-an-open-letter-to-the-pm-4124378

GHSC-PSM. (2018). *Uganda National Supply Chain Assessment Capability and Performance Report*. https://library.health.go.ug/medical-products-technologies/pharmaceuticals-and-drugs/uganda-national-supply-chain-assessment

Huf, W., Mohns, M., Bünning, Z., Lister, R., Garmatiuk, T., Buchta, C., & Ettl, B. (2022). Benchmarking medical laboratory performance: survey validation and results for Europe, Middle East, and Africa. *Clinical Chemistry and Laboratory Medicine (CCLM)*, *60*(6), 830-841.

Improve, M. (2024). *Ensuring Compliance and Safety in Medical Lab Reagent Storage and Disposal*. Improve Medical. https://www.improve-medical.net/resources-articles/Ensuring-Compliance-and-Safety-in-Medical-Lab-Reagent-Storage-and-Disposal

Kabera, J. C., & Mukanyangezi, M. F. (2024). Influence of inventory management practices on the availability of emergency obstetric drugs in Rwandan public hospitals: a case of Rwanda Southern Province. *BMC Health Services Research*, *24*(1). https://doi.org/10.1186/s12913-023-10459-x

Kalu, O. C., & Chukwura, E. F. (2022). Medical Laboratory Supply Chain Management Reviews; Implications in Achieving a Standard Diagnostic Outcome. *International Journal of Advances in Engineering and Management (IJAEM)*, *4*(8), 10. https://doi.org/10.35629/5252-040810021011

Kalyesubula-Kibuuka, S., & Silva, K. A. (2018). Building cross-country networks for laboratory capacity and improvement. *Global Health and Pathology, An Issue of the Clinics in Laboratory Medicine*, *38*(1), 119-130.

Kiwanuka, S. N., Namuhani, N., Akulume, M., Kalyesubula, S., Bazeyo, W., & Kisakye, A. N. (2020). Uganda's laboratory human resource in the era of global health initiatives: experiences, constraints and opportunities—an assessment of 100 facilities. *Human Resources for Health*, *18*(1). https://doi.org/10.1186/s12960-020-0454-5

Komasawa, M., Aung, M. N., Nsereko, C., Ssekitoleko, R., Isono, M., Saito, K., Nantume, J., Shirayama, Y., Chandani, S., & Yuasa, M. (2023). Impact of Hospital Closure on Patients with Communicable and Non-Communicable Diseases During the COVID-19 Pandemic in Uganda: A Cross-Sectional and Mixed-Methods Study. *Risk Management and Healthcare Policy*, *Volume 16*, 2593-2607. https://doi.org/10.2147/rmhp.s419969

Kyalisiima, I., Kitutu, F. E., Gibson, L., Akaso, I., Ndaabe, A., Aguma, H. B., Musoke, D., Adome, R. O., & Kutyabami, P. (2023). Compliance of public health facilities with essential medicines and health supplies redistribution guidelines in Mbale district, Eastern Uganda: a mixed-methods study. *Journal of pharmaceutical policy and practice*, *16*(1). https://doi.org/10.1186/s40545-023-00545-0

Lee Hilborne, E. G., Iman Kundu. (2022). *Laboratory Supply Chain Shortage Effects on Laboratory Workforce and Effective Test Utilization*. American Society for Clinical Pathology. https://www.criticalvalues.org/news/all/2022/05/10/laboratory-supply-chain-shortage-effects-on-laboratory-workforce-and-effective-test-utilization

Lesego, A., Were, L. P. O., Tsegaye, T., Idris, R., Morrison, L., Peterson, T., Elhussein, S., Antonio, E., Magwindiri, G., Dumba, I., Mtambirwa, C., Madzikwa, N., Simbi, R., Ndlovu, M., & Achoki, T. (2024). Health system lessons from the global fund-supported procurement and supply chain investments in Zimbabwe: a mixed methods study. *BMC Health Services Research*, *24*(1). https://doi.org/10.1186/s12913-024-11028-6

Lugada, E., Komakech, H., Ochola, I., Mwebaze, S., Olowo Oteba, M., & Okidi Ladwar, D. (2022). Health supply chain system in Uganda: current issues, structure, performance, and implications for systems strengthening. *Journal of pharmaceutical policy and practice*, *15*(1), 14. https://doi.org/https://dx.doi.org/10.1186/s40545-022-00452-w

Matama, C. (2022). *JCRC impact story on laboratory systems strengthening in Uganda* T. J. C. R. C. (JCRC). https://jcrc.org.ug/wp-content/uploads/2022/08/Impact-story-strenghtening-labs-002_Dan-Edits1.pdf

MOH. (2009). *Uganda National Health Laboratory Services Policy*. Ministry of Health, Uganda Retrieved from https://library.health.go.ug/sites/default/files/resources/Uganda%20national%20health%20Laboratory%20services%20policy_0.pdf

MOH. (2012). *Management of medicines and health supplies manual*. Kampala,Uganda: Ministry of Uganda Retrieved from https://www.health.go.ug/docs/MOMHSM_2012.pdf

MOH. (2017). *Laboratory Supervision Performance Assessment and Recognition Strategy Data Collection Tool & Support Supervision Visit Guidance*. Ministry of Health, Uganda Retrieved from https://cphl.go.ug/web/sites/default/files/2024-

10/Lab%20SPARS%20Data%20Collection%20%26%20Support%20Supervision%20Guide%2024062017.pdf

MOH. (2018). *Uganda essential medicines and health supplies management manual.* . Ministry of Health, Retrieved from https://www.health.go.ug/sites/default/files/EMHS%20Manual_MASTER_COPY_14-Mar-2019.pdf

MOH. (2021). *Stock Status Report*. Ministry of Health, Uganda Retrieved from https://library.health.go.ug/sites/default/files/resources/MOH%20SSR%201st%20February%202021_Final-1.pdf

MOH. (2022). *Monitoring and Evaluation Plan for Implementation of the Ministry of Health Strategic Plan 2020/21 – 2024/25* Ministry of Health, Uganda Retrieved from https://library.health.go.ug/sites/default/files/resources/M%26E%20Plan%20for%20MOH%20SP%20-%20FINAL%2014th_11_2022---%20Signed.pdf

MOH. (2023). *National Health Laboratory Services Strategic Plan III (2021-2025)* Ministry of Health, Uganda Retrieved from https://guluhospital.net/wp-content/uploads/2023/01/NATIONAL-HEALT-LAB-SERVICES-STRATEGIC-PLAN.pdf

MOH. (2024). *Ministry of Health Annual Health Sector Performance Report 2023/24*. Plot 6 Lourdel Road, Nakasero P.O Box 7272, Kampala, Uganda: Ministry of Health, Uganda Retrieved from https://library.health.go.ug/monitoring-and-evaluation/annual-quarterly-performance-reports/annual-health-sector-performance-8

Mubangizi, P. (2022). *Breaking down AMR barriers in Uganda*. The Fleming Fund. https://www.flemingfund.org/publications/case-study-breaking-down-barriers-to-investment-in-uganda

Mulleta, D., Jaleta, F., Banti, H., Bekele, B., Abebe, W., Tadesse, H., Eshetu, L., Zewdu, A., Botore, A., Tadesse, L., & Debela, T. (2021). The Impact of Laboratory Quality Management System Implementation on Quality Laboratory Service Delivery in Health Center Laboratories of Oromia Region, Ethiopia. *Pathology and Laboratory Medicine International*, *Volume 13*, 7-19. https://doi.org/10.2147/plmi.s314656

Muttamba, W., O'Hare, B., Ramsay, A., Saxena, V., Kirenga, B., & Sabiiti, W. (2025). A laboratory-focussed desk review of health systems in Uganda, Kenya, and the UK to respond to current and future pandemics. *Journal of Global Health*, *15*, 04194. https://doi.org/10.7189/jogh.15.04194.

Mwangusya , M., John ,Otim, Kirwisa, Matovu. (2025). The Influence Of Regulatory Policies On Procurement Processes In Uganda: A Case Study Of National Medical Stores-Nms. *Metropolitan Journal Of Social And Educational Research Vol. 4* (Issue 6, June- 2025), 99-110. https://www.researchgate.net/publication/393105949_The_Influence_Of_Regulatory_Policies_On_Procurement_Processes_In_Uganda_A_Case_Study_Of_National_Medical_Stores-Nms

Namuhani, N., Kiwanuka, S. N., Akulume, M., Kalyesubula, S., Bazeyo, W., & Kisakye, A. N. (2021). Laboratory Diagnostics Performance in Uganda: A Survey of Test Availability and Constraints Across 100 Laboratories. *Public Health*(1). https://www.researchgate.net/publication/354802027_Laboratory_Diagnostics_Performance_in_Uganda_A_Survey_of_Test_Availability_and_Constraints_Across_100_Laboratories

Needle.Tube. (2024a). *Best Practices for Inventory Management of High-Use Reagents in Hospitals*. Fibulas, Inc. https://www.needle.tube/resources-39/Best-Practices-for-Inventory-Management-of-High-Use-Reagents-in-Hospitals

Needle.Tube. (2024b). *Challenges and Best Practices for Inventory Management of Lab Reagents*. Fibulas, Inc. https://www.needle.tube/resources-18/Challenges-and-Best-Practices-for-Inventory-Management-of-Lab-Reagents

Needle.Tube. (2024c). *Challenges and Strategies for Managing Laboratory Diagnostic Reagents in US Hospitals*. Fibulas, Inc. https://www.needle.tube/resources-29/Challenges-and-Strategies-for-Managing-Laboratory-Diagnostic-Reagents-in-US-Hospitals

Needle.Tube. (2024d). *The Consequences of Improper Storage of Lab Reagents in Medical Diagnostic Labs*. Fibulas, Inc. https://www.needle.tube/resources-20/The-Consequences-of-Improper-Storage-of-Lab-Reagents-in-Medical-Diagnostic-Labs

Needle.Tube. (2024e). *Implications of Stockouts on Patient Care and Laboratory Operations: Strategies for Prevention*. Fibulas, Inc. https://www.needle.tube/resources-16/Implications-of-Stockouts-on-Patient-Care-and-Laboratory-Operations%3A-Strategies-for-Prevention?utm_source=chatgpt.com

Needle.Tube. (2024f). *Mitigating the Impact of Reagent Supply Chain Disruptions on Hospital Operations in the United States*. Fibulas, Inc. https://www.needle.tube/resources-36/Mitigating-the-Impact-of-Reagent-Supply-Chain-Disruptions-on-Hospital-Operations-in-the-United-States

NewVision. (2020). Hospitals in shortage of Hepatitis B test kits, reagents and diagnostic machines. *New Vision* https://www.newvision.co.ug/news/1525416/hospitals-shortage-hepatitis-b-test-kits-reagents-diagnostic-machines

Nexusmedia, A., Atewo. (2024). *MPs Raise Concern Over Expired Drug Storage Practices at Entebbe Regional Referral Hospital.* Nexusmedia Uganda. https://nexusmedia.ug/mps-raise-concern-over-expired-drug-storage-practices-at-entebbe-regional-referral-hospital

Nilepost, M. M. (2024). *Gov't responds to critical equipment shortage at Entebbe regional referral hospital.* Nilepost. https://nilepost.co.ug/news/204031/govt-responds-to-critical-equipment-shortage-at-entebbe-regional-referral-hospital

Niyonkuru, D., Mitiku, S., Ngenzi, J. L., Niragire, F., & Mukamurigo, J. (2024). Stock management practices and the availability of HIV viral load reagents and consumables in Burundi public laboratories, a cross-sectional study design, from January to December 2023. *Research Square* https://doi.org/10.21203/rs.3.rs-4909134/v1

Niyonzima, N., Wannume, H., Kadhumbula, S., Wasswa, H., Osinde, G., Mulumba, Y., Tusabe, T., Kalungi, S., & Orem, J. (2021). Strengthening Laboratory Diagnostic Capacity to Support Cancer Care in Uganda. *American journal of clinical pathology*, *156*(2), 205-213. https://doi.org/10.1093/ajcp/aqaa218

Nkengasong, J. N., Mbopi-Keou, F.-X., Peeling, R. W., Yao, K., Zeh, C. E., Schneidman, M., Gadde, R., Abimiku, A. l., Onyebujoh, P., & Birx, D. (2018). Laboratory medicine in Africa since 2008: then, now, and the future. *The Lancet infectious diseases*, *18*(11), e362-e367.

NMS, M. (2020). *FY2020/21 National Annual Needs Analysis & Quantification Report for Public Health Facilities in Uganda. Kampala, Uganda*. Plot 6 Lourdel Road, Wandegeya, P.O Box 7272, Kampala, Uganda Ministry of Health, Uganda Retrieved from https://www.health.go.ug/wp-content/uploads/2020/07/FY2020-21-National-Annual-Quantification-Report-for-EMHS.pdf

Okaba, P. (2023). Two remanded over theft of govt drugs. *Daily Monitor*. https://www.monitor.co.ug/uganda/news/national/two-remanded-over-theft-of-govt-drugs-4240294

RegionalCommitteeforAfrica73. (2023). Regional strategy on diagnostic and laboratory services and systems, 2023–2032 for the WHO African Region: report of the Secretariat. World Health Organization. Regional Office for Africa., Article AFR/RC73/7. https://iris.who.int/handle/10665/373408

Shuna, S., & Kithandi, C. K. (2024). Monitoring and Evaluation Practices and Performance of Health Development Projects in Kenya. *International Journal of Scientific and Research Publications*, *14*(12). https://doi.org/10.29322/IJSRP.14.11.2024.p15527

Ugandaradionetwork, J. A. (2022). *Entebbe Hospital Reopens*. Uganda radio network. net. https://ugandaradionetwork.net/story/entebbe-hospital-reopens-?districtId=0&utm

Ugandaradionetwork, S. A. (2017). *Drug Shortage Hits Mbale Regional Referral Hospital*. Ugandaradionetwork. https://ugandaradionetwork.net/story/drug-shortage-hits-mbale-regional-referral-hospital

USAID | DELIVER PROJECT, T. O. (2008). Guidelines for Managing the Laboratory Supply Chain: Version 2. https://iaphl.org/wp-content/uploads/2016/05/Guidlines-for-Managing-the-Lab-Supply-Chain.pdf?utm_source (Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1)

WHO. (2010). Monitoring the building blocks of health systems: A handbook of indicators and their measurement strategies. *Geneva, Switzerland: WHO Document Production Services*, *2025*. https://hpfhub.info/wp-content/uploads/2021/12/Monitoring-the-Building-Blocks-of-Health-Systems-2010_WHO.pdf

WHO. (2015). Technical consultation on preventing and Managing global stock outs of medicines. Geneva, Switzerland.

WHO. (2023a). *Patient safety*. World health organisation(WHO). https://www.who.int/news-room/fact-sheets/detail/patient-safety

WHO. (2023b). *Progress report on the implementation of the framework for strengthening health laboratory services, 2016–2023* (EM/RC70/INF.DOC.10 August 2023). https://applications.emro.who.int/docs/Progress-report-laboratory-services-eng.pdf

Zalwango, J. F., Zalwango, M. G., Naiga, H. N., Akunzirwe, R., Kimuli, R., Biribawa, C., Bulage, L., Kadobera, D., Migisha, R., & Ario, A. R. (2023). Increasing Stockouts of Critical Malaria Commodities in Public Health Facilities in Uganda, 2017-2022. *The Uganda Public Health Bulletin*. https://uniph.go.ug/wp-content/uploads/2023/10/Increasing-stockouts-of-critical-malaria-commodities-in-public-health-facilities-in-Uganda-2017-2022.pdf

Annex 2: Consent form

MAKERERE UNIVERSITY COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH RESEARCH AND ETHICS COMMITTEE

(SPH-REC)

INFORMED CONSENT: KEY INFORMANT INTERVIEW

Title of the proposed study: "Assessment of monitoring and evaluation practices in management of laboratory reagent stock outs in selected Regional referral hospitals in Uganda. A concurrent mixed method study".

Researcher: Ms Sanger Daphine, student of Master of Public health monitoring and evaluation of School of Public health, Makerere university – 0773-393930

Introduction

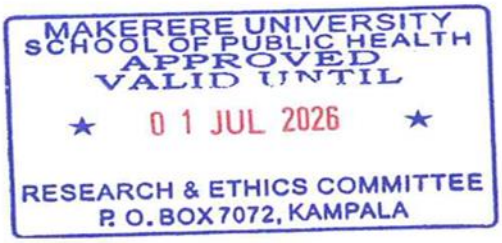
Dear Dr/Ms/Mr, my name is ..... I am asking you to volunteer for this sub-study of establishing the monitoring and evaluation practices used in managing laboratory reagents and exploring the facilitators and barriers to implementation of monitoring and evaluation practices in managing laboratory reagents in Entebbe regional referral hospital and Mbale regional referral hospital in Uganda. Once you have read all the necessary information below and agree to participate in the key informant interview, we will ask you to sign two copies of this consent form or make your mark with a thumbprint in the presence of a witness, if applicable. We will give you a copy of this form. This consent form might contain some words that you do not know. Please ask us to explain anything you do not understand.

Background and rationale for the study:

Frequent stockouts of laboratory reagents in Uganda's referral hospitals severely disrupt diagnostic services, leading to delayed test results and compromised patient care. A 2018 survey indicated that over 90% of facilities experienced stockouts, while Lugada et al. (2022) reported that 84% of health facilities faced similar shortages in 2022. Noel Namuhani et al. (2024) further highlighted that laboratories are forced to refer specimens for tests due to reagent shortages, increasing inefficiencies. Despite existing government interventions, gaps in monitoring and evaluation n (M&E) practices hinder effective stock management.

Purpose of the Study:

This study aims to assess the effectiveness of M&E practices in managing laboratory reagent stockouts in selected Ugandan regional referral hospitals. By examining stock tracking,



Statement of voluntariness:
Participation in this study is entirely voluntary you may join on your own free will. You also have a right to withdraw from the study at any time without penalty.

Dissemination of results:

The research participants will get feedback on findings and progress of the study. Additionally, findings from the study will be published in open access peer reviewed journals.

Ethical approval:
The study has been reviewed and approved by the School of Public Health Research and Ethics Committee (SPH-REC).

Questions about this study
If you have any questions regarding design and the science of the study, please contact Sanger Daphine, +256773-393930

Questions about participants rights:
If you have any questions about your rights as a research subject, you can call Dr: Kagaayi Joseph the Chairperson of the Makerere University School of Public Health Research and Ethics Committee on +256773785333

STATEMENT OF CONSENT

I have read this form or had it read to me. I have discussed the information with the study staff, and my questions have been answered. I have been told that my decision on whether to participate in the study is voluntary. By signing this form, I voluntarily agree to participate as a key informant. This does not take away my rights as a study participant.

_____ _____

Name of Participant (CAPITAL LETTERS). Signature of participant Or thumbprint.

Date _____/_____/_____
dd/mm/yyyy

_____ _____
Name of staff Administering Consent (CAPITAL LETTERS). Signature

Date_____/_____/_____
dd/mm/yyy

Annex 3: KII Questionnaire

Key Informant Interview (KII) guide

Study title: Assessment of monitoring and evaluation practices in management of laboratory reagent stock outs in selected Regional referral hospitals in Uganda. A concurrent mixed method study

SECTION A: Social Demographics

Participant ID # _____ Interviewer_____

Audio file #: _____ Date_____ Gender_____

Role _____ Duration of service_____

Name of institution: _____

SECTION B

Welcome, and thank you for accepting to participate in this interview. My name is ..... and I will conduct this interview.

This study aims to assess the effectiveness of M&E practices in managing laboratory reagent stockouts in Ugandan regional referral hospitals. By examining stock tracking, procurement efficiency, and response mechanisms, the study seeks to identify weaknesses and propose evidence-based interventions. Findings will contribute to improving stock management strategies, ensuring a steady supply of reagents, and enhancing healthcare service delivery. Your participation is voluntary and anonymous, with no names recorded and your level information not shared.

You can choose to stop participating at any time. We will take notes during the interview and audio record to help capture your comments accurately and complete our notes. We will destroy the recordings after we make the notes. You can choose not to respond to a question at any time, and your participation in this study is voluntary, and you can leave at any time.

Today's interview should take about 45 minutes.

Before we start, do you have any questions about today's interview?

SECTION C

Warm-up Question

1. What is your general impression of the availability of laboratory reagents in your facility?

Part 1: Service Delivery

Reagent Management Practices:

2. Can you describe the current protocols for monitoring stock levels of laboratory reagents?
3. How are stockouts of reagents typically identified and addressed within your facility?
4. What are the common causes of stockouts for laboratory reagents in your facility?

Monitoring and Reporting:

5. How is the usage of laboratory reagents tracked, and what tools or systems are used for this purpose?
6. How often do you report stock levels and stockout incidents to higher management?
7. Monitoring Plan: Is there an existing monitoring plan for laboratory supplies? If yes, how is it utilized in practice?

Part 2: Health Workforce

Staffing:

8. What is the current status of staffing for laboratory services in your facility?
9. Are there specific personnel dedicated to overseeing inventory management? If yes, please explain their roles.

Capacity Building:

10. Are there training programs in place for laboratory personnel related to stock management of laboratory reagents? If so, how often and adequate.

Part 3: Health Information Systems

Data Management:

11. How is data regarding lab reagent inventory generated and recorded?
12. What tools or systems do you currently use for managing this data?

Data Accuracy and Reliability:

13. How do you ensure the accuracy and reliability of the data regarding reagent stock levels?
14. Were there any specific challenges you faced in data collection related to reagent stocks?

Reporting Mechanisms:

15. How often are stock levels reported, and to whom?
16. Are there any regular audits conducted to assess inventory accuracy?

Data Use:

17. How is the data collected used to improve service delivery or inform decision-making in your lab?

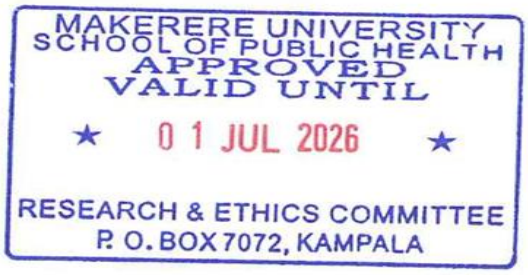
Part 4: Access to Laboratory Essential Medicines/Diagnostics

Reagent Availability:

18. How do you assess the availability of lab reagents at your facility?
19. What measures are in place to ensure a continuous supply of essential lab reagents?

Impact of Stockouts:

20. What are the impacts of reagent stockouts on laboratory service delivery and patient care?
21. Can you share any recent examples when stockouts led to issues in service delivery?



Procurement and Supply Chain:

22. Can you describe the procurement procedures for laboratory reagents within your health facility?
23. How do you ensure that essential laboratory reagents are available and accessible when needed?
24. What challenges do you face in the procurement of lab reagents?

Part 5: Financing

Funding Sources:

25. What are the primary sources of funding for your laboratory services?
26. Is there enough financial support to manage lab operations effectively, including reagent procurement?

Budgeting Practices:

27. How is the budget for laboratory services determined and managed?
28. Are there any financial constraints that hinder laboratory operations?

Part 6: Leadership/Governance

Policy Framework:

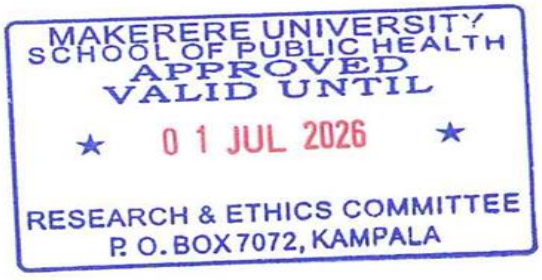
29. What policies govern laboratory service delivery in your region?
30. How are these policies communicated and enforced within your facility?

Leadership Support:

31. How does leadership at your institution support laboratory operations?
32. Are there mechanisms for staff input into decision-making processes regarding laboratory services?

Collaborations:

33. How do you collaborate with other health sectors or organizations to enhance lab services?



Part 7: Behavioural

Adherence to SOPs:

34. Are standard operating procedures (SOPs) for stock management readily available and followed?
35. What challenges do staff face in complying with SOPs related to stock monitoring and reporting?

Communication:

36. How would you describe communication among staff regarding stockouts and reagent needs?
37. Is teamwork encouraged and practiced in managing lab supplies?

Attitudes:

38. How do staff perceive the importance and usefulness of M&E practices for stock management?
39. Are there any misconceptions or challenges in implementing M&E due to staff attitudes?

Accountability:

40. How is accountability for reagent stock levels ensured among staff?
41. Are there consequences or feedback mechanisms for failure to comply with stock management procedures?

Motivation and Commitment:

42. How motivated are staff to complete stock management and reporting tasks?
43. What factors influence staff commitment to reagent monitoring and evaluation duties?

Conclusion:

44. Is there anything else you would like to add regarding lab reagent management or overall improvements in laboratory services?

Thank you for your time and valuable insight

Annex 4: Checklist

Stock level Checklist

Study title: Assessment of monitoring and evaluation practices in management of laboratory reagent stock outs in selected Regional referral hospitals in Uganda. A concurrent mixed method study

Name of the Hospital_____

Date _____

Name of reagent_____

S/N		Year 2023				Year 2024			
		Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4	Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4
1	VEN Classification								
2	In the last 24 months of 2023 and 2024, any stockout? (Yes/No)								
3	If yes, in which quarter								
4	If yes, what is the duration of stockout in days								
5	Uses of the reagent								
6	Was there an alternative to the reagent which was out of stock? (Yes/No)								
7	If yes, what was the alternative reagent								
8	Last date of delivery by NMS of reagent prior to stockout								
9	Last date of submission of order to NMS of reagent prior to stockout								

10. Reason(s) for stockout? .....
.....
.....

11. Any other comment /observation.....
.....
.....

Annex 5: MakSPH REC Approval letter

MAKERERE UNIVERSITY
P.O. Box 7072
Kampala UGANDA
Email: sphrecadmin@musph.ac.ug

Tel: +256 -414-543 872/ 031-2-263158
Fax: +256-414-531807
Website: www.sph.mak.ac.ug

COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH
Research and Ethics Committee

1st July, 2025

Ms. Sanger Daphine,
Master student, (2023/HD07/3127U)
School of Public Health, Makerere University

Re: Approval of a research proposal titled: "Assessment of M&E Practices in Management of lab Reagent Stock Outs in Selected RRFs in Uganda. A Concurrent Mixed Method Study".

Please note that your study protocol number with MakSPH-REC is **669.** Please be sure to reference this number in any correspondence with MakSPH-REC. Note that your study was first approved by the MakSPH-REC on **01/07/2025**, and therefore approval expires at every annual anniversary of this approval date. The current approval is therefore valid until **01/07/2026.**

Continued approval is conditional upon your compliance with the following requirements:

1) No other consent form(s), questionnaire and/or advertisement documents should be used. The consent form(s) must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed consent form.

2) All protocol amendments and changes to other approved documents must be submitted to MakSPH-REC and not be implemented until approved by MakSPH-REC except where necessary to eliminate apparent immediate hazards to the study subjects.

3) Significant changes to the study site and significant deviations from the research protocol and all unanticipated problems that may involve risks or affect the safety or welfare of subjects or others, or that may affect the integrity of the research must be promptly reported to MakSPH-REC.

Please complete and submit reports to MakSPH-REC as follows:

MAKERERE UNIVERSITY
SCHOOL OF PUBLIC HEALTH
APPROVED
VALID UNTIL
★ 01 JUL 2026 ★
RESEARCH & ETHICS COMMITTEE
P. O. BOX 7072, KAMPALA

a) Renewal of the study approval – complete and return the continuing Review Report – Renewal Request (Form 404A) at least 60 days prior to the expiration of the approval period. The study cannot continue until re-approved by MakSPH-REC.
b) Completion, termination, or if not renewing the project – send a final report within 90 days upon completion of the study.

Yours sincerely,

Dr. Joseph Kagaayi,
Chairperson, MakSPH- Research and Ethics Committee

MAKERERE UNIVERSITY
SCHOOL OF PUBLIC HEALTH
APPROVED
VALID UNTIL
★ 01 JUL 2026 ★
RESEARCH & ETHICS COMMITTEE
P. O. BOX 7072, KAMPALA

Annex 6: Entebbe RRH Admin. Clearance letter

Telephone lines
Hospital Director: +256414323283
Principal Hospital Administrator: +256414323271

Email: entebbereferralhospital@gmail.com

THE REPUBLIC OF UGANDA

ENTEBBE REGIONAL REFERRAL HOSPITAL
P. O. BOX 29,
ENTEBBE
UGANDA
Website: www.Entebbe Referral Hospital

In any correspondence on
This subject please quote no: ERRH/ HR/INTER/001/001/010

25th/July /2025

Ms. Sanger Daphine

Makerere University.

RE: REQUEST TO CONDUCT RESEARCH ON THE ASSESSMENTS OF MONITORING AND EVALUATION PRACTICES IN THE MANAGEMENT OF LABORATORY REAGENT STOCK OUTS IN SELECTED REGIONAL REFERRAL HOSPITALS IN UGANDA (A CONCURRENT MIXED METHOD STUDY).

Entebbe Regional Referral Hospital has granted your request to conduct the above captioned study for the period approved by Makerere University.

You will abide by the rules and regulations governing research as per the Ugandan National Council for Science and Technology

ENTEBBE REGIONAL REFERRAL HOSPITAL 29 JUL 2025 P. O. BOX 29, ENTEBBE

... .

For Dr. Nsereko Christopher
For: HOSPITAL DIRECTOR

Cc. Principal Human Resource Officer.

Annex 7: Mbale RRH Admin. Clearance letter

4. All conditions as spelled out by REC on record **MakSPH-REC must** be adhered to including the requirement to use only approved/stamped data collection tools and consent forms.

5. You shall be required to share a copy of your findings/ progress reports with **MRRH-REC,** including an end-of study report upon completion.

6. That you include **Mbale Regional Referral Hospital** in your acknowledgments and in all your publications.

Yours sincerely,

OFFICE OF THE CHAIRPERSON
APPROVED
APPROVED DATE 04 JUL 2025 EXPIRY DATE 01 JUL 2026
MBALE REGIONAL REFERRAL HOSPITAL
RESEARCH & ETHICS COMMITTEE
(MRRH- REC)

Dr.Fred Bulamba, MBchB, MMeD, cert Med Educ.
Chairperson-MRRH-REC

Thank you for submitting the above study to **Mbale Regional Referral Hospital** (MRRH- REC) for Research and Administrative clearance.

In line with MRRH-REC S.O.P # 04, I am glad to inform you that the above application, that was reviewed and approved by the **School of Public Health, Makerere University Research and Ethics Committee(MakSPH-REC),** has been granted administrative permission to be carried out within Mbale Regional Referral Hospital.

This Administrative Approval covers the dates **(04th July 2025 to 01st July 2026)** in line with **–the MakSPH-REC-approved** period.

You are responsible for fulfilling the following requirements of Administrative approval:

1. All Co-investigators and the heads of the department from where your study will be carried out must be **informed and involved** in all aspects of this research.
2. While in the Hospital, your research activities should not interfere with the day-to-day routine activities in the respective department.
3. In the conduct of your study, you are required to adhere to the Ministry of Health and the Uganda National Council of Science and Technology Guidelines for Conduct of Research, including abiding by all reporting requirements.