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EAC Regional Centre of Excellence for Vaccines, Immunization and Health Supply Chain Management (EAC RCE-VIHSCM)

EVALUATION OF THE INTEGRATION OF HEALTH SUPPLY CHAIN MANAGEMENT IN RWANDA

Thesis submitted to the University of Rwanda, in partial fulfillment of the

requirements for the degree of Masters in Health Supply Chain Management (MHSCM)

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DECLARATION

I, Theobald Habiyaremye, hereby declare that this dissertation on ‘‘**Evaluation of the integration of health supply chain Management in Rwanda**’’ is my original work and has not been presented for any degree award in any university.

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Theobald HABIYAREMYE

DEDICATION

This work is dedicated to my beloved wife Mrs. Joslyn M. KALISA and our children ISANO GASHUGI and BEZA for their love, care, understanding, endless patience and constant encouragement during this academic process.

ABSTRACT

Introduction: Well-functioning supply chain ensures quality healthcare system through continuous availability of affordable, high-quality medicines, vaccines and health products at all health service delivery points. The integrated supply chain system ensures the optimization in delivering products from the point where they are manufactured to the end user in a cost-effective way. In order to accommodate with challenging customer requirements and product proliferation, Rwanda Ministry of Health has redesigned the integration of health supply chain to profitably deal with market complexity and ultimately meet better customer service.

The aim of the research was to evaluate the integration of public health supply chain management in Rwanda. We therefore assess the followings: 1) availability of strategic and governance documents; 2) the process of integrated quantification of public health commodities; 3) the processes of procurement; 4) warehouse and distribution and 5) Logistic Management Information System.

Method: A descriptive research design study using qualitative and quantitative data. This design was found suitable, as it enabled the collection of intended data for the study. This study used purposive sampling techniques and used the questionnaire for data collection. Collected data have been manipulated and analyzed by MS excel.

Results: Findings from this study revealed that Rwanda National Pharmacy Policy, Standard Treatment Guidelines and National Formulary List and National Pharmaceutical Strategic Plan are the strategic and governance documents that guide the integrated health supply chain system in Rwanda. The process of forecasting and supply planning of public health commodities is well coordinated and integrate all product categories of HIV, Malaria, TB, FP, MCCH, Nutrition and Essential medicines. For forecasting methods, 100% of the respondents confirmed the use morbidity and consumption-based methods while 70% confirmed the use of demographic based method and 60 % the use Service statistic based method. The forecast accuracy of the tracer commodities from all program related product categories has shown that 7 selected health commodities have the forecast accuracy above 85% while one health product has a forecast accuracy of 36.83%. The procurement of health products integrates all health product categories and are procured by MPPD and other implementing partners. 100% of health products from different sources are stored in central medical store/MPPD. LMIS system is integrated to ensure end to end data visibility across all levels of supply chain system.

Conclusion: From the results of the study, Rwanda Ministry of Health has adopted the integration of health supply chain management. However, fully integration requires further improvement especially for the procurement process and the integration of vaccines.

ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
CPDS	Coordinated Procurement and Distribution System
DH	District Hospital
DP	District Pharmacy
e-LMIS	Electronic Logistic Management Information System
EM	Essential Medicines
GHSC-PSM	Global Health Supply Chain Procurement Supply Management
HC	Health Facility(ies)
HMIS	Health Management Information System
HSCM	Health Supply Chain Management
KPIs	Key performance indicators
IT	Information Technology
LMIS	Logistic Management Information System
LMU	Logistic Management Unit
MOH	Ministry of Health
NGOs	Non-governmental organizations
R&R	Report and Requisition
SDPs	Service Delivery Point
SPSS	Statistical Package for Social Sciences
USAID	United States for Agencies International Development
WHO	World Health Organization

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SIGNATURES

This is to certify that this Dissertation has passed through the antiplagiarism system and found compliant and this is the approved final version of the Dissertation.

EVALUATION OF THE INTEGRATION OF HEALTH SUPPLY CHAIN MANAGEMENT IN RWANDA

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CHAPTER ONE: INTRODUCTION

Effective “supply chain management consists of set of activities to ensure that the right product is delivered to the customer in the right quantities and at the right time”(1). It contributes to the improvement of operations and ensure clients satisfaction (2). Well-functioning supply chain ensures continuous availability of high-quality pharmaceuticals at the last mile(3). Integration of the supply system includes “organizations, staff, process, IT innovation, activities, information, and resources” required to ensure the delivery of the product from the manufacturer to the last mile(4).

Supply chain management has been on pressure related to the increased number of products and programs with the increased patients to be managed. To consistently optimize this “variety of products and customer considerations, Ministries of Health manage them within a well-defined essential medicines” supply system(5).

“Public health supply chains were established to integrate various standalone innovations in integrating program related supply chains in order to improve performance, reduce redundancies, for increased efficiencies”. This strategy provides the basis to “optimize and coordinate various initiatives to be able to adapt to changes due to new products, new initiatives, changing demographics to ensure the effectiveness of the entire system. In order to accommodate with changes, Ministry of Health has worked on the integration of its supply chain to optimize its supply chain system”(6).

This journey was undertaken since 2008 to integrate “all supply chain functions in terms of policy and governance, forecasting and supply planning, procurement, warehouse and distribution, logistic management information system”. It has gradually implemented the integrated coordinated procurement and distribution system(CPDS) that coordinates and efficiently manages available resources with an aim to reach a streamlined integration and harmonization of program supply chain practices, and attain improved quantification, procurement, supply plan monitoring, storage and inventory management controls of public health commodities(7).

1.1. Definition of the key concepts

1.1.1. Essential medicines

Essential medicines are those that satisfy the priority of health care requirements of the citizens. They are intended to be available within the context of functioning health systems at all times in

adequate amounts, in the appropriate dosage forms, with assured quality and adequate information, and at a price the individual and the community can afford. The implementation of the concept of essential medicines is intended to be flexible and adaptable to many different situations; exactly which medicines are regarded as essential remains a national responsibility (WHO 2002).

1.1.2. Health Supply chain integration

Supply chain integration means framework that interconnect different levels, organizations, and functions of supply chain to ensure maximized the customer service needs. In healthcare, this is simply used to mean the merging of supply functions processes of standalone programs or product categories(8).

1.1.3. Commodity security

Commodity security refers to the satisfaction of clients when they can obtain and use essential health commodities when they need them (9).

1.1.4. Integration of health product Procurement processes

Improving access to essential medicines and health products is essential to achieving universal health coverage and is recognized as an essential element of a health system. The integration of procurement processes contributes to the ability of health system to respond to the health-care needs of the general population and ensures efficiency and value for money (10).

1.1.5. Integration of health product warehousing and distribution processes

After an item has been procured, its physical management, through various levels of an in-country supply chain, must be carried out in a structured way to ensure that it will be protected from harmful environmental conditions or handling and is available, accessible, and in good condition while posing no risk of injury to workers. To meet this requirement a combination of interventions requiring both physical infrastructure and structured procedures must be maintained.

Distribution is a key activity in the integrated supply-chain management of pharmaceutical products. Effective pharmaceutical distribution relies on good system design and good management system that continuously avail pharmaceutical products categories, distribute the products in good environment along the distribution process, maintain accurate inventory system and use transportation resources efficiently(11).

1.1.6. Integration of Logistic Management Information (LMIS) system processes

LMIS is the system of physical- and technology-based records and reports that supply chain workers and managers use to collect, compile, present and use logistics data gathered across all levels of the system. An effective integrated LMIS depends on the right combination of people, processes, and technology. Skilled people must record, analyze, manage, and use supply chain data at every level. The integrated LMIS must enable efficient business processes and workflows of forecasting, inventory management, distribution planning, reporting and ordering, order fulfillment, temperature monitoring, equipment maintenance, performance monitoring, etc. and incorporate routine data management processes. And the LMIS must leverage appropriate technology that is feasible to deploy and sustain, and is embraced by users at each level(12). The automation of LMIS ensures end to end data visibility across all levels of supply chain from central level up to the service delivery points (13).

1.1.7. Coordinated Procurement and Distribution System (CPDS)

The Coordinated Procurement and Distribution System (CPDS) is a government mechanism that was put in place to coordinate available resources with purpose to reach an integration and of public health program related supply chain practices, in line to improve quantification, procurement, supply plan monitoring, inventory management of public health commodities and distribution of HIV, TB, Malaria, Family Planning and other essential health commodities(7).

1.2. Problem Statement

An integrated system is made up of a network that includes companies, different involved people that strive together to make sure that health commodities are available to the population. This network of actors is embedded in a country's health system at all levels of the system at central medical store, districts pharmacies, health facilities and communities to guide on the integration of supply chain processes. This integrated supply chain links all stakeholders involved in managing essential health commodities into one cohesive supply chain management framework to reach health commodities to the last mile(14).

In Nicaragua, the Ministry of Health has institutionalized supply chain management and manages products through an integrated supply chain. Recognize the need for a group of health supply chain managers who can make quality products available to clients and make all product management decisions from regional to delivery points Services(15). In Zimbabwe, integration has helped companies learn to provide their customers with good quality products in an efficient, timely and

secure manner. These. improvements have resulted in increased profits, more viable businesses, and better customer service With the right approach, integrated supply chains can be as transformative in the public health sector as in the commercial sector, offering greater coverage, better use of resources and better quality of care(14).

After the design of the system in 2005, Tanzania moved to an integrated logistics system to include most vertical programs and essential drugs in the same system, and to associate routine reporting with routine replenishment, which improves accountability. and provides data centrally. In the integrated logistics system, clinics, health centers and hospitals order quantities of each product according to their needs and budget. The integrated logistics system was designed to facilitate supervision, clarify roles and responsibilities, streamline processes by reducing the number of reporting and replenishment forms required, improve data visibility by strengthening data collection and strengthening relations between the different levels and actors of the system(16).

From 2004, Rwanda has started to integrate supply chain process by putting in place a coordinated procurement and distribution(CPDS) system as a "mechanism to coordinate and optimize available resources in the supply chain from all involved partners in order to create a common basket fund for the procurement of health commodities including but not limited to ARVs, laboratory reagents, test kits, laboratory consumables, laboratory equipment, nutrition commodities as well as other essential medicines" procured, stored and distributed through a centralized and coordinated mechanism. The advantage of this system includes:

• Improvement of management in the simplification of the health product purchasing process to ensure the timely delivery of quality products, the optimization of storage space and the minimization of costs related to their management;

• optimization of human and financial resources at different levels of the system;

• Harmonization of health product management procedures at all levels

• Improved quality of purchased health products

• Improved health product management: All purchased products, whether purchased by the central medical store or various partners, are shipped to the central medical store for storage and distribution to health facilities.This optimization included specific area like quantification and supply planning, procurement, storage, inventory control system and distribution(17).

This coordination mechanism has shown great value in the management of health commodities and in the increase of the availability of health commodities to all. Obviously, CPDS mechanism has contributed to the reduction of commodities cost and effective management through improved partner's collaboration(17).

In 2011, Ministry of Health in collaboration with its partners harmonized the LMIS tools and in 2012, started the automation of electronic Logistic Management Information System and this innovation reached all public health facilities were using electronic logistic management information system from 2014(18).

From the lesson learnt from CPDS, all health product categories from public health programs and essential medicines were integrated and the quantification of national commodity requirement is conduct on annual basis with the scope that focus all health products needed in the country(7).

Although Rwanda has established the integration of healthcare supply chains, health system continues to face some shortage and risk of expiries for some essential health products. A structured evaluation of public health supply chain integration processes is needed to assess the as is of the current integration and its contribution to the system.

1.3. Justification of the study

The Rwanda Ministry of Health established the integration of public health "supply chain functions to improve the effectiveness of regulatory policies and procedures, forecasting and supply planning, inventory monitoring, purchasing, inventory control and inventory, distribution and logistics management information system". This integration aimed to link "all actors involved in the management of public health products into a coherent supply chain management organization". People managing supply chains need product, cost and customer data to generate the information needed to make decisions and optimize the performance of all functions, levels and partners of the supply chain. An integrated approach to the management of the public health supply chain takes into account the entire system, rather than examining different functions. Integration provides a more cost-effective, agile and reliable supply chain that contributes to better outcomes, such as reducing out-of-stock rates, affordability with quality and cost-effectiveness. Understanding the processes that the Ministry of Health of Rwanda has undertaken to integrate components of the health supply chain requires conducting the evaluation study of the integration of the supply chain management in Rwanda.

1.4. Research Questions

This research intends to respond to the following questions:

1. What is the governance policy, strategic and guidelines of the integrated health supply chain system?
2. What are the processes and performance of integrated quantification of health

commodities?

3. What are the processes and performance of procurement of health commodities?
4. What are the processes followed for warehousing and distribution of health commodities?
5. What are the processes followed for logistic management information system for health commodities?

1.5. Objectives

1.5.1. General objective

The overall objective of this study was to “evaluate the status of integration of public health supply chain functions in Rwanda”.

1.5.2. Specific objectives

1. To assess “public health supply chain Strategic Planning, policy and governance of health supply chain management”;
2. To analyze the process of integrated quantification of public health commodities;
3. To analyze the processes of integrated procurement of health products
4. To analyze the processes of warehousing and distribution of health products
5. To analyze the processes of integration of Management Information Systems,

CHAPTER TWO: LITERATURE REVIEW

2.1. Overview the topic

“A strong health system is reinforced by a well-designed supply chain management system that can guarantee the safety of health products”. “With large-scale investments in health programs and expanding services in line with population growth, supply chains need to be flexible and responsive in this changing environment”. At the same time, donors and policymakers are looking for responsibility for each link in the supply chain and improvements that can be sustained without funding indefinitely(19).

Supply chain integration is an essential part of supply chain strategy and it is defined by Frohlich and Westbrook as "a set of activities that manufacturers use to integrate their internal processes into suppliers and customers "(20). Another study by Flynn et al. emphasizes on the importance of supply chain integration, as "the degree of strategic collaboration of a manufacturer between supply chain partners and collaborative management of intra and inter -organizational processes" , which is also applicable to any other supply chain institution in order to achieve efficient and

profitable process flows, products and services, information, money and decisions, to provide maximum value to the customer, at low cost and high speed. Building on the existing literature on the concept of supply chain integration, supply chain integration is classified into three categories: internal integration, customer integration and vendor integration(21).

Flynn et al. demonstrate the importance of internal integration within an organization to improve the operational and business performance of an organization. In line with this study, the coordinated procurement and distribution country mechanism emphasizes on the importance of coordinating supply chain activities as an integrated approach that involve all stakeholders, GoR and implementing partners for successful implementation of supply chain management(7).

It is believed that the integration of systems into an organization should always lead to a more efficient and will improved operational performance, internal management methods and cross-functional teamwork, increased customer confidence, and reduced costs. In this chapter, we will discuss the processes and performance associated with integrating the health supply chain, gaps and mitigation strategies. “Supply chains must meet the demand for essential health products in all sectors and operate at every level of the system”(19).

In strong health systems, supply chains meet the requirements and objectives dictated by the large public health institution, the operational context and the society in which these supply chains operate in “identifying appropriate solutions at the local level, strengthening local organizations, maximizing the efficient use of resources and improving the quality of life. availability of resources. basic products”. A coherent and effective public health supply chain helps lay the foundation for a “successful pharmaceutical management system, provide the information needed to manage health programs and funding mechanisms and ensure the level of accountability”(19).

“The integration of actors, levels and functions in the supply chain has the overall goal of improving supply chain processes and customer service for public health products. Integration is an approach that recognizes the dynamic elements of a system and the interconnection of different characteristics”(22).

2.2. Policy and governance

2.2.1. National Medicine Policy

National Medicine Policy(NMP) highlights the Ministry's commitment to align with the country's vision to ensure the safety, efficacy and effectiveness of health products from manufacturers to end-users.(23). This governance strategy covers various interventions required in terms of

partnership and coordination, quality assurance, legislation and regulation, selection, purchase, storage and distribution of integrated health product categories. The research conducted by Joelle M Hoebert and all on the review of developments and development processes of national drug policies have highlighted the concern of all countries to develop the NPM in collaboration with their partners in order to define the strategies required to cope with the continuous supply of drugs. quality and affordable medicines for their population(24).

2.2.2. Standard Treatment Guidelines and National Essential Medicine List

Treatment guidelines are designed to help health professionals make decisions about appropriate and effective patient care. However, designers and those responsible for implementing the guidelines often do not meet high quality standards. The goal of standard treatment guidelines is to promote standards of practice and to improve the quality of health care(25).

Policies, laws and regulations lay the groundwork for the functioning of the pharmaceutical system and play a vital role in promoting the effectiveness, efficiency and safety of patients. Essential drugs are those that "meet the priority health care needs of the population" and should be selected on the basis of public health needs, disease prevalence, safety and clinical effectiveness and cost comparison. To ensure the effectiveness, safety and cost-effectiveness of essential medicines and products and to minimize undue influence and inconsistencies, decision-making must be guided by clearly defined criteria and based on sound and unbiased evidence. The criteria used to select these pharmaceuticals should be derived from in-depth discussion and acceptance by a multidisciplinary panel of experts. Selection panel experts can interpret data and assess the safety of drugs in their area of expertise. Once agreed, clearly defined criteria must be published and potential conflicts of interest declared and managed by members.

The process of selecting drugs on a national, sub-national or institutional list of essential drugs therefore requires the application of strict governance practices. Developing a structure for the drug selection committee that ensures accountability and delineates authority is essential for engaging key stakeholders and management resources. In addition, ensuring transparency helps protect the conflict of interest selection process(26).

2.2.3. National Pharmaceutical Strategic Plan

A number of actors involved in the national drug strategy have been working on the vision of good drug use for the benefit of the patient. A National Strategic Plan for the Pharmaceutical Sector (NPSSP) has been developed to support the implementation of the National Drug Policy. The

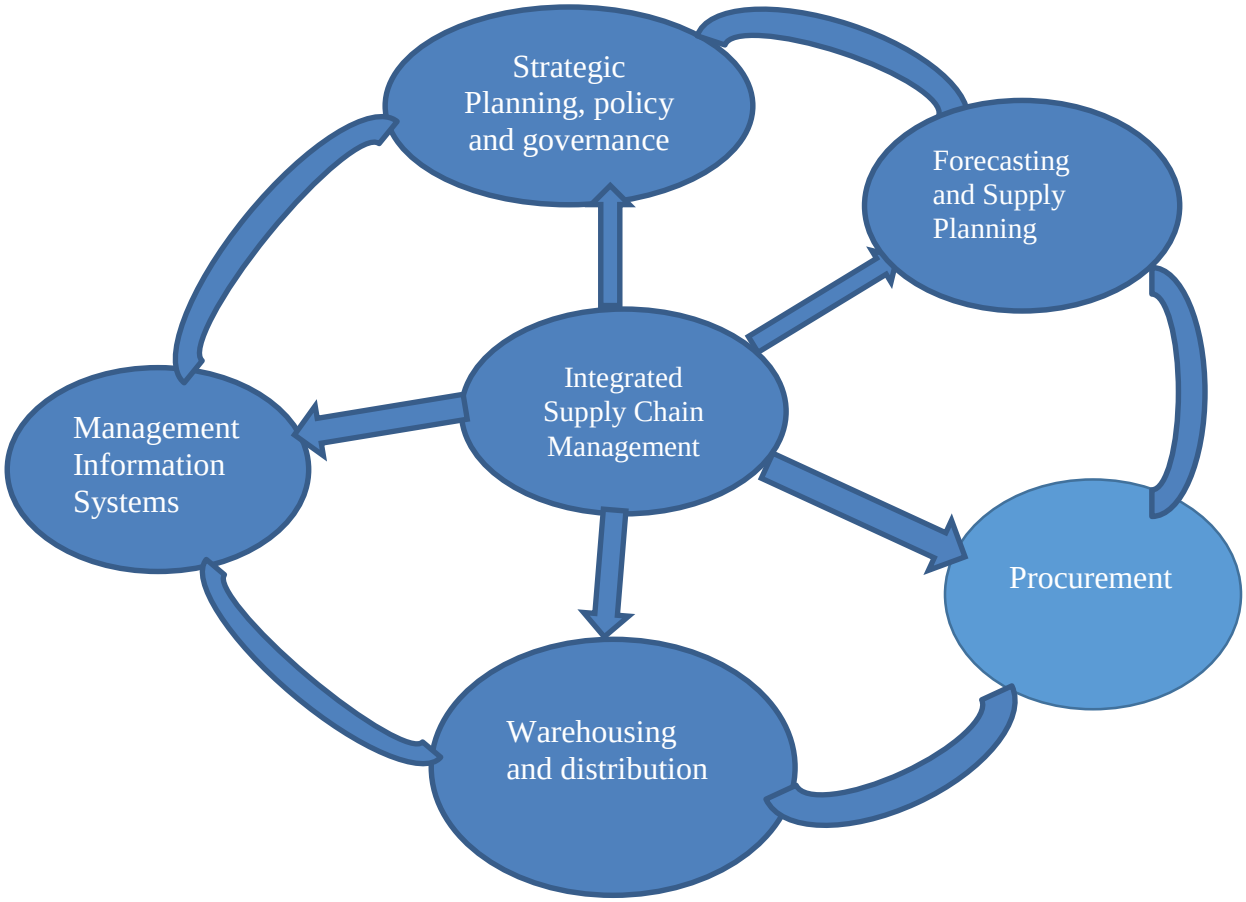
NPSSP development process requires extensive consultations with various stakeholders. In the coming strategic period, the health sector intends to expand health services with a view to progressively achieving universal health coverage with essential services, using primary health care(27). Rwanda National Pharmaceutical Sector Strategic Plan 2018-2024 is in line with the National Pharmaceutical Policy, 2016 and serves as the overall implementation plan for improving pharmaceutical in the public and private sectors of Rwanda(28).

2.3. Integrated forecasting and supply planning

The quantification exercise takes place every year and is initiated by technical coordination. The forecasts cover two to three years and include a one-year supply plan for all public health products. The Quantification Committee is responsible for the entire process, from data collection to final results presentation to the RMC. During the forecast exercise, several forecasting methods are used and the results are compared to each other to obtain the strongest representation of future consumption. Active participation and involvement of CPDS programs is essential. Program Managers must facilitate and provide appropriate support to their respective staff, allowing them to attend the various activities of the Quantification Committee and inform the strategic direction.(7). The Quantification Committee has a chair who oversees the quantification process from data collection to report writing and submission for all program products. The chairman of the control committee will be the technical coordinator of the CPDS. The QC is composed of subcommittees chaired by their respective program managers. The RMF provides all approved procurement plans to procuring entities to initiate the procurement process. The allocation of funds between the GOR and development partners should be based on specific program agreements. All donations must be communicated prior to planning to facilitate incorporation into approved procurement plans. All purchases begin after the completion of the national quantification exercise and are based on regulations in force in national and international markets.(7).

2.4. Conceptual framework

"As shown in the figure below related to the conceptual framework of our study, supply chain management processes include the supply chain function cycle below, which links all functions of the supply chain".



CHAPTER THREE: MATERIAL AND METHODS

3.1. Study location

The study was done at central level at MoH, Central medical store, Public health programs and implementing partners that are most involved in public health supply chain operations.

3.2. Study Design

A descriptive research design study using qualitative and quantitative data was conducted. "The design of the study guided the process of data collection, analysis and interpretation of the results".

3.3. Analysis Plan

Each objective had corresponding responses from the participants of the study. After collecting data with target respondents, the data entry and analysis was done using MS Excel.

3.4. Study Population

In order to achieve the objectives of this study, the participants to the study were selected in Ministry of Health, RBC Divisions: HIV Division, TB Division, Malaria Division, MCCH Division, National Reference Laboratory Division, Non-Communicable Diseases Division, Medical Procurement and Production Divisions and implementing partners' staff.

The identification and recruitment criteria of potential participants in the study were based on their role in health supply chain management.

- Medical supply chain coordination in Ministry of Health: Medical supply chain coordination officer is the staff who coordinate and oversight health supply chain system.
- Health supply chain senior officers in HIV, TB, Malaria and MCCH Public Health Programs are monitoring supply chain activities for their respective public health programs to ensure that the required level of stock is maintained. They are the key staff that play a big role in the planning of country integrated commodity requirements.
- Staff from MPPD are involved in the implementation of different supply chain operations from the planning, procurement, storage and distribution

Quantification unit: The selected staff for quantification unit are involved in the integrated quantification team that plans country needs in health commodities, they regularly make aggregation of needs and compile them to elaborate a procurement plan.

Procurement Unit: The selected staff are involved in the implementation of the procurement plan and ensure that the procurement process is followed.

Warehouse Unit: Selected warehouse staff conduct all transactions of replenishment, picking, packing and dispatching health commodities.

- Staff from implementing partners are part of the integrated team that ensure supply chain system strengthening and commodity security.

3.5. Sample size

The table below indicates the distribution of study participants in institutions.

Table 1: Distribution of study population

Institutions of Target	**Population Size**	**Selected informants**	**sample size (%)**
MOH	2	1	4.00%
RBC Divisions	6	5	20.00%

MPPD	30	14	56.00%
UNFPA	2	1	4.00%
GHSC-PSM	6	4	16.00%
Total	**46**	**25**	**100.00%**

3.6. Sampling technique

This study used purposive sampling that method targets the staff from central level institutions that are involved in supply chain strategic planning and operations at Ministry of Health, RBC/HIV, RBC/TB, RBC/Malaria and RBC/TB Divisions, RBC/MCCH, RBC/NCD, RBC/NRL, Medical Procurement and Production Division and Global Health Supply Chain-Procurement and Supply Management Project as implementing partner and UNFPA.

3.7. Inclusion and exclusion criteria

3.7.1. Inclusion criteria

The study involved health institutions that were involved in the health supply chain management in Rwanda. The key informants were the staff working in the mentioned institutions who are involved in real time supply chain oversight and operations from MOH, MPPD, Rwanda Biomedical Center Divisions: HIV/AIDS & STIs, OBBI Division, TB & other respiratory diseases Division, Malaria and Other Parasitic Diseases Division and MCCH Divisions.

3.7.2. Exclusion criteria

The study was not conducted at District and Service Delivery point level due to the limited time and a separate study can be conducted at the intermediary and health facility level.

3.8. Material

3.8.1. Data Collection Techniques and instruments

The data collection questionnaire was used to guide data collection and analysis. The questionnaire was used to evaluate the integration and performance of supply chain functions at central level.

Table 2: Supply chain function evaluated by institution

#	SC FUNCTIONS ASSESSED	MOH	MPPD	HIV	TB	Malaria	MCCH	GHSC-PSM	UNFPA
1	Strategic, policy and governance	√	√	√	√	√	√	√	√
2	Forecasting and Supply Planning	√	√	√	√	√	√	√	√
3	Procurement		√					√	√
4	Warehousing and distribution		√						
5	Logistics Management Information	√	√	√	√	√	√	√	√

Key Performance Indicator tool was also used to assess the performance of integrated health supply chain. Data that were collected cover for the fiscal year 18/19. Eight tracer commodities were used for KPI calculation throughout this evaluation and were selected from all product categories.

Table 3: List of tracer health commodities

	PRODUCT NAME	DOSAGE	PRODUCT CATEGORY
1.	TDF+3TC+EFV	300/300/600mg	ARV
2.	Cobas Taqman HIV-1 Tests	V2.0/HI2CAP 48T	Viral Load test
3.	Medroxyprogesterone (Depo-Provera)	150mg/ml	Family planning
4.	Coartem 6x4	20/120mg	Anti-Malarial
5.	RHZE	150/75/400/275MG	TB

6.	Insuline lente	100UI/ML	Essential medicine
7.	Insuline rapide	100UI/ML	Essential medicine
8.	Hydrochlorthiazide	25mg	Essential medicine

3.9. Data Analysis

After collecting data with target respondents, the data entry was done and analyzed using MS Excel.

3.10. Ethical Considerations

Ethical considerations were considered to ensure that the research was conducted according to the requirements. The confidentiality was respected, and all data were collected with consent agreement of the informants. Analysis of the data was presented in a way that excludes the possibility of the identification of individuals. The approval of ethical clearance was issued by the university though Institutional Review Board and National Health Research Committee and the copies are in annex.

CHAPTER FOUR: RESULTS

4.1. Introduction

Findings from the completion of the study are outlined below. Overall, data were collected from 8 offices at central level.

Results are detailed for each supply chain function evaluated and within each function, the findings on each function are presented first; where relevant, Key Performance Indicators (KPIs) are included in the results. Discussion and recommendations specific to that module or service level follow the presentation of findings.

4.2. Availability of strategic and governance documents

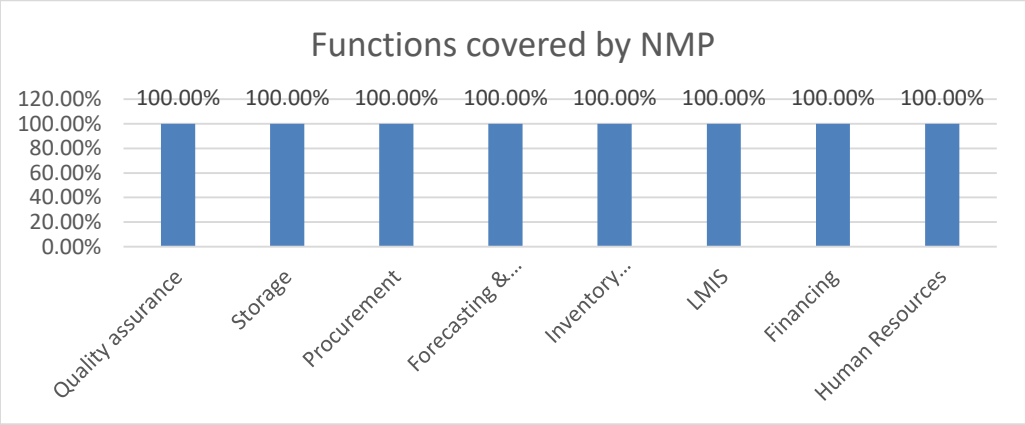
4.2.1. Availability of National Medicine Policy

Rwanda National Pharmacy Policy exists from 2015 as political commitment with the aim to improve and sustain, within the available resources, the health of the population of Rwanda by

treating, curing, reducing or preventing disease conditions through the use of safe, effective, good quality, affordable medicines in both public and private sector. It provides directions on organization and management of pharmaceutical sector to ensure policy, regulation and availability of health commodities and technologies are provided. It provides insight on the partnership and coordination of stakeholders at national, regional and international level.

It gives the area of integrated interventions on quality assurance, legislation, regulation and procurement, storage and distribution of health commodities(23). This was also 100% of respondents have reported that the national pharmacy policy provides commitment to different functions of supply chain as illustrated in the below figure.

Figure 1: Functions covered by NMP



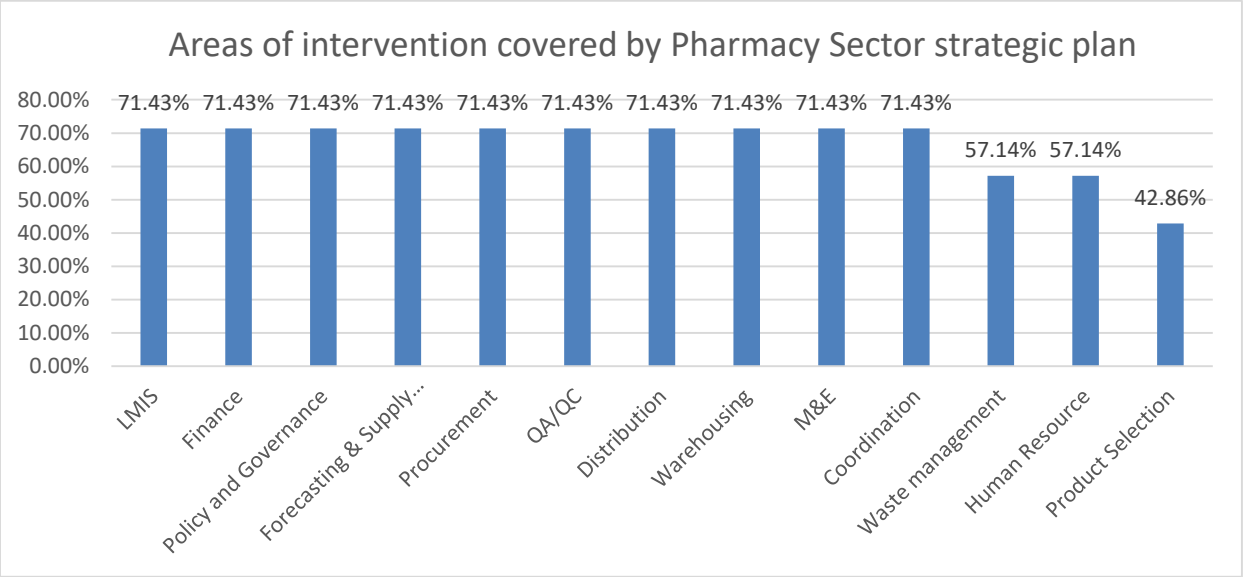
4.2.2. Standard Treatment Guidelines and National Formulary List

Treatment guidelines are available. They are diseases oriented and reflect a consensus on the treatment for a range of medical conditions and help to promote rational medicine use. The latest version was developed in 2012 although respondents confirmed the review period of 2 years(29)(30).

4.2.3. National Pharmaceutical Strategic Plan

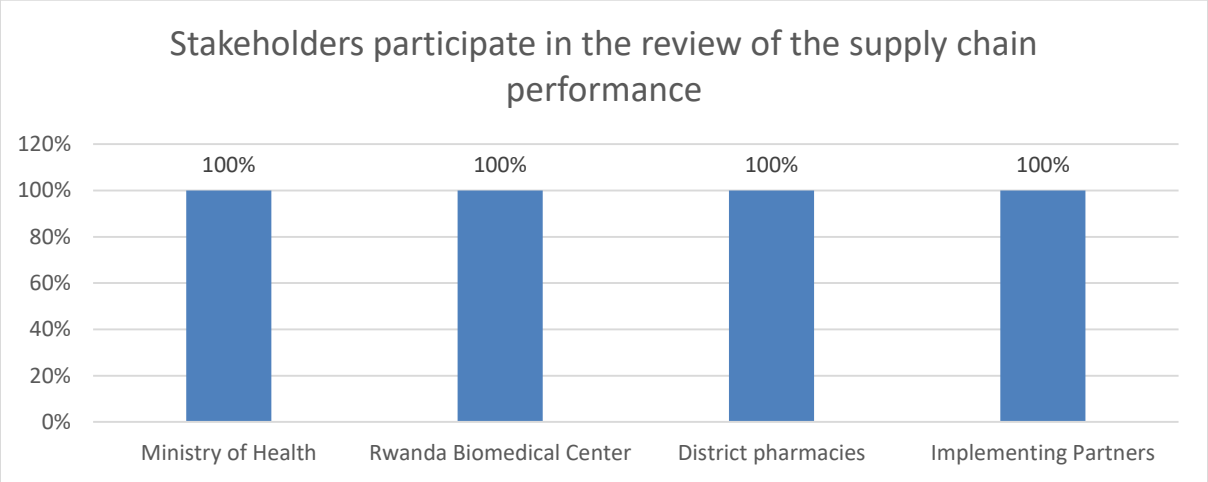
The National Pharmaceutical Strategic Plan (NPSP) which sets the strategies to improve supply chain management is available and align to the Health Sector Strategic Plan to ensure the availability of safe and quality health commodities(28)(31). The figure below shows the feedback from respondents on the area of interventions covered in the pharmacy sector strategic plan.

Figure 2: Area of intervention of pharmaceutical strategic plan



4.2.4. Stakeholders involved in implementation of Health Supply chain

Figure 3: stakeholders participate in the review of the integrated supply chain performance



To responsibly provide an uninterrupted supply of quality medicines to its health facilities, the MOH still needs the assistance of its national and international partners. “The MOH acknowledges the invaluable cooperation and participation of its partners in this area and believes that the establishment of a system reflective of good governance of which transparency, accountability, and efficiency are cornerstones to better facilitate the management of partner contributions and in-country resources for optimal support and service to the people of Rwanda”. The implementation of CPDS mechanism mitigates problems such as duplication of resources, irrational use of medicines, a lack of essential medicines and overestimated and unplanned quantities of medicines

which result in expiration. The establishment of the CPDS governance enabled the MOH to ensure accessibility of essential medicines to the population. This coordination mechanism gather all involved stakeholders to participate in the "planning of health commodity requirements, procurement, distribution and implementation monitoring"(7).

4.3. Analysis of the process of integrated quantification of public health commodities

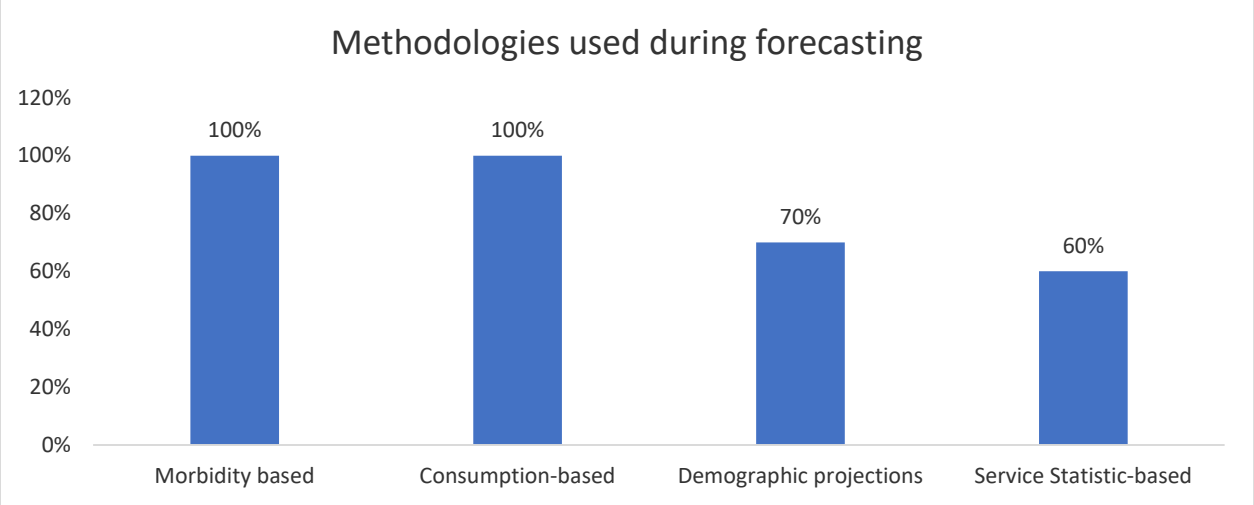
4.3.1. Forecasting Structure

The process of quantification uses an integrated approach that gather many stakeholders from public institutions, Private, donors and implementing partners. The quantification exercise is conducted on annual basis by an integrated quantification team composed of staff from above mentioned institutions and approved by the Resource Management committee which is a high decision making organ of the Coordinated Procurement and Distribution System(7). The scope of quantification includes HIV, Malaria, TB, FP, MCCH, Nutrition and Essential medicines managed through the Public supply chain system in Rwanda(32).

4.3.2. Forecasting Methodology

The respondents to this section response on the methodology used for forecasting, 100% reported to use morbidity and consumption-based methods while 70% report the use of demographic based method and 60 % report the of Service statistic based method.

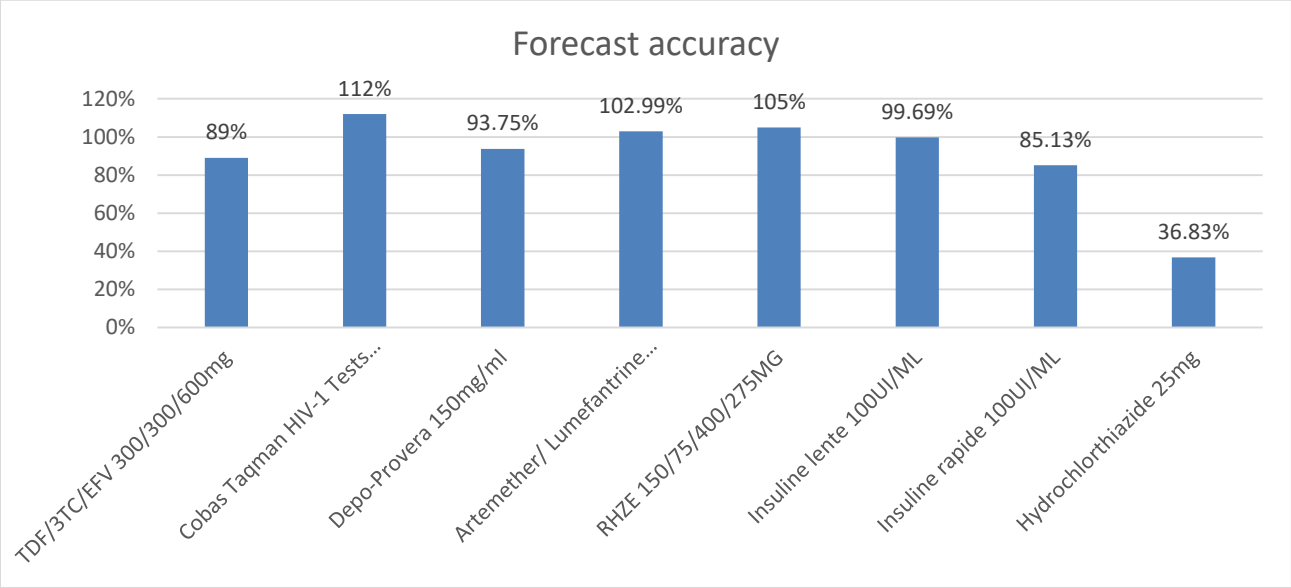
Figure 4: Forecasting Methodology used



4.3.3. Forecast accuracy

Using the tracer commodities of 8 selected medicines from all product categories

Figure 5: Forecast accuracy

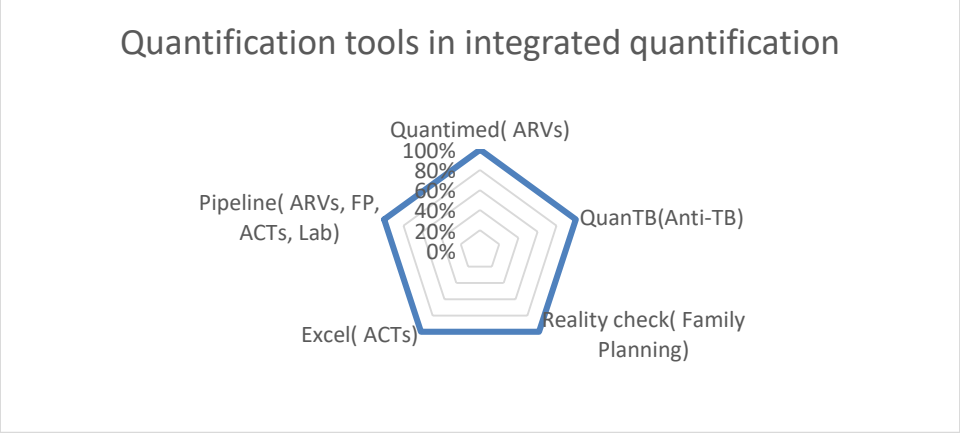


The forecast accuracy of the tracer commodities from all program related product categories are good. 7 selected health commodities have the forecast accuracy above 85% while one health product has a forecast accuracy of 36.83%.

4.3.4. Hardware and Software Forecasting

The integrated quantification has appropriate tools used for forecasting& supply planning

Figure 6: Quantification tools in integrated quantification



As shown on the above figure, the quantification team use 5 quantification tools to quantify the country commodity requirements.

4.4. Analysis of the processes of integrated procurement

4.4.1. Procurement control

The results on table 4 show that the procurement of health products is done by the central medical store, Medical Procurement and Production Division(MPPD), USAID/GHSC-PSM Project, UNFPA and UNICEF. MPPD does the procurement of health products funded by the Government of Rwanda and the part of health commodities that are funded by the partners are procured by implementing partners and UN agencies. The procurement practice is regulated by Rwanda Public Procurement Authority and governed by the law N°62/2018 of 25/08/2018 governing public procurement(33).

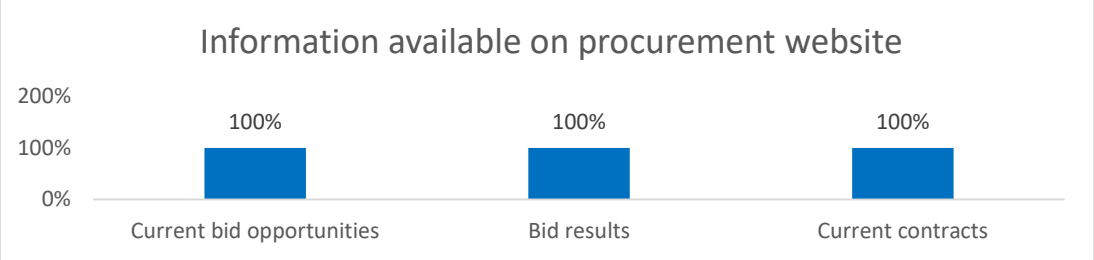
Table 4: Procurement entities and scope

Institutions	**HIV**	**TB**	**Malaria**	**Family Planning**	**Nutrition**	**Vaccines**	**Essential medicines**
Central medical store (MPPD)	√	√	√	√	√		√
USAID/GHSC-PSM	√		√	√			
UNFPA				√			
UNICEF					√	√	

4.4.2. Identification and Qualification of Vendors

The results of this evaluation show that the procurement follow the process of identification and qualification of bidders. Using the electronic procurement, procurement information is maintained in a database and accessible to the external stakeholders. The figure below shows that the respondents on information that are accessible to e-procurement website. 100% of respondents confermed that 3 category of information is available on e-Procurement

Figure 7: Information available on procurement website



4.4.3. Fair competition and Vendor Performance Evaluation

As shown in the table below, Fair competition and performance evaluation are followed and this is reference to the law governing public procurement in its article 30 on tender document

requirement on required information to allow fair competition. Terms and conditions clauses that guide the contract management are included in the tenders. Criteria and processes to evaluate the vendor performance are in place to ensure the transparent fair competition and cost effectiveness. Notification are sent to both successful and unsuccessful bidders.

4.5. Integration of the warehouse and distribution of health commodities

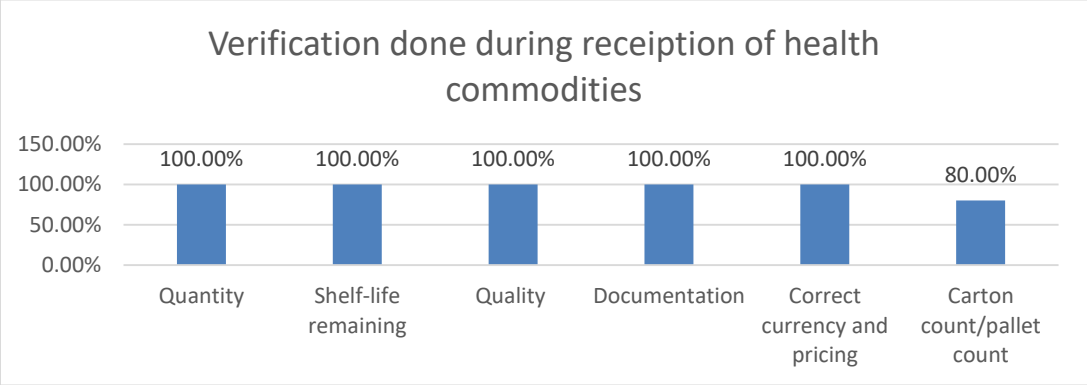
4.5.1. Warehousing Standard Operating Procedures

Standard operating procedures (SOPs) for Warehousing & Storage are available at the central medical and are reviewed on regular basis. This include integrated storage internal processes that guide on the storage of all health products stored in the central medical store(34).

4.5.2. Commodity Reception

When the commodities are received in medical warehouse, the respondent confirm to perform check to ensure that the delivery is compliant to the norms. The approach is the same for all health product categories received within the central medical store.

Figure 8: Verification done before the reception of the shipment



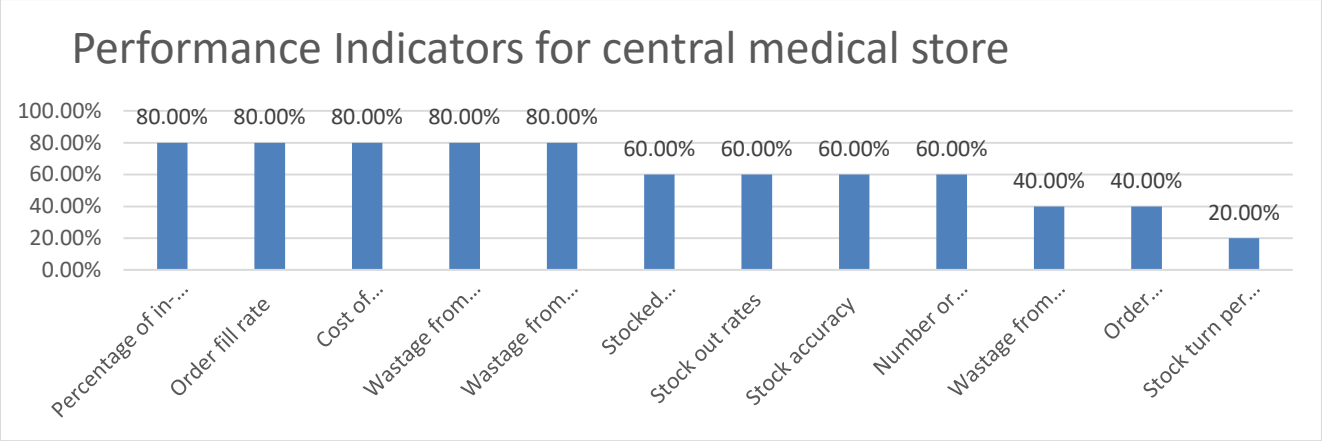
4.5.3. Central medical store organization

100% of respondents agree that all products from different sources are stored in same location and use same procedures. Products from different programs are not segregated and stored in specific programs' or implementing partner's Central medical store, they are all stored in central medical store.

4.5.4. Central medical store Performance

The respondents informed on the performance indicators that are monitored to ensure the availability of health commodities in central medical store.

Figure 9: Performance Indicators for central medical store

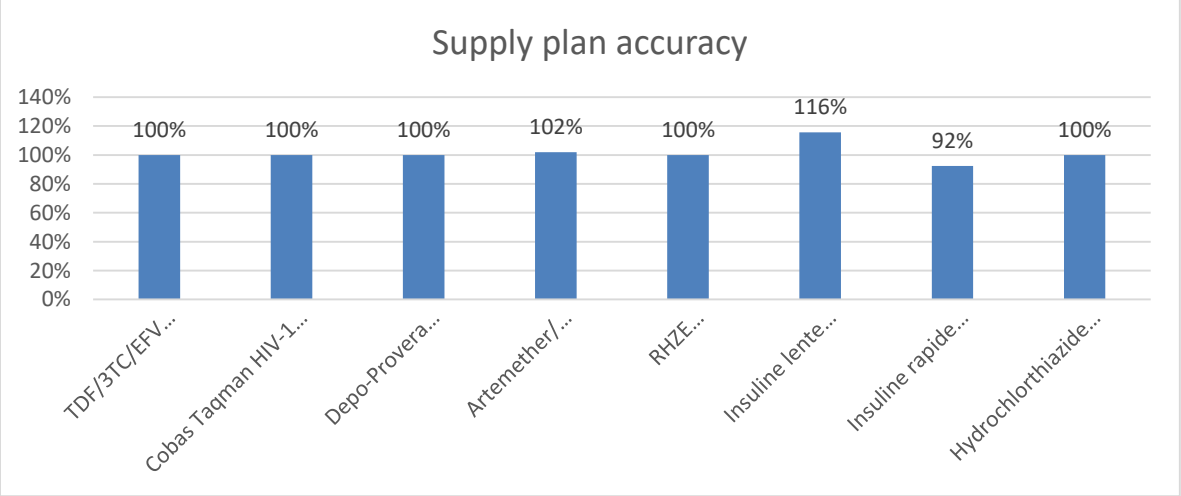


From the above figure, 80% of the respondents reported to monitor the supply chain performance by measuring order fill rate, the less % is the stock turn per annum equivalent to 20%.

4.5.5. Supply plan accuracy

Using the list of tracer commodities, the calculation of supply plan accuracy was done and the figure below show the supply plan accuracy for the period of FY 18/19.

Figure 10: Supply plan accuracy



The supply plan accuracy of the tracer commodities from all program related product categories is ranging between 92% for insulin rapide and 116% for insulin lente when comparing the planned quantities with the quantities received in the warehouse.

4.5.6. Distribution planning

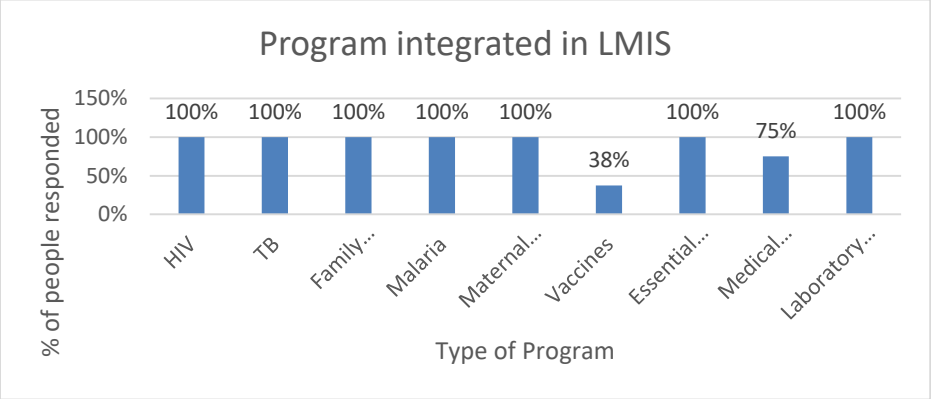
Distribution plans are approved, and distribution plans and operations are captured in data management system. Products from different programs are distributed in an integrated manner(34).

4.6. Logistic Management Information System

LMIS tools are standardized at all levels of the supply chain. The system covers all programs, as

the respondents confirm in the graph below. e-LMIS is a recording and reporting system used to group, analyze, validate and display the data used to make logistics decisions and manage the supply chain. E-LMIS data elements include available inventory, losses and adjustments, consumption, demand, issues, shipment status, and product costs managed in the system(35).

Figure 11: Program integrated in e-LMIS



CHAPTER FIVE: DISCUSSION

5.1. Availability of strategic and governance documents

In this study, it was found that the strategic and governance document on policy of pharmaceutical sector are available. According to WHO, national medicine policy (NMP) is a "political commitment and a guide for action that shows how the government ensure that efficacious and safe medicines of good quality are affordable and accessible"(36). Currently Rwanda has customized this recommendation from WHO and is implementing National Pharmacy Policy Since 2016. Standard Treatment Guidelines and essential medicine list are available and help to standardize and optimize patient care and help to simplify medicine supply and treatment decisions. However the two governance documents are not regularly updated(37).

National Pharmaceutical Sector Strategic Plan is available and aligned to Health Sector Strategic Plan especially in integrated approaches for development of pharmaceutical industry plants for production of medical products, devices and commodities and also research (clinical trial & drugs development) on emerging superbugs and by implementing both strategies sustainable availability of essential medicines(pharmaceuticals, vaccines and blood components) and will reinforce food and medicines regulations.

5.2. Analysis of the process of integrated quantification of health commodities

The process of quantification is integrated from the planning of country commodity requirements for all program related product categories. The involved team is multidisciplinary and belongs to many institutions who are stakeholders of Ministry of Health in Supply chain.

The quantification team use different methods while forecasting and the choice of the method used reflects the product category to be forecasted.

The forecast accuracy is calculated to ensure that the forecast is closer to the actual consumption. The quantification uses appropriate/standard tools to come up with the country needs in health commodity requirements(32).

5.3. Analysis of the processes of integrated procurement for health products

procurement of health products is scattered by different procurement entities using different procurement regulations. However, the public procurement law state to the public procurement entity to follow the partner guidelines when is doing procurement that is in line with the bilateral agreement done with donors(33)(38). Central medical store is only using the public procurement law for all activities, SoPs on the management of procurement process might bring an added value to the process management.

5.4. Warehouse and distribution

In central medical store, warehousing and distribution SoPs are followed. The storage and distribution of health products that belong to different product categories are integrated to ensure the optimization of health products integration.

5.5. Logistic Management Information System

LMIS is standardized across the supply chain system at all levels and all programs related products are integrated in the system to ensure the data visibility. LMIS system is automated to ensure end to end data visibility at all levels of supply chain management.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

From the results of the study, the level of integration of health supply chain in Rwanda has been noticed. It promotes health care delivery trough the integration of clarity of roles, agility, streamlined processes and end to end information visibility.

6.2.Recommendations

6.2.1. Recommendations to the MoH

- To develop the M&E plan for continuous monitoring of implementation of Pharmaceutical Sector Strategic Plan
- To update the national Strategic Guidelines and National Formulary manual
- To conduct feasibility study on the integration of vaccines in the supply chain with other health commodities
- To provide to the Central Medical Store to procure for all public health commodities including the items that are procured by implementing partners.

6.2.2. Recommendations to the MPPD

- To develop the Standard Operating Procedures for procurement activities
- To benchmark its purchase prices against market indices

6.2.3. Recommendations to other researchers

- To Conduct further research on uncovered study areas of integration of health supply chain management;
- To conduct the same study at the service delivery points to evaluate the impact of integration of health supply chain

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APPENDIXES

APPENDIX 1: INFORMED CONSENT

Informed consent form for key Informants

Title of study: Evaluation of the integration of health supply chain Management in Rwanda

Name and contact information of principal investigator

Theobald HABIYAREMYE

Introduction

My name is Theobald HABIYAREMYE. I work at Rwanda Ministry of Health as Pharmacist in charge of CPDS Coordination. I am currently pursuing the masters in Health Supply Chain Management in the University of Rwanda.

Purpose

The purpose of this study is to evaluate the integration of health supply chain management in Rwanda to assess the impact of integration of supply chain in terms of regulatory policies and procedures, forecasting and supply planning, stock monitoring, procurement, warehouse and inventory control, distribution, logistic management information system.

Procedure

A specific questionnaire was prepared to collect needed information and data about the integration of supply chain in terms of regulatory policies and procedures, forecasting and supply planning, stock monitoring, procurement, warehouse and inventory control, distribution, logistic management information system. A data collector will visit the staff from central level institutions that cover the large volume of public health commodities and technical operational flow: **MOH, RBC/HIV, RBC/TB, RBC/MCCH, RBC/MALARIA AND RBC/TB DIVISIONS, RBC/NCD, RBC/NRL, Medical Procurement and Production Division and implementing partners.**

Benefits

After completion of the study, all participants will be informed on the findings and related recommendations for improvement.

Risks

Your participation in this research is entirely voluntary and there is no risk.

Privacy and confidentiality

We will not share information about you and your institution/company to anyone outside of the team undertaking this activity. The information that we will collect will be kept private. All collected data will be stored in a database accessible only by the principal investigator. Any information about you and your institution/company will be identified by a number on it instead

of your name/your company.

Study approval

This proposal has been reviewed and approved by CMHS Institutional Review Board (IRB) whose task is to make sure that research participants are protected from harm. If you wish to find more about the ethics committee, please contact

Prof Jean Bosco GAHUTU, Chairman of the CMHS Institutional Review Board (IRB)

Tel: 0783340040 and email: gbgahutu@yahoo.com

For any questions about any part of the study, you may ask **Theobald HABIYAREMYE** the Principal investigator on Tel: **0788755822,** email: hatheogashugi@gmail.com or you may contact Professor **Pierre Claver KAYUMBA**, Supervisor of the study on **Tel: 0788309768**, email: pclaver.kayumba@gmail.com**.**

Consent and signature

I have read the foregoing information, I have had the opportunity to ask questions about it and any questions I have asked, have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Statement by the person taking consent

I have accurately read the information sheet. I confirm that I have received an opportunity to ask questions about the activity, and all the questions that I have asked have been answered correctly and to the best of my understanding. I confirm that I have not been coerced into giving consent, and my consent has been given freely and voluntarily.

A copy of this Informed Consent Form has been provided to me.

Print name of person taking consent _____

Signature of person taking consent _____

Date _____

Day/month/year

Formulaire de consentement éclairé pour les informateurs clés

Titre de l'étude: Évaluation de l'intégration de la gestion de la chaîne d'approvisionnement en santé au Rwanda

Nom et coordonnées du chercheur principal

Theobald HABIYAREMYE

Introduction

Je m'appelle Theobald HABIYAREMYE. Je travaille au ministère de la Santé du Rwanda en tant que pharmacien chargé de la coordination de la CPDS. Je fais actuellement le master en gestion de la chaîne d'approvisionnement des produits de santé à l'Université du Rwanda.

L'Objectif de l'étude

Le but de cette étude est d'évaluer l'intégration de la gestion de la chaîne d'approvisionnement en santé au Rwanda afin d'évaluer l'impact de l'intégration de la chaîne d'approvisionnement en termes de politiques et procédures réglementaires, de prévision et de planification des approvisionnements, de suivi des stocks, de passation des marchés, de gestion des stocks et des stocks, de la distribution et le système d'information de gestion logistique.

Les procédures

Un questionnaire spécifique a été préparé pour recueillir les informations et données nécessaires sur l'intégration de la chaîne d'approvisionnement en termes de politiques et procédures réglementaires, de prévisions et de planification des approvisionnements, de suivi des stocks, de passation des marchés, de gestion des stocks et des stocks, de la distribution et du système d'information de gestion logistique. Un collecteur de données visitera le personnel des institutions centrales couvrant le grand volume de produits de santé publique et leur flux opérationnel technique : MS, RBC / VIH, RBC / TB, RBC / MCCH, RBC / MALARIA ET DIVISIONS RBC / TB, RBC / NCD, RBC / NRL, Division des achats et de la production de produits médicaux et partenaires d'exécution.

Avantages

Une fois l'étude terminée, tous les participants seront informés des résultats et des recommandations d'amélioration connexes.

Risques

Votre participation à cette recherche est entièrement volontaire et sans risque.

Confidentialité et confidentialité

Nous ne partagerons pas d'informations sur vous et votre institution / entreprise à des personnes extérieures à l'équipe chargée de cette activité. Les informations que nous allons collecter resteront

confidentielles. Toutes les données collectées seront stockées dans une base de données accessible uniquement par l'investigateur principal. Toute information sur vous et votre institution / entreprise sera identifiée par un numéro à la place de votre nom / de votre entreprise.

Approbation de l'étude

Cette proposition a été examinée et approuvée par le comité d'examen institutionnel (CIS) du CMHS, dont la tâche est de s'assurer que les participants à la recherche sont protégés du préjudice causé. Si vous souhaitez en savoir plus sur le comité d'éthique, veuillez contacter **Pr Jean Bosco GAHUTU**, président du comité de révision des institutions de CMHS (IRB) Tel: **0783340040** et email: gbgahutu@yahoo.com**.**

Pour toute question relative à une partie de l'étude, vous pouvez contacter Mr Theobald HABIYAREMYE l'enquêteur principal par Tél: **0788755822,** email: hatheogashugi@gmail.com et **Pr Pierre Claver KAYUMBA** par tél. **Tel: 0788309768**, pclaver.kayumba@gmail.com**.**

Consentement et signature

J'ai lu les informations qui précèdent, j'ai eu l'occasion de poser des questions à ce sujet et les questions que j'ai posées ont reçu une réponse satisfaisante. Je consens volontairement à participer à cette étude.

Déclaration de la personne qui prend son consentement

J'ai lu la fiche d'information avec précision. Je confirme que j'ai eu l'occasion de poser des questions sur l'activité et que toutes les questions que j'ai posées ont reçu une réponse correcte et au meilleur de ma compréhension. Je confirme que je n'ai pas été contraint de donner mon consentement et que mon consentement a été donné librement et volontairement.

Une copie de ce formulaire de consentement éclairé m'a été fournie.

Nom de la personne qui donne son consentement

_____

Signature de la personne qui donne son consentement

_____

Date _____

Jour/Mois/ Année

APPENDIX 2: QUESTIONNAIRE

Strategic Planning, Policy& Governance

Q#	QUESTIONS	RESPONSES		SKIPS
PG-100: Strategies and Governance				
MOH	Has the MOH established a National Medicines Policy that includes objectives for supply chain management?	Yes		
		No		
MOH	How often is the National Medicines Policy revised? NOTE: For answers in between the choices, round up. For example, if updates are done every 2.5 years, select "3 or 4 years"	Every 2 years or more often		
		Every 3 or 4 years		
		Every 5 years		
		Less often than every 5 years		
MOH Warehouse Public Health Programs	Does National Medicine Policy cover the following functions?	Waste management		
		Quality assurance		
		Storage		
		Procurement		
		Forecasting & Quantification		
		Supply Planning		
		Inventory Management		
		LMIS		
		Financing		
		Human Resources		
PG-200: Standard Treatment Guidelines				

Q#	QUESTIONS	RESPONSES		SKIPS
MOH Public Health Programs	Are national standard treatment guidelines available (in electronic or paper copy)?	Yes		
		No		
MOH	Are the standard treatment guidelines adapted from universal clinical guidelines, such as those put forth by the World Health Organization (WHO)?	Yes		
		No		
MOH	How often are standard treatment guidelines revised? NOTE: For answers in between the choices, round up. For example, if revisions are done every 15, 18 or 21 months, select "Every 2 years"	Annually or more often		
		Every 2 years		
		Every 3 years		
		Every 4 years or less often		
PG-300: Registration of New Products and Technologies				
PG-301 MOH Rwanda FDA	Is there a process for registering new drugs, products and technologies?	Yes		
		No		
PG-302 MOH Rwanda FDA	Approximately how long does it take to register a new drug on average?	up to 3 months		
		more than 3 months, up to 6 months		
		more than 6 months, up to 1 year		
		Over 1 year		
PG-303 MOH Rwanda FDA	Does the regulatory organization in charge of drug registration make a list of registered products available to the public?	Yes		
		No		

Q#	QUESTIONS	RESPONSES		SKIP&OBSERVATION
SPM-100: Strategic Plan				
MOH Central medical store Public Health Programs	Do you have an approved supply chain strategic plan?	Yes		
		No		
MOH Central medical store Public Health Programs	Does the supply chain strategic plan include the following areas?	Human Resource		
		LMIS		
		Finance		
		Policy and Governance		
		Forecasting & Supply planning		
		Procurement		
		QA/QC		
		Distribution		
		Warehousing		
		Waste management		
		M&E		
		Coordination		
		Product Selection		
MOH Central medical store Public Health	Has the Organization gone through an exercise to identify important stakeholders (stakeholder mapping)?	Yes		
		No		

Programs				
MOH Central medical store Public Health Programs	How often is the supply chain strategic plan newly developed or formally updated?	Annually or more often		
		Every 2 years		
		Every 3 years		
		Every 5 years or less often		
		Never		
Q#	**QUESTIONS**	**RESPONSES**		**SKIP&OBSERVATION**
MOH Central medical store Public Health Programs	Does the Supply Chain Strategic Plan contain contents and themes that are aligned with the National Health Sector Strategic Plan and/or Pharmaceutical Sector Strategic Plan?	Yes		
		No		

2. Forecasting and Supply Planning

Q#	**QUESTIONS**	**RESPONSES**		**SKIP&OBSERVATION**
FSP-100 Forecasting Structure				
MOH Central Medical Store Public Health Programs	Does the country conduct the quantification of all Public health commodity requirements?	Yes		
		No		

Q#	QUESTIONS	RESPONSES		SKIP&OBSERVATION
MOH Central Medical Store Public Health Programs	Who leads the quantification process? NOTE: only one answer can be chosen for "leading" the process. The next question will ask who participates.	MOH/CPDS		
		Development partners		
		CMS (Central Medical Stores)		
		Public Health Programs		
		Consultants		
		Lower level/Local staff		
		Quantification committee		
MOH Central Medical Store Public Health Programs	Who are the stakeholders involved in the quantification process? **[MULTIPLE RESPONSES ALLOWED]**	MOH staff		
		Public Health programs representatives		
		CMS (Central Medical Stores)		
		Development partners		
		Consultants		
		Lower level Central Medical Stores/storeroom staff		
		Lower level Hospital/SDP staff		

Q#	QUESTIONS	RESPONSES		SKIP&OBSERVATION
		Others Please specify:		
FSP-200: Forecasting Methodology				
MOH Central Medical Store Public Health Programs	At which frequency the national quantification exercise is conducted?	Three years		
		Two years		
		One year		
MOH Central Medical Store Public Health Programs	Which of the following methodologies is used during forecasting?	Morbidity based		
		Consumption-based		
		Demographic projections		
		Service Statistic-based		
		Others Please specify:		
MOH Central Medical Store Public Health Programs	Do the quantification results used to mobilize funding from government and donor sources?	Yes		
		No		
MOH	Do the quantification results	Yes		

Q#	QUESTIONS	RESPONSES		SKIP&OBSERVATION
Central Medical Store Public Health Programs	used to inform health commodity procurement?	No		
FSP-500: Forecast Accuracy				
MOH Central Medical Store Public Health Programs Implementing partners	Is forecast accuracy measured at least annually?	Yes		
		No		
FSP-600: Supply Plan				
MOH Central Medical Store Public Health Programs	Does this facility conduct supply plan review for health commodity?	Yes		
		No		
MOH Central Medical Store Public Health Programs	How often is the supply plan monitored and updated?	continuously or daily		
		weekly		
		monthly		
		quarterly		
		Bi-annually (twice per year)		
		annually		

Q#	QUESTIONS	RESPONSES		SKIP&OBSERVATION
FSP-800: Hardware and Software Forecasting				
MOH Central Medical Store Public Health Programs	Does the system have appropriate tools for forecasting&supply planing?	Yes		
		No		
MOH Central Medical Store Public Health Programs	Which software is used for forecasting?	Specialized forecasting software that uses machine learning or advanced algorithms to determine future need		
		Standardized health forecasting software (e.g., Pipeline, Quantimed, LabEquip, commercial sector solutions)		
		Excel or a general database program		
		Other Please specify:		

3. Procurement

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
PRO-100: Procurement Control				
MOH Central medical store Public Health Programs Implementing partners	Does this location procure drugs/medical supplies from the private sector?	Yes		
		No		
MOH Implementing partners	Which entity(ies) are responsible for implementing health commodity procurements? NOTE: Procurement refers to acquisition of pharmaceutical products and medical supplies	Central medical store		
		Development partners(USAID, UN agencies)		
MOH Implementing partners	Which entity is responsible for regulation and oversight of the overall procurement process? NOTE: Procurement refers to acquisition of pharmaceutical products and medical supplies	Ministry of Health		
		Rwanda Public procurement authority		
		Central medical store		
		Development partners		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
Central medical store Public Health Programs Implementing partners	Are procurements approved by authorized personnel/stakeholders?	Yes		
		No		
MOH Central medical store Public Health Programs Implementing partners	What internal control systems are in place for procurement? **[MULTIPLE RESPONSES POSSIBLE]**	Value thresholds (procurements of different values need different approval procedures)		
		Formally enforced order & approval protocols		
		Contracts Committee		
		Procurement & Adjudication committee/Tender committee		
		Contract management		
		Legal Review		
		Others		
PRO-400: Product Specifications				
MOH Central medical	During sourcing and procurement	National treatment guidelines		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
store Public Health Programs Implementing partners	(prequalification or bidding), is reference made to the following?	Essential medicines list		
		Medical and Lab supplies list		
		User department specifications		
		Forecasts		
PRO-500: Identifying and Qualifying Vendors				
MOH Central medical store Public Health Programs Implementing partners	Is there a documented process in place for identifying and qualifying vendors?	Yes		
		No		
MOH Central medical store Public Health Programs Implementing partners	Is there an approved vendor list?	Yes		
		No		
MOH Central medical store Public Health Programs Implementing partners	Is vendor information maintained in a database (can be electronic or paper based)?	Yes		
		No		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
MOH Central medical store Public Health Programs Implementing partners	Do you maintain a procurement website accessible to external stakeholders? **[VERIFY WITH PRO-1405]**	Yes		
		No		
MOH Central medical store Public Health Programs Implementing partners	Which information does this procurement website make available?	Current bid opportunities		
		Bid results		
		Current contracts		
		Solicitation schedules		
MOH Central medical store Public Health Programs	Is detailed feedback provided to vendors and other stakeholders after the qualification process is completed? **[VERIFY WITH PRO-1407]**	Yes		
		No		
PRO-600: Fair Competition & Cost Effectiveness				
MOH Central medical store Public Health Programs	Do the tenders include terms and conditions?	Yes		
		No		
MOH	Are there formal	Yes		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
Central medical store Public Health Programs Implementing partners	processes in place to maintain vendors' proprietary information as confidential?	No		
MOH Central medical store Public Health Programs Implementing partners	Are formal notifications sent to both successful AND unsuccessful bidders?	Yes		
		No		
MOH Central medical store Public Health Programs Implementing partners	Does this location benchmark or compare its purchase prices against market indices?	Yes		

4. Warehousing and Distribution

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
WS-100: Warehousing Standard Operating Procedures				
MOH	Are there standard operating	Yes		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
Central medical store Public Health Programs	procedures (SOPs) for Warehousing & Storage available at the central medical store? NOTE: For example, SOPs for order picking & verification, order processing, order dispatch & loading	No		
MOH Central medical store Public Health Programs	How often are standard operating procedures for Warehousing & Storage updated?	Annually or more often		
		Every 2 years		
		Every 3 years		
		Every 4 years or less often		
		Never		
WS-200: Commodity Receipt				
Central medical store Public Health Programs	Which of the following checks are made for inbound shipments (shipments received)?	Quantity (number of units)		
		Shelf-life remaining		
		Quality (beyond external packaging, e.g. sampling for pharmaceutical quality testing)		
		Carton count/pallet count		
		Documentation		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
		Correct currency and pricing		
Central medical store Public Health Programs	What actions do you take when there is a discrepancy in the commodities received?	Notify the Central medical store/supplier that issued the product		
		Reject the products		
		Fill in a discrepancy form		
		Re- order		
		Quarantine the products		
WS-300: Central medical store Design & Layout				
Central	Are products from different	Yes		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
medical store	programs stored in an integrated manner in the central medical store warehouse? Or is it segregated and stored in specific programs' or implementing partner's Central medical store? NOTE: Integration of warehouse and storage means that all products must be received and stored in the central medical store settlements whether procured by implementing partners (e.g., HIV, TB, Malaria, Family Planning, MEG……)	No		
WS-1600: Central medical store Performance				
WS-1601 MOH Central medical store	Which of the following indicators are regularly measured and tracked at the Central medical store?	Stocked according to plan (the percentage of commodities between the established minimum and maximum stock levels)		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
		Stock out rates (the percentage of commodities that experienced a stock out during a defined period)		
		Stock accuracy (comparison between the stock quantity on a stock card and/or in an inventory management software with the quantity counted in a physical inventory)		
		Order fill rate (comparison between the quantity in accepted orders to the quantity delivered)		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
		Stock turn per annum (the number of times the Central medical store issues and replaces its inventory during the period under review)		
		Cost of warehousing operations (cost of the operation of the Central medical store, which may be expressed as a percentage of the total value of the commodities managed by the Central medical store)		
		Wastage from damage (measurement of the total value or quantity of stock that was lost due to damage during a defined period)		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
		Wastage from theft (measurement of the total value or quantity of stock that was lost to theft during a defined period)		
		Wastage from expiry (measurement of the total value or quantity of stock that was lost to expiry during a defined period)		
		Order turnaround time (the time taken by the Central medical store to fulfill orders from lower level DPs)		

Q#	QUESTIONS	RESPONSES		SKIPS&OBSERVATION
		Number or duration of temperature excursions (the number of days in which there was a temperature excursion or percentage of time that the cold storage facility was not at the required temperature)		
		Percentage of in-coming batches tested for quality (the percentage of product batches received from suppliers and tested by a quality assurance laboratory)		

Q#	QUESTIONS	RESPONSES		Skips & observations
DIS-100: Distribution planning				
MOH	Is there an approved	Yes		

Q#	QUESTIONS	RESPONSES		Skips & observations
Central medical store	distribution plan? NOTE: A distribution plan defines when products will be delivered to different clients.	No		
MOH Central medical store	Do you have a data management system that captures distribution plans and operations?	Yes		
		No		
Central medical store	Are distribution routes pre-planned? NOTE: Pre-planned distribution routes specify the specific order that clients will be visited in, and which roads will be utilized.	Yes		
		No		
Central medical store	Which of the following do routing plans take into consideration?	Truck capacity		
		Product volumes (or number of pallets)		
		Weights of individual products		
		Geographic location		
		Others, please specify		

Q#	QUESTIONS	RESPONSES		Skips & observations
MOH Central medical store	Are products from different programs distributed in an integrated manner, to the extent that product requirements allow? Or is it segregated per program or by implementing partner? NOTE: Integration doesn't mean ALL products must be distributed on the same truck; certain product may have special characteristics (e.g., cold chain requirement, high value, short expiry date) that necessitate different treatment for distribution.	Distribution is done in an integrated manner wherever product characteristics allow.		
		Most programs or partners integrate distribution.		
		Most or all programs/partners conduct separate, vertical distribution.		
DIS-200: Distribution and transportation policies and procedures				
MOH Central medical store	Are there policies that cover distribution and transportation of commodities?	Yes		
		No		
MOH Central medical store	Do the policies and procedures that cover distribution and	Transportation of cold chain commodities		

Q#	QUESTIONS	RESPONSES		Skips & observations
	transportation include the following aspects about commodities?	Transportation of expired commodities		
		Security		
		Storage conditions during transport		
		Documentation		
		Re-distribution		
		Reverse logistics		
MOH Central medical store	Do the policies and procedures that cover distribution and transportation include the following aspects about fleet management?	Repair & preventative maintenance		
		driver briefing and debriefing		
		driver logs		
		system to track vehicle status (in/out) with their expected return date		
		Vehicle schedules for future deployments		
		Accidents & emergencies		
		GPS tracking		

5. Logistics Management Information System

Q#	QUESTIONS	RESPONSES		SKIP& OBSERVATION
LM-100: LMIS Policies and guidelines				
MOH Central Medical Store Public Health Programs	Which type of Logistics Management Information System (LMIS) tools are used?	Paper based LMIS only		
		Electronic LMIS (eLMIS) only		
		Both Paper based LMIS & electronic LMIS		
MOH Central Medical Store	Are there policies in place that guide the electronic LMIS (eLMIS)?	Yes		
		No		
MOH Central Medical Store	Are the LMIS tools standardized across the supply chain - across geographic regions, health programs and health system levels?	Yes		
		No		
MOH Central Medical Store	Which program areas have the same reporting cycles? **[MULTIPLE RESPONSES ALLOWED]**	HIV		
		TB		
		Family Planning		
		Malaria		
		Maternal and Child Health		
		Vaccines		

Q#	QUESTIONS	RESPONSES		SKIP& OBSERVATION
		Essential Medicines		
		Medical consumables		
		Laboratory reagents, tests& consumables		
MOH Central Medical Store Public Health Programs	What is the reporting frequency for electronic LMIS data?	Real time/Daily		
		Weekly		
		Monthly		
		Quarterly		
		Less than quarterly		
MOH Central Medical Store Public Health Programs	Is there a standard process, such as scheduled, regular meetings, to review LMIS (paper or electronic LMIS) data and reports?	Yes		
		No		
MOH Central Medical Store Public Health Programs	Is there a formal system or mechanism for users to report issues with the system that require improvements?	Yes		
		No		
MOH	Is there a technical working group that	Yes		

Q#	QUESTIONS	RESPONSES		SKIP& OBSERVATION
Central Medical Store Public Health Programs	addresses all technical input into the system?	No		
MOH Central Medical Store Public Health Programs	Is there a help desk or other mechanism for users to ask questions and request support with the system?	Yes		
		No		
LM-200: Data Tools and Indicators				
MoH Central Medical Store Public Health Programs	What challenges do you face when using electronic LMIS? **[MULTIPLE RESPONSES ALLOWED]**	Internet connectivity		
		Down time centrally (system failure)		
		Availability of computers		
		Delayed feedback from higher levels (MOH or Central Medical Store) on system & reporting		
		Lack of time due to other tasks		

Q#	QUESTIONS	RESPONSES		SKIP& OBSERVATION
		Data Loss		
		Challenges in analysis of data		
		Challenges in retrieval of data		
		Use of different versions of the tool		
		Slow adaptation of revisions within tools		
		Insufficient training or human resources capability		
		Insufficient staff		
		Data quality or data entry errors		
		Others Please specify:		
		None		
MOH	How many supply chain commodity	1-3		

Q#	QUESTIONS	RESPONSES		SKIP& OBSERVATION
Central Medical Store Public Health Programs	category reports are displayed through electronic LMIS? NOTE: For example, are separate reports required for different programs or products, such as Lab, ART, malaria, family planning, MCH, vaccine program, Essential medicines,…..	4-6		
		7-10		
		>10		
MOH Central Medical Store Public Health Programs	Which data-points are recorded in the electronic LMIS? **[MULTIPLE RESPONSES ALLOWED]**	Stock on hand		
		Consumption		
		Adjustments		
		Losses and Expiry		
		Issues and receipts		
		Safety stock for each commodity		
		Frequency of reordering		
		Quantity of reordering		
		Expiration dates		
		Number of days out of stock		

Q#	QUESTIONS	RESPONSES		SKIP& OBSERVATION
MOH Central Medical Store Public Health Programs	Which supply chain management activities are informed by (electronic or paper) LMIS reports? **[READ EACH. MULTIPLE RESPONSES ALLOWED]**	Ordering & reporting		
		Supply planning		
		Forecasting		
		Procurement (emergency or scheduled)		
		Product selection		
		Inventory management		
		Reverse logistics		
		Re-distribution		
		Donor activities		
		Budgeting		
		Waste management		
		Transportation		
LM-208 MOH Central Medical Store	Which supply chain management Monitoring and Evaluation activities are informed by eLMIS reports?	Ordering & reporting		
		Supply planning		
		Forecasting		

Q#	QUESTIONS	RESPONSES		SKIP& OBSERVATION
Public Health Programs		Procurement (emergency or scheduled)		
		Product selection		
		Inventory management		
		Reverse logistics		
		Re-distribution		
		Donor activities		
		Budgeting		
		Waste management		
		Systems Performance		

Key Performance Indicators

Forecast accuracy

	Drug / Commodity Name	***Quantity in forecast for***	***Unit for Column A***	***Quantity of consumption (or issues) for***	***Unit for Column C***	***Quantity in column C/ is Issues [I] or Consumption [C]***
3.1	TDF/3TC/EFV 300/300/600mg					
3.2	Cobas Taqman HIV-1 Tests V2.0/HI2CAP 48T					
3.3	Depo-Provera 150mg/ml					

3.4	Artemether/ Lumefantrine (24's) 20/120mg					
3.5	RHZE 150/75/400/275MG					
3.6	Insuline lente 100UI/ML					
3.7	Insuline rapide 100UI/ML					
3.8	Hydrochlorthiazide 25mg					

How is forecast accuracy calculated?	**1 – (Actual consumption – Forecasted consumption)/Actual consumption**

Supply plan accuracy

Drug / Commodity Name	***Quantity in supply plan for FY 18/1910-10-2019: Planned quantity of commodity to be ordered in the period***	***Quantity from orders for FY 18/19: Include orders placed by the procurement unit in the period under review.***
TDF/3TC/EFV 300/300/600mg		
Cobas Taqman HIV-1 Tests V2.0/HI2CAP 48T		
Depo-Provera 150mg/ml		
Artemether/ Lumefantrine (24's) 20/120mg		
RHZE 150/75/400/275MG		
Insuline lente 100UI/ML		
Insuline rapide 100UI/ML		
Hydrochlorthiazide 25mg (B/1000)		

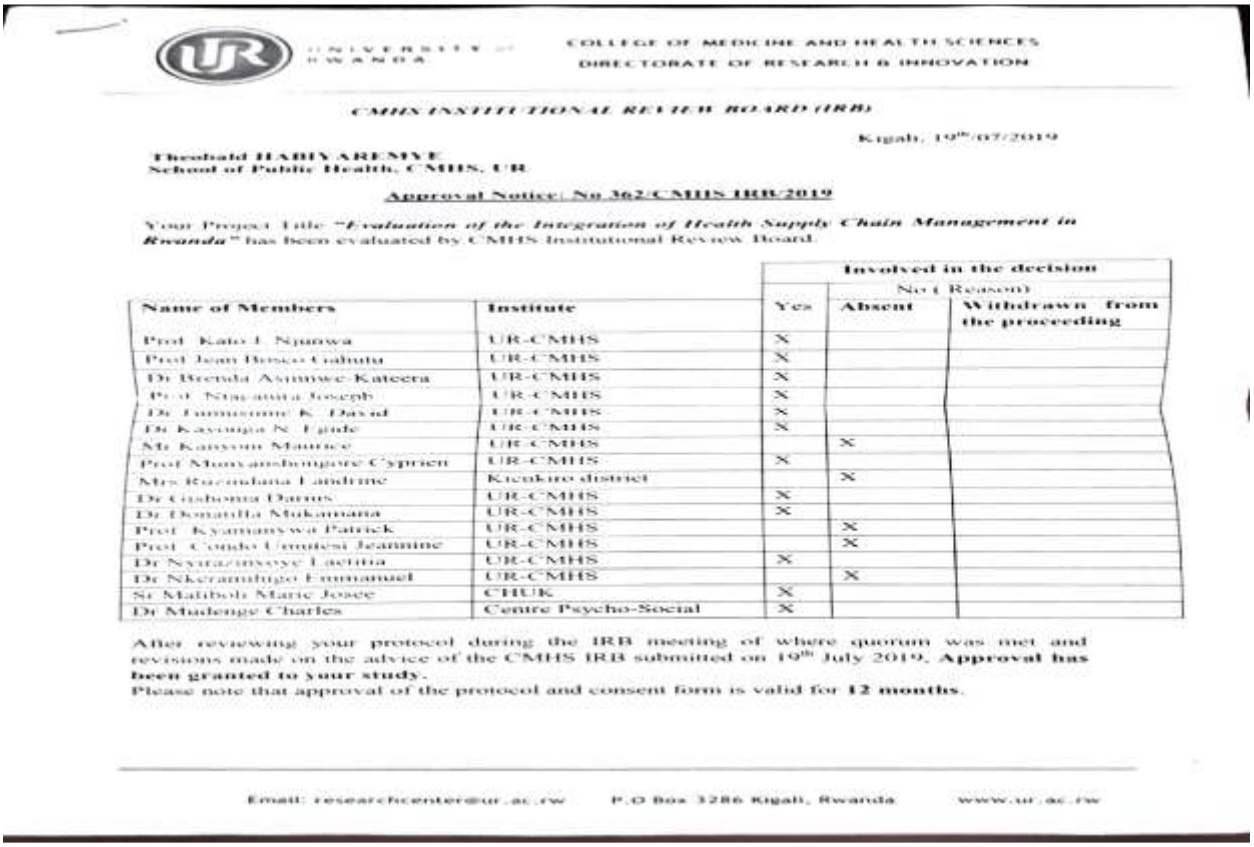
APPENDIX 3: BUDGET IN FRWS

Category	**Units**	**Cost per unit**	**Total Amount (Frws)**
Pilot study	1	50,000	50,000
Transport	15	10000	150,000
Data Analysis	1	60,000	60,000
Printing	12	18000	216,000
Ream of papers	3	5000	15,000
Pens	4	150	600
Photocopying	150	50	7,500
Binding/ Lamination	4	5000	20,000
TOTAL AMOUNT			**519,100**

APPENDIX 4: RESEARCH PLAN

PERIOD	ACTIVITIES PLANNED FOR THIS PERIOD
June –July 2019	Refining the data collection tools Ethical clearance application
July-August 2019	Data collection Data processing
August 2019	Data analysis First draft dissertation writing First draft dissertation submission
September 2019	Addressing manuscript reviewer comments Second draft dissertation writing and submission Addressing manuscript reviewer comments
October 2019	Defense of dissertation Final submission

APPENDIX 5: APPROVAL FROM CMHS INSTITUTIONAL REVIEW BOARD (IRB)



UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES
DIRECTORATE OF RESEARCH & INNOVATION

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 19th/07/2019

Theobald HABIYAREMYE
School of Public Health, CMHS, UR

Approval Notice: No 362/CMHS IRB/2019

Your Project Title *"Evaluation of the Integration of Health Supply Chain Management in Rwanda"* has been evaluated by CMHS Institutional Review Board.

		Involved in the decision		
			No (Reason)	
Name of Members	**Institute**	Yes	**Absent**	**Withdrawn from the proceeding**
Prof. Kato J. Njunwa	UR-CMHS	X		
Prof Jean Bosco Gahutu	UR-CMHS	X		
Dr Brenda Asiimwe-Kateera	UR-CMHS	X		
Prof. Ntaganira Joseph	UR-CMHS	X		
Dr Tumusiime K. David	UR-CMHS	X		
Dr Kayonga N. Egide	UR-CMHS	X		
Mr Kanyoni Maurice	UR-CMHS		X	
Prof Munyambonyuze Cyprien	UR-CMHS	X		
Mrs Rucumbana Landrine	Kicukiro district		X	
Dr Gishoma Damas	UR-CMHS	X		
Dr Donatilla Mukamana	UR-CMHS	X		
Prof. Kyamanywa Patrick	UR-CMHS		X	
Prof. Condo Umulisa Jeannine	UR-CMHS		X	
Dr Nyirazinyoye Laetitia	UR-CMHS	X		
Dr Nkeramihigo Emmanuel	UR-CMHS		X	
Sr Malibosi Marie Josee	CHUK	X		
Dr Mudenge Charles	Centre Psycho-Social	X		

After reviewing your protocol during the IRB meeting of where quorum was met and revisions made on the advice of the CMHS IRB submitted on 19th July 2019, **Approval has been granted to your study.**
Please note that approval of the protocol and consent form is valid for **12 months**.

Email: researchcenter@ur.ac.rw P.O Box 3286 Kigali, Rwanda www.ur.ac.rw

You are responsible for fulfilling the following requirements:

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrolment of participants.
3. All consent forms signed by subjects should be retained on file. The IRB may conduct audits of all study records, and consent documentation may be part of such audits.
4. A continuing review application must be submitted to the IRB in a timely fashion and before expiry of this approval
5. Failure to submit a continuing review application will result in termination of the study
6. Notify the IRB committee once the study is finished

Sincerely,

Date of Approval: The 19th July 2019

Expiration date: The 19th July 2020

Professor GAHUTU Jean Bosco
Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate Studies, UR

APPENDIX 6: APPROVAL FROM NATIONAL HEALTH RESEARCH COMMITTEE

Republic of Rwanda

MINISTRY OF HEALTH

National Health Research Committee
Ref: NHRC/2019/PROT/043

To: **Theobald Habiyaremye**
Principal Investigator

Scientific Review Approval Notice

With reference to your request for approval of the Research Protocol entitled; "**Evaluation of the integration of health supply chain Management in Rwanda .**"; We are pleased to inform you that, following a thorough review and critical analysis of your proposal **(NHRC/2019/PROT/043)**, your Research Protocol has been approved by National Health Research Committee.
However,

1) Changes amendments on approach and methodology must be submitted to the NHRC for review and approval to validate the changes.
2) Submission to NHRC of final results is mandatory
3) Failure to fulfill the above requirements will result in termination of study

Once again National Health Research Committee appreciates your interest in research and requests you to submit this proposal to the National Ethics Committee (NEC) and then share a copy of the approval letter from them.

Your final approval reference number is **NHRC/2019/PROT/043.**

Sincerely,

Dr. Parfait UWALIRAYE
Chairperson of NHRC

Date: 05/08/2019