EFFECT OF MOVING FROM PUBLIC TO STATE-OWNED PRIVATE HEALTH SUPPLY CHAIN SYSTEM ON THE AVAILABILITY OF ESSENTIAL MEDICINES IN RWANDA

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"A dissertation submitted in partial fulfillment of the Requirements the Award of the Degree of Master for Master of Health Supply Chain Management in school of public health of the University of Rwanda."

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Declaration

I, Evariste Ndaribumbye, hereby declare that the work contained in this dissertation is my original work, and that any work done by others or by myself previously has been acknowledged and referenced accordingly.

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Date: 15th July 2023

DECLARATION

This dissertation has been submitted for review with our approval as the student's supervisor:

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process.

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NDARIBUMBYE Evariste

Dedication

To my lovely wife MUSHIMIYIMANA Irène, our children Cyusa Dorian, Gihozo Dylan and Shami Declan for the support, encouragement and understanding during my academic journey towards this research.

Abstract

Introduction: a strong health system relies on the existence of a robust health supply chain management system that ensures an uninterrupted supply of essential and affordable health products. In Rwanda, the National Supply Chain Assessment of 2017 (NSCA) and previous studies revealed low performance of the supply chain system and low availability of health products. In 2020, Rwanda created Rwanda Medical Supply Limited (RMS Ltd), a state-owned private entity, to improve the procurement system and increase availability of the health products. From then, we have not yet been able to find results about the effectiveness of the new procurement system. This study assesses the effect of RMS Ltd 'processes on the availability of essential medicines.

The objective: this research aimed to assess the effect of switching from a public to a state-owned private health supply chain system on the availability of key medications, vaccines, and technology as compared to the prior system.

Method: this study used descriptive design with quantitative approach. Data on procurement, inventory management, data records quality and human resource management influence on the availability of essential medicines were collected using a questionnaire. The purposive sampling was used to recruit 41 respondents from RMS HQ, 30 RMS branches and 7 referral hospitals based on their roles and functions. The data were analyzed using SPSS version 24.

Results: findings revealed that the branches of RMS, a state-owned entity, make direct purchase whereas various procurement methods including open tender, restricted method, request for quotation and others could be leveraged before RMS. The use of direct purchase resulted in a decrease of the lead time at all levels concerned. The stock levels are based on order, and the products stocked according to plan increased from 10-30 % in 2017 to 72-94 % in 2022 contrary to what used to happen with the previous system. The availability of some essential medicines such as amoxicillin and captopril increased respectively from less than 30 % and 80 % in 2020 to 89.9 % and 87 % in 2022. In contrast to the results of 2017's NCSA, the e-LMIS data are being used for decision-making by RMS branches, RMS HQ and Referral hospitals. Over 70 % of the respondents claimed that they are motivated by their responsibilities and the salary was increased between 10 % -20 % by a score of 73 % of the respondents.

Conclusion: the study shows that, in contrast to the former public procurement system, the creation of RMS Ltd increased the availability of essential medicines through improvement of processes of supply chain components of the present study.

Keywords: state-owned private system, effect, health supply chain, health products, availability, essential medicines.

Abbreviations and Acronym

GAVI	Global Alliance for Vaccines and Immunization
WHO	World Health Organization
MOH	Ministry of Health
RMS	Rwanda Medical Supply Limited
MPPD	Medical Procurement and Production Division
DPs	District Pharmacies
LABOPHAR	Laboratoire Pharmaceutiques du Rwanda
NSCA	National Supply Chain Assessment
CMS	Central Medical Store
SDGs	Sustainable Development Goals
SDPs	Service Delivery Points

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Chapter I. Introduction

1.1. Background of the study

A strong health system relies on the existence of a robust health supply chain management system that ensures uninterrupted supply of health products and satisfaction of the clients with the right products, in the right quantities, in the right condition, to the right place, at the right time, for the right cost (1). The eighth goal of the third Sustainable Development Goals states unequivocally that achieving Universal Health Coverage involves access to key medications, vaccines, and technologies (2).

According to the WHO framework for health systems, equitable access to vital medicines, vaccines, and technology necessitates a well-functioning health supply chain system that minimizes leakage and wastes via selection, procurement, supply, storage, and distribution (3). In low-income countries, the majority of supply chain systems adopt a distribution model in which the government purchases necessary medicines and distributes them directly to SDPs from the central medical stores or through existing distribution points using either state-owned transport or third party transport means (4).

Having many levels was found to be challenging during the landscaping of the structure of GAVI country vaccine supply chains and testing the effect of redesigning, as it complicates coordination, increases the number of sites to manage, reduces economies of scale, introduces redundancies, increases response time, and increases the risk of wastages (5). Therefore, for greater capability, responsiveness, and flexibility, a supply chain may need to be reformed and/or redesigned whenever it is required to satisfy patient needs (6). Previously, countries changed from state-owned central medical stores, with several issues, to autonomous or semi-autonomous central medical stores which increased the performance of supply chain management. Some countries attempted to redesign the supply chain of vaccines to make them effective and positive outcomes were achieved (7).

A simulation study done for Singapore's hospitals indicated that the redesigning supply chain of the healthcare industry supports the centralization of the system as it results in reduction of staff, storage space, response time from suppliers to user service, and a cost reduction of 60 % (5). An evaluation conducted in Benin on the impact of a redesigned supply chain system revealed positive outcomes regarding capital saving and elimination of redundancy in equipment, personnel, locations and routes (8). In Zambia, switching from three tiers of distribution to direct distribution from a central agency via cross-docking to health institutions has reduced the incidence of first-line pediatric anti-malarial stockouts from 47.9 % to 13.3 % (5).

A study conducted in Rwanda by Bizimana Thomas in 2020, found that the availability of health medicines was 59.3 % in the public sector (9). According to Mbonyinshuti François' study conducted in Kirehe District-based health institutions, longer lead times and stock outs at top stores were identified as variables limiting the supply of medicines for non-communicable diseases in hospitals(10). Rwanda's government began integrating supply chain management in 2004 by establishing a coordinated procurement and distribution system with the goal of maximizing resources from various partners. More initiatives, such as the harmonization of logistics management information management and reporting systems, as well as electronic logistic management systems, have been implemented to ensure end-to-end system visibility and real-time data availability for supported planning and decision making (11).

The Rwandan Ministry of Health's fourth health sector strategy plan, 2018-2024, places a high priority on the provision of safe, effective, and high-quality health products, vaccines, and technology. Despite various efforts, issues with the availability of health products continue to exist, despite the government's goal of achieving 90 % of availability by 2024 (12). The National Pharmaceutical Strategic Plan provides several gaps that hinder the supply chain system in Rwanda (13). With the same journey of improving the system, in 2020, the government of Rwanda transformed the supply chain systems where the Central medical store management moved from being full public system to state-owned private system after merging the central medical store and district stores with the objective of enhancing the management of the supply chain system to guarantee that patients receive the right medicines, in the right quantity whenever they need them at the affordable cost (14).The present study evaluated the effect of redesigning the public supply chain to state-owned private system on the availability of essential medicines.

1.2. Problem statement

Although the government of Rwanda invested a lot to increase the availability of health products, some issues continued to exist including but not limited to inaccurate planning, long lead times, stock outs, inaccurate data, expiries, etc. The results of the NSCA conducted in 2017 revealed a low performance of the health supply chain system at different levels including the central medical stores (CMS) CMS, District Pharmacies and Service Delivery Points (SDPs) (13). Other researchers highlighted low availability of health products in public while they are available in private and delay in delivery was mentioned to be among key challenges that lead to stock outs. In an effort to find solutions and strengthen the supply chain system, the Ministry of Health in Rwanda, presented a concept in March 2019 to merge MPPD, Rwanda Pharmaceutical Laboratory (LABOPHAR), and DPs to create the Rwanda Medical Supply Limited a single entity to increase the performance of the procurement system and increase the availability of health products (15). In August 2020, the government of Rwanda merged the MPPD and DPs to form RMS Ltd in order to create a flexible and coordinated operating environment and improve the availability of quality, reliable, and affordable essential medicines, vaccines, and technologies in all public health facilities of Rwanda in line with the pharmacy policy through a flexible and coordinated operating environment (16). By the time that the present study was conducted, after a period of more than two years and half of existence, we have not able been to find studies to inform various stakeholders of the supply chain about the effectiveness of a new system on the availability of essential medicines to strategize their interventional activities towards established objectives and goals. The present study assessed the effect of RMS's processes on the availability of essential medicines in comparison to the former public supply chain system.

1.3. Purpose of the study

The goal of this research is to assess how the formation of RMS Ltd has affected process performance and availability of health products. The study provides the effect on drug availability in terms of quantity. The objective was attained through primary and secondary data collection and interpretation. Participants were the employees of RMS Ltd HQ, RMS branches and referral hospitals based on roles, experience in procurement, inventory management, logistic data quality process and human resources.

1.4. Research objectives

1.4.1. General objective

The major goal of this research is to assess the effect of switching from a public to a state-owned private health supply chain system on the availability of key medications, vaccines, and technology as compared to the prior system.

1.4.2 Specific Objectives

1. To determine the effect of RMS's procurement process on the availability of essential medicines
2. To indicate the effect of RMS' inventory management practices on the availability of essential medicines
3. To evaluate the effect of RMS's data records quality on the availability of essential medicines
4. To determine the effect of RMS's workforce motivation on the availability of essential medicines

The research met its the objectives by responding to below study questions:

1. What is the effect of RMS's procurement process on the availability of essential medicines?
2. What is the effect of RMS' inventory management practices on the availability of essential medicines?
3. What is the effect of RMS's data records quality on the availability of essential medicines?
4. What is the effect of RMS's supply chain workforce motivation on the availability of essential medicines?

1.5. Study limitations

The study was not conducted at all service delivery points, and it has not included all components of the supply chain. There might be co-founders that contributed to the findings that were not covered by the present study. The researcher recommends complementary studies that may reach all levels and include more supply chain's components including co-founding factors such as financial management. Since the current health products procurement model that is being implemented is not common, it has been challenging to find other cases to refer to.

1.6. The significance of the study

The former supply chain system was composed of three interlinked but autonomous supply chain levels; Central, intermediate and SDPs. Central and intermediate levels were merged to form RMS Ltd. This study evaluated the effect of RMS's processes on the availability of essential medicines and collected information to understand the performance of the present and former supply chain systems. The results will inform policy makers, supply chain managers, academicians, supply chain stakeholders about the results of the redesigned supply chain system towards needed benefits of resolving gaps, balancing supply, and demand to satisfy customers within an effective and efficient way. The research will provide recommendations for leaders and professionals about challenges related to the new system on the availability of quality, safe, affordable essential medicines. Lastly but greatly, the successful completion of this study will help the researcher to obtain a master's degree in health supply chain management with minimum knowledge of existing systems and challenges to orient his intervention and contribution.

Chapter II. Literature review

2.1. Procurement of health commodities

Procurement is the process of purchasing, renting, or leasing products, services, or works (17). Procurement process is the major determinant of health commodities availability and their total costs(18). The process begins with the selection of products, forecasts and quantification of product requirements (19) and the ultimate goal of all procurement activities is to achieve value for money (20). The process involves different parties whose decisions and requirements impact the outcome. Those parties are the beneficiary government/institution, National Regulatory Authority, the funding agency, in-country distributors, suppliers and manufacturers (21). Open tender, restricted tender, e-procurement and reverse auction, competitive negotiation, international or local shopping, and direct procurement are some of the procedures that governments, nongovernmental organizations, and other organizations use to complete their procurement. The increase of competition among suppliers and health commodities decreases the prices of products. The rule of five asserts that when there are five or more generic alternatives for a product or when there are at least five bids per product in a tender, the lowest competitive pricing is accessible (22). A variety of elements influence the procurement technique used, including the client's capacity and capabilities, the available time frame, product cost, quality, risk, program, and the external environment, such as regulatory level and product availability (23).

2.2. Procurement of health commodities in Rwanda

The procurement process in Rwanda is governed by legal instruments such as the government procurement statute N°62/2018 of August 25, 2018. The law describes all steps to be followed and types of procurement methods which are mainly guided by the value of the tender (24). One of the points to note is the generical nature of the law with no specificity about health products. That characteristic has been challenging the availability of essential medicines and the Ministry of Health has been issuing a circular of pharmaceutical procurement and supply chain in Rwanda applicable to intermediary and lower levels but not to the central medical store (25). In 2004, the Government of Rwanda initiated Coordinated Procurement and Distribution System (CPDS) with the objective of coordinating and efficiently manage available resources and reach a streamlined integration and harmonization of program supply chain practices, and attain improved quantification, procurement, supply plan monitoring and inventory management of medicines such as antiretrovirals, anti-malarial, anti-tuberculosis (26). From August 2020, the procurement of health commodities has been performed by the central medical store, Rwanda Medical Supply Limited, with more flexibility as it is no longer relying on public procurement law instead, on internal approved procurement manuals. The health facilities receive health supplies through periodic reordering and do not go through procurement processes. One of the simplest, cheapest, and least time-consuming ways to demonstrate improvement in operations, according to supply chain management experts, is to use supply chain performance indicators or metrics. The following indicators are used to assess supply chain system improvement at various levels: Among other things, the procurement method used, the percentage of contracts issued as framework contracts, the lead time for contract/purchase order issue, and the lead time for contract award (27).

2.3. Inventory Management

Inventory management is the part of the supply chain that comprises ordering, receiving, storing, distributing, issuing, and re-ordering health commodities stock. Documenting and recording of all activities are very essential for good inventory management (28). Inadequate inventory management results in a waste of financial resources, shortages of some essential drugs or overstocking of others, causing expiration, and a decline in the quality of medical care in many countries. Irrational ordering decisions, incorrect records, a lack of regular monitoring, a lack of understanding and awareness of what inventory management requires, and inadequate management can all contribute to poor inventory management. Managers can utilize simple mathematical formulas to define policies about stock levels, reordering frequency, and quantity to deal with diverse inventory management difficulties, whether in a private or public setting. All rules about inventory management will be guided by two factors mainly; dependence versus independence demand system and pull versus push system for distribution. The first factor defines if a client orders finished products from a warehouse or other supply source, or if the system supports primarily internal manufacturing. The second aspect has to do with the distribution system and who chooses what needs to be transported. In the pull system the client order based on their needs while in the push system the upper level determines quantity to ship to the client (22). From the above, the system in Rwanda is predominantly an independent demand system and pull system where facilities orders needed products in line with the defined levels of stock to be held at a specific level of health service.

2.4. Types of inventory control models

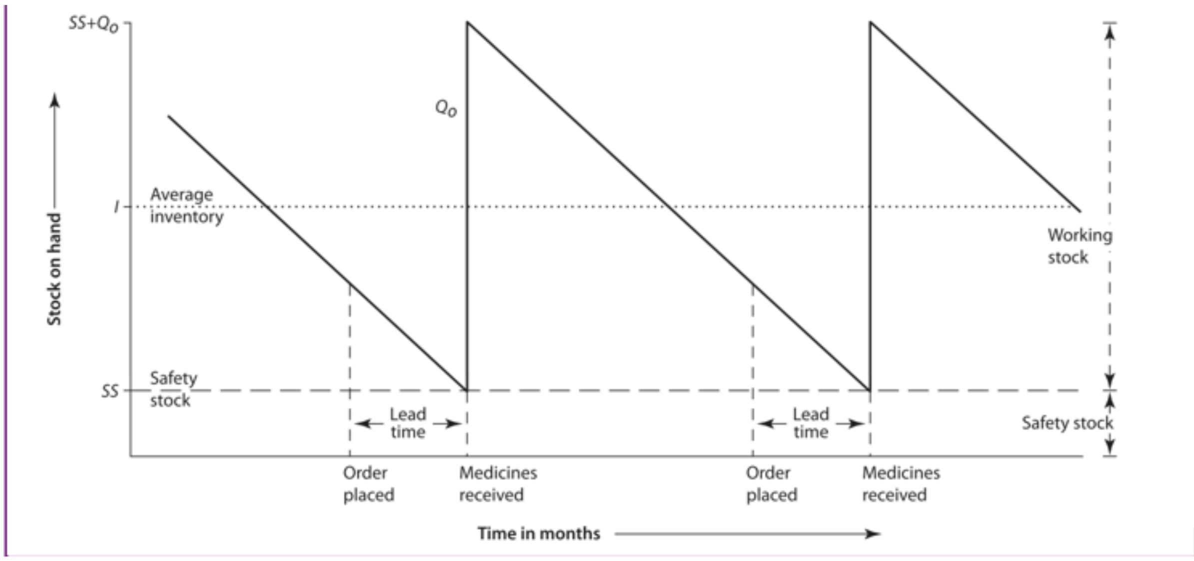

Figure 1. Ideal inventory control model

Source: Managing Access to Medicines and Health Technologies (22)

The achievement of optimal service level depends on safety stock and many ways can be used to determine stock level and all consider the average monthly consumption and lead time. In an ideal inventory control model, supply responds to demand in such a way that the stock on hand steadily diminishes until the order must be placed, avoiding stock out. With the ideal model the supplier respects lead time and supplies arrive at the right time to bring back the stock level to the maximum. Annual purchasing is a periodic review model in which orders are placed once a year, scheduled purchasing is a periodic review model in which orders are placed at predetermined intervals, perpetual purchasing is a periodic review model in which stock levels are reviewed each time stock is issued and orders are placed whenever stock falls below a minimum level, drawdowns from framework contracts, and a combination of annual, scheduled, and perpetual purchasing are the most common inventory control models (22). Indicators such as stock according to plan, stock out rate by tracer commodities by level in the system, stock accuracy, order fill rate, wastage rate, on-time delivery to facility, and percentage of orders placed by health facilities as emergency orders are measured to ensure that inventory is well managed (29).

2.5. Supply chain data quality management

Information, particularly facts or statistics, collected to be analyzed, considered, and used to aid decision-making, or information in an electronic form that can be stored and accessed by a computer, is referred to as data. quality, according to ISO 9000:2015, is the degree to which an object's intrinsic qualities meet standards(30). Data quality refers to the goodness of collected and reported information in the supply chain to support decisions about availability of health commodities. In the health supply chain main data may be collected but the three essentials are consumption data, available stock and losses and adjustments(31).

Preventive care, treatment monitoring, and tracing health items from the manufacturer to the point of use all require data in the modern era of healthcare. Governments are using big data analytics to help them make better decisions. Interoperable systems, such as electronic medical records (EMR), human resource information systems (HRIS), health management information systems (HMIS), or logistics management information systems (LMIS), are used to collect data in the supply chain (6).

A logistics management information system (LMIS) is a paper-based or electronic system of records and reports for aggregating, analyzing, validating, and displaying data from all levels of the logistics system. The most crucial part of the logistics process is this (31).

A good pharmaceutical management information system gives you the data you need to make informed decisions about patient adherence, medication resistance, medicine and laboratory supply availability, post-market intelligence, product registration, finance, and program management. Data that is relevant, accurate, and timely is essential for achieving a well-coordinated health supply chain (22).

According to the 2017 national supply chain evaluation, a combination of paper-based and computer-based LMIS systems have been used to retain transactional data and report them across all levels of Rwanda's public health supply chain. The evaluation found that users at lower levels were having difficulties due to a lack of time as well as unreliable internet, which had impacted data quality(29). To ensure achieve data quality, there are steps which must be documented and implemented in harmony across the system which are data collection where staff responsible of data collection shall be trained and get refresher trainings and report in appropriate reporting forms based on clear standards operating procedures to get correct data, Data reporting with review of data reported and regular basis and feedback provided timely for improvement, validation of data during data monitoring, aggregation, and analysis based on historical information and automated LMIS to reduce errors(32).

2.6. Human resources management in health supply chain

A well-functioning supply chain system that supplies quality and inexpensive medications relies heavily on human resources. Policymakers are aware of the growing needs of supply chain workers, and they are paying close attention to their management in order to ensure an efficient and effective supply chain system. Doctors, nurses, midwives, and community health professionals have been the emphasis in the past. In poor and middle income nations, inequalities in access to medicines have been linked to a shortage of supply chain employees, according to studies (33).

An effective human resource requires a rigorous, transparent, fair, and competitive recruitment process that focuses on valuable skills, qualifications, training, and relevant experiences. At the completion of the recruitment process guided by competency-based job descriptions, any organization must have a clear plan to attract and retain the best employees through capacity building of its employees, improved working conditions and motivation of the employees. In East Africa Community, public supply chain organizations fail to implement some important aspects of human resources that lead to lack of competitive salaries, lack of continuous staff capacity assessment and improvement plan and inadequate physical working environment(34).

In Rwanda, the national supply chain assessment of 2017 revealed some achievements such as existence of job descriptions for varying roles, supportive supervision, provision of training etc. The same study indicated that there were no HR management strategies in place to account for future supply chain people needs, as well as no supply chain management training programs (29). The assessment did not touch on the motivation of staff retention aspects to inform readers.

According to People that Deliver (PtD), there are four pathways that are linked to human resource policies that are expected to be implemented in public organizations to attract and retain skilled, qualified, and experienced supply chain workforce: staffing, skills, working conditions, and motivation(35).

2.7. Summary of literature review

Published literature demonstrates that different mechanisms can be implemented to improve the availability of essential medicines. Well-designed systems and processes are key to satisfying consumers in the right products at an affordable cost. Rwanda has implemented various health procurement mechanisms and has been ensuring that the system is supported but the results have not reached the desired level as indicated by reports from surveys.

2.8. Conceptual framework

As described by the below conceptual framework the availability of health products is linked to how procurement is performed, how inventory management is executed, the availability of updated and accurate data to support timely decision making as well as the capacity, qualification, motivation, and availability of human resources Performance.

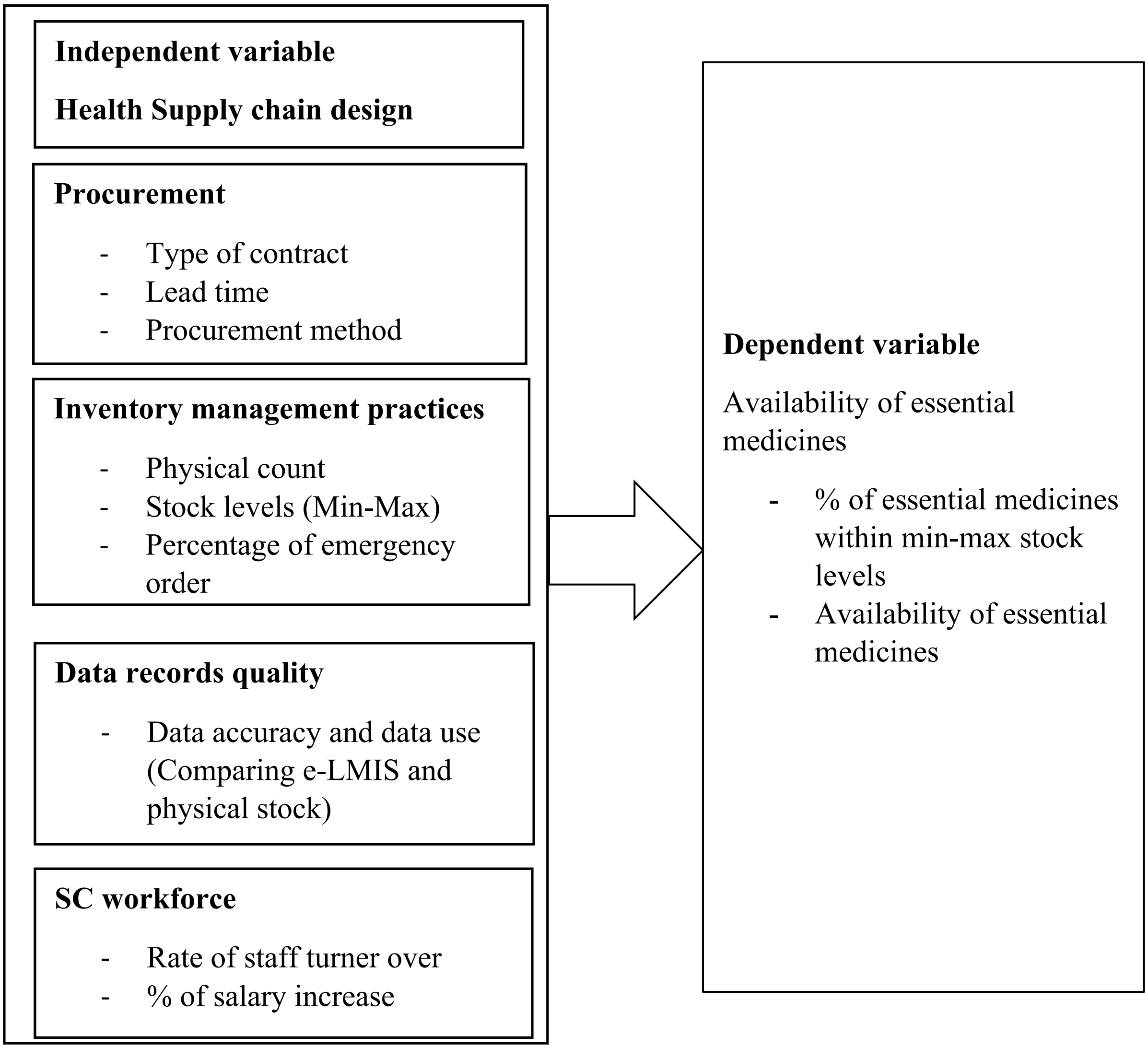

Figure 2 Variables dependance

Chapter III. Research Methodology and Materials

This chapter outlines the study settings, the study method, research design, the population under study, the sampling procedure, and the method that was used to collect data. The reliability and validity of the research instrument are addressed and ethical considerations pertaining to the research are also discussed

3.1. Study settings

The restructuring of the supply chain system resulted in merging the former CMS and former DPs. The DPs became the branches of RMS Ltd. This study was conducted at RMS Ltd headquarter, RMS branches and referral hospitals. As other health settings reorder to have their inventory based on standard operating procedures (SOPs) for health commodities management as issued by the Ministry of health in 2014(36).

3.2. Study design

The study evaluated the results of redesigning the supply chain system with reflexive comparison(37). To achieve the above, before and after interventional was selected as it enables the researcher to collect data on prioritized four areas in the current supply chain system. Data from operational records and surveys conducted in the past were considered to understand the system performance before and after restructuring and make it possible to measure the changes with associated explanations(38). At RMS Ltd Headquarters, RMS branches and referral hospitals, four areas including procurement, inventory management, LMIS and human resource were at the focus of this study.

3.3. Study population

To achieve the objectives of this study, procurement data records, e-LMIS based data, stock cards-based transactions and staff management records as well as responses of respondents at RMS and referral hospitals were considered to respond to research questions. Experience and role in the four areas of focus of the study as well as participant availability were the basis of interviewing a participant of this study.

3.4. Sample frame and sampling technique

The sample frame is defined as to list the accessible populations from which sample is selected from(39). For this study, the sampling frame consisted of RMS Ltd, RMS branches and 7 referral hospitals from areas of the study. A period of 24 months before and 24 months after the creation of RMS Ltd composed reference for data collection.

Purposive sampling technique to select managers and/or professionals that may provide information based on their roles and functions available at either RMS, RMS Branches and Referral Hospitals experience and availability was applied.

With purposive sampling technique the researcher chooses participants on his/her judgment in line with the purpose of the study(40). For the present study, we evaluated the effect at the levels that the redesigning affected which RMS, RMS branches and referral hospitals.

3.6. Sample size

Respondents from RMS headquarters, 30 RMS branches and 7 referral hospitals participated in the study. Procurement, inventory management, data quality management and human resource comparative performance were assessed as practices that affected the availability of essential medicines within the new supply chain system after the merging of former MPPD and DPs. The areas were selected because they were among the less matured as revealed by the NSCA of 2017.Four professionals were interviewed at RMS and one respondent picked from each RMS branch. Five medicines were selected to serve for reference which are Amoxicillin 250 mg tablet (Capsules), Captopril 25 mg tablet, metformin 500 mg tablet/Metformin 850 mg tablet, Oral rehydration salt and Paracetamol 500 mg tablet.

3.7. Inclusion criteria

In this research the staff fulfilling supply chain functions at RMS headquarter, 30 RMS branches and referral hospitals were interviewed during data collection. The records related to the indicators to be measured for procurement, inventory management, data records quality and supply chain workforce were consulted for historical data collection.

3.8. Exclusion criteria

In the present study, none of the supply chain staff have not been interviewed during data collection and data that was recorded 24 months before and 24 months after the creation of RMS Ltd was considered.

3.9. Data collection technique and tools

The researcher collected data using interview and review document and records including transactions on stock cards, digital records from e-LMIS and warehouse management system, procurement documents such as purchase orders and delivery notes, staff management documents such as reports on recruitments and salary history, for the areas of focus. The researcher used a pre-tested structured questionnaire guide to record data for further analysis. Authorization for data collection was requested and interviewees were communicated on when and where the interview was to take place. The questions for interview and records were related to indicators to be assessed.

3.10. Data analysis

Data were collected using a semi-structured data collection tool designed and coded to provide numerical research data. At this end, the Likert scale style to respond to the study objectives were used in questionnaire formulation. Participants were asked to indicate the extent to which they agreed or disagreed with the information provided. Then the categorical and numerical codes were assigned to different variables to facilitate its analysis. The data collection was done using the open data kit toolbox that collects information and stored in data CSV dataset format for further analysis. The Statistical Package for the Social Sciences (SPSS) was used in data cleaning and processing. Then after tables, charts and graphs were produced for key findings.

3.11. Dissemination of findings

The results of this study are presented to the University of Rwanda, national and international scientific conferences. The results are published on University of Rwanda platforms as well as in the selected international reputable scientific journal.

3.12. Ethical considerations

To conduct this study, we requested permissions from RMS Ltd allowing us to access data in need. First clearance from the University of Rwanda Institutional Review Board was asked to conduct the study. As well as permission from the Rwanda Medical Supply Ltd and referral hospitals, allowing us to have access to the data from all concerned institutions in this study.

A recommendation letter from the College of Medicines and Health Sciences, East African Regional Center of Excellence for Vaccines, Immunization, and Health Supply Chain Management was provided as well.

A consent form for participants is established. Before data collection, we inform the participants that participation in the study is voluntary and get an explanation concerning the aim of the study, objectives, benefits, and methodology that is being used after participants are requested to sign the consent form.

We reassured the participants about confidentiality and anonymity of the interview as they use codes (number) instead of their names during the interview; we assured them that shared data is kept safe and be used by only researchers. Voluntary participation was highlighted that there will be no payments or other awards from the study, but the results will help initiate the interventions that relevant and scientific based.

After data collection, all the participants’ responses were kept confidential. The analyzed data was saved in computer files secured by a password that is only known by the researchers.

Chapter IV: Results

This chapter presents analysis and findings of the research. The study was conducted using a digitalized questionnaire to collect primary and secondary data at RMS headquarter, 30 RMS branches and 7 referral hospitals. In total, 41 respondents participated in the study which constitutes 100 % of the total population of the study. The following paragraphs will describe the results which are presented in the form of percentage, figures, and tables.

4.1. Sociodemographic characteristics

The respondents to the present study comprised 30 (73 %) pharmacists from RMS branches, 7 (17 %) pharmacists and one manager from referral hospitals and 4 (10 %) staff from RMS headquarter.

Table 1 shows characteristics of the respondents as follows; 51 % of the respondents were between 30-39 years old, 42 % were between 40-49 years old and 7 % were above 50 years old. 78 % of respondents were males while 28 % were females. Pharmacists represent 96 % of all respondents and procurement staff, data analyst and human resource staff represent a portion of 4 % of the respondents. By working experience, 78 % were found to have above 6 years of working experience and only 5 % were found to have between 2-3 years of working experience. The information collected on education of the respondents showed that 60 % have a master’s degree while 40 % have a bachelor’s degree. The above socio-demographic characteristics of the respondents of this research ensure the maturity, professional with experience and education level that guarantee the reliance and correctness of collected information.

Table 1 Sociodemographic characteristics of respondents

Variable	Values	Frequency n (%)
Age groups	30- 39 Years	21 (51)
	40- 49 Years	17 (42)
	Above 50 Years	3 (7)
Sex	Female	9 (21)
	Male	32 (78)
Professional	Data quality analyst	1 (2.4)
	Procurement	1 (2.4)
	Pharmacist	38 (92.6)
	Human resource manager	1 (2.4)
Working experience	2- 3 Years	2 (5)
	4- 5 Years	7 (17)
	Above 6 Years	32 (78)
Education	Bachelor's Degree	25 (60)
	Master's degree	16 (40)

4.2. Procurement of essential medicines

This section presents the changes of RMS's procurement processes on the availability of essential medicines. The research focused on the procurement methods, delivery lead time, type of contract used as well as the appreciation of the new procurement process after the creation of RMS.

4.2.1. Type of procurement methods used.

The purpose of assessing the procurement methods used by the RMS is to inform its effects on the acquisition of an appropriate stock level to prevent stock outs or overstocking. From figure 3 below, the most predominantly used methods is the direct purchase which scored 89 %, followed by the combination of open tender, request for quotation (RFQ) and direct purchase (5 %), the combination of open tender, restricted method, and request for quotation (3 %) as well as the only use of request for quotation.

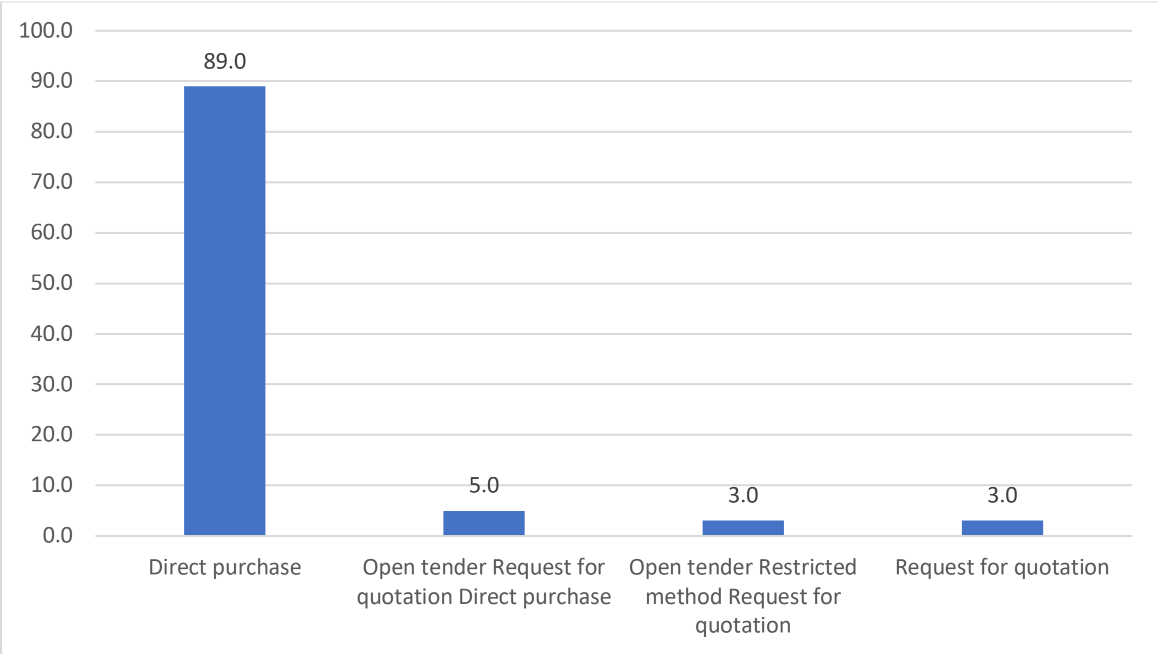

Figure 3 Percentage of used procurement methods

4.2.2. Procurement methods by level of facility

Table 2 shows that different methods are used at different levels. From the results, it was revealed that all RMS branches use direct purchase, and the same method is used by referral hospitals either alone or in addition with other methods at a percentage of 76 %. Requests for quotation are also used by referral hospitals at 14 %. RMS headquarter uses a combination of Open tender, RM and RFQ.

Table 2 Procurement methods used by facility level

		Procurement method used				Total
		Direct purchase	**Open tender RFQ Direct purchase**	**Open tender RM RFQ**	**RFQ**	
Referral hospital	Count	4	2	0	1	7
	% within Levels of facility	57.00 %	29.00 %	0.00 %	14.00 %	100.00 %
RMS branch	Count	30	0	0	0	30
	% within Levels of facility	100.00 %	0.00 %	0.00 %	0.00 %	100.00 %
RMS headquarter	Count	0	0	1	0	1
	% within Levels of facility	0.00 %	0.00 %	100.00 %	0.00 %	100.00 %

*RFQ: Request for Quotation; RM: Restricted method.

4.2.3 The type of procurement contract

The supply chain of health medicines is mostly done through contracts with external suppliers. The creation of RMS brought some changes in contracting methods.

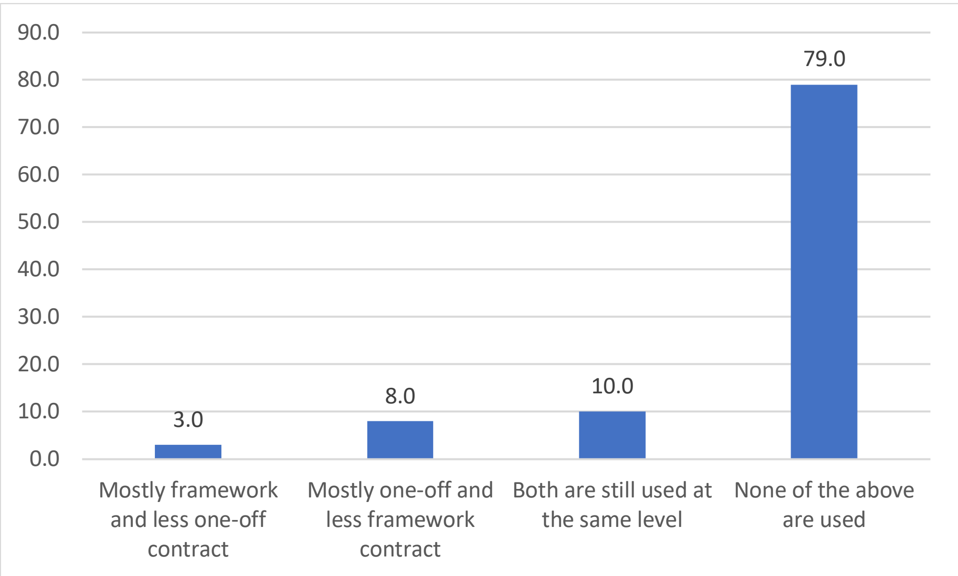

Figure 4 types of procurement contract

By considering the type of contract used, the depicted information in figure 4 has revealed that 79 % of the respondents claimed to not use any kind of contract with medical suppliers while 10 % are using the combination of one-off and framework contracts. Only 3 % use mostly framework contracts and less one-off contracts.

Table 3 Procurement contract by level

			Type of contract used				
			Mostly framework and less one-off contract	**Mostly one-off and less framework contract**	**Both are still used at the same level**	**None of the above are used**	**Total**
Levels of facility	**Referral hospital**	Count	0	3	4	0	7
		% within Levels of facility	0.0 %	43.0 %	57.0 %	0.0 %	100.0 %
	RMS branch	Count	0	0	0	30	30
		% within Levels of facility	0.0 %	0.0 %	0.0 %	100.0 %	100.0 %
	RMS headquarters	Count	1	0	0	0	1
		% within Levels of facility	100.0 %	0.0 %	0.0 %	0.0 %	100.0 %

The results in table 3 show that all RMS branches do not use contracts to acquire essential medicines. This figure explains the big variation in score in figure 3 where those that don't use any type of contract scored 79 %. 79 % include the 30 RMS branches.

4.2.4 Decrease in delivery lead time

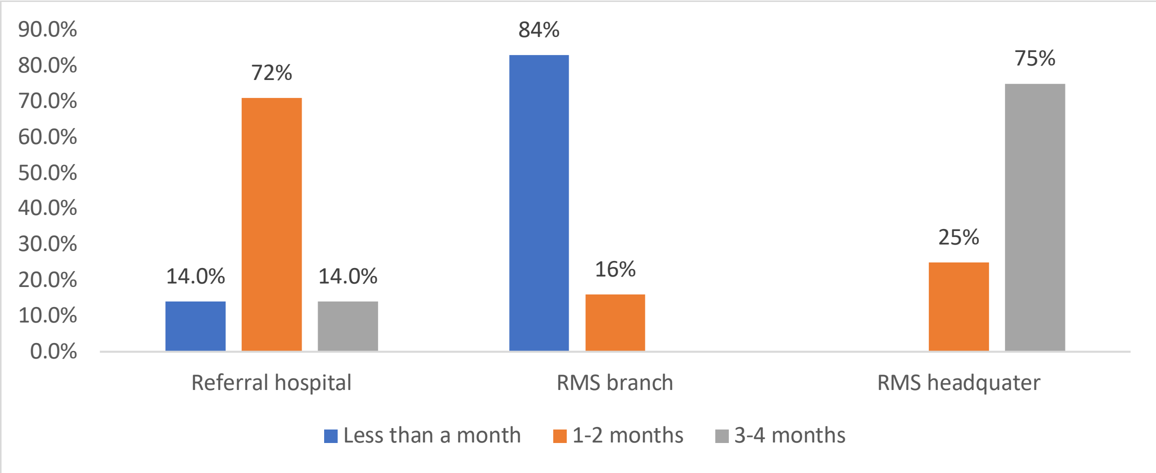

Figure 5 Delivery lead time decrease

Figure 5 shows that the lead time decreases proportionally to the facility levels compared to the prior system. It was decreased from 3-4 months at RM Headquarter as confirmed with 75 % of respondents. 84 % of respondents confirmed that the decrease was less than a month at RMS Branches while 72 % said that the decrease was 1-2 months at Referral Hospitals.

4.2.5 Respect of delivery time by RMS

To measure the performance of the system regarding the respect of delivery time, 24 orders were considered at RMS Branches and referral hospital level distinctly as they receive medicines from RMS headquarter. For that purpose, 12 orders before and 12 orders after the creation of RMS were selected. Figure 6 and figure 7 described the findings.

Figure 6 Order delivery performance before RMS

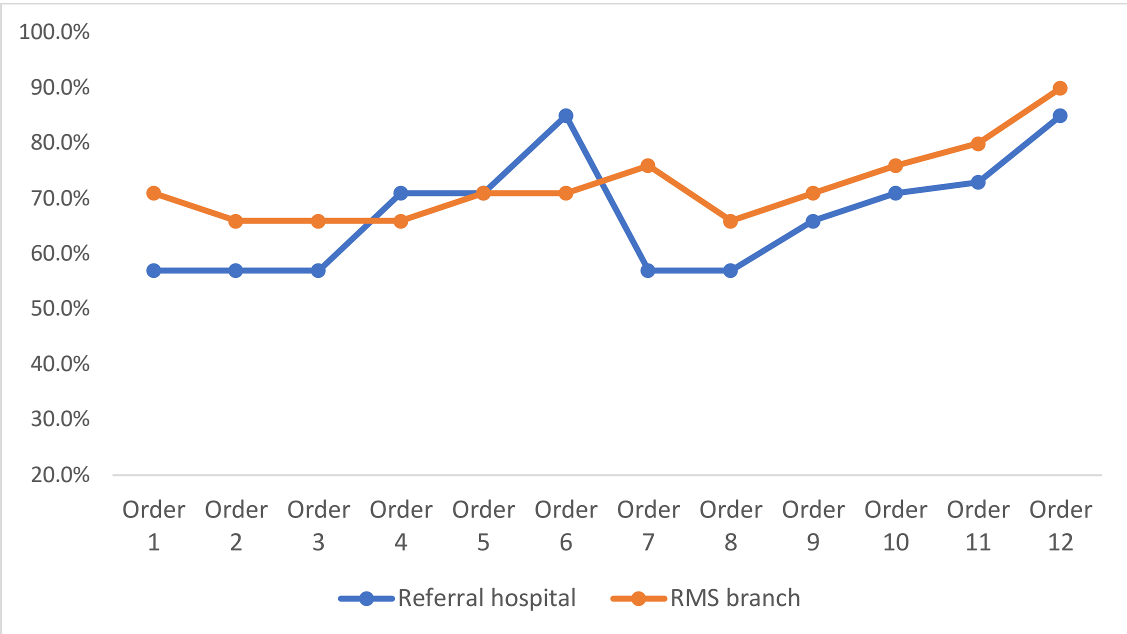

Figure 7 Order delivery performance after RMS

Figure 6 shows a fluctuation in time delivery whereby figure 7 shows that after the creation of RMS the delay of delivery lead time consistently decreased. For referral hospitals the delay time decreased consistently between 57 % and 85 %.

4.2.6 Perception of procurement methods and contracts

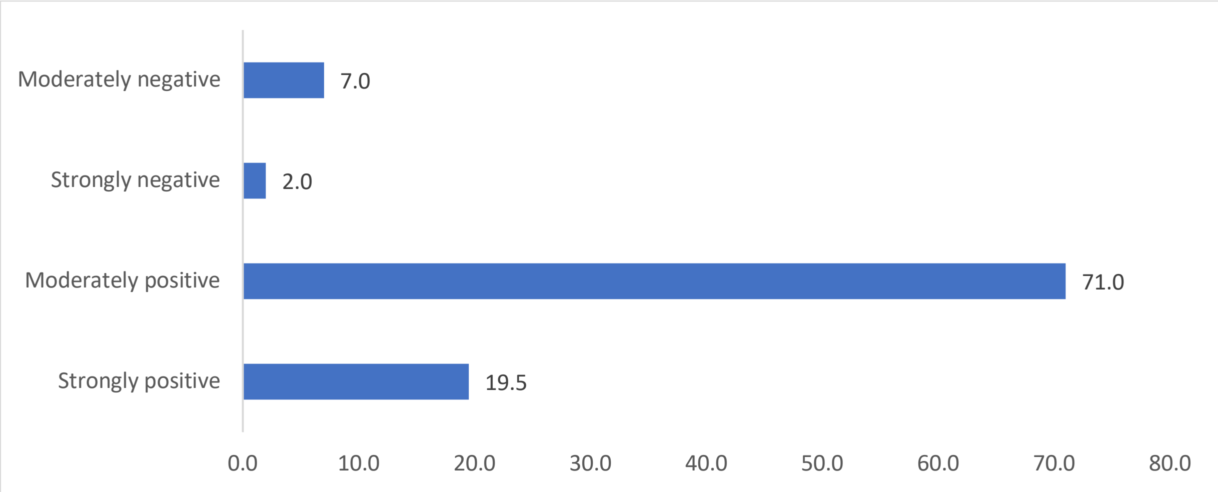

Figure 8 Procurement methods perception

The results presented in figure 8 show that the respondents of this research have appreciated the change in procurement practices including the methods and contract used to avail the essential medicines whereby 71 % and 19.5 % confirmed respectively that the current procurement method and contract affected strongly and moderately improve the availability of health essential medicines.

4.3 Inventory management practices

This section presents the results on the inventory management practices by appreciating its inputs for the availability of essential medicines following the creation of RMS. Responses were collected to describe the use of existing standards operating procedure, the stock levels, and the inventory count practice.

4.3.1 Inventory counts practices and stock level

By considering the inventory counts change in management of stock and standards, from table 4, 66 % of respondents said that the inventory count frequency has changed after the creation of RMS where, in addition to the irregular monthly inventory at RMS branches, there are semi-annual and annual mandatory inventories conducted at both RMS headquarter warehouses and

RMS branches. Regarding the existence of new SOPs for inventory management, 68 % of respondents confirmed that the new SOPs consider the stock levels at the rate of 78 %.

Table 4 Change in inventory management

Variable	Values	Frequency (%)
Change in inventory count frequency	Changed	27 (66)
	No change	14 (34)
Having new SOP for inventory	Doesn't have	13 (31)
	Having	28 (68)
Existence of level base on stock levels	Don't exist	9 (22)
	Existing	32 (78)

4.3.2 Maintenance of stock levels

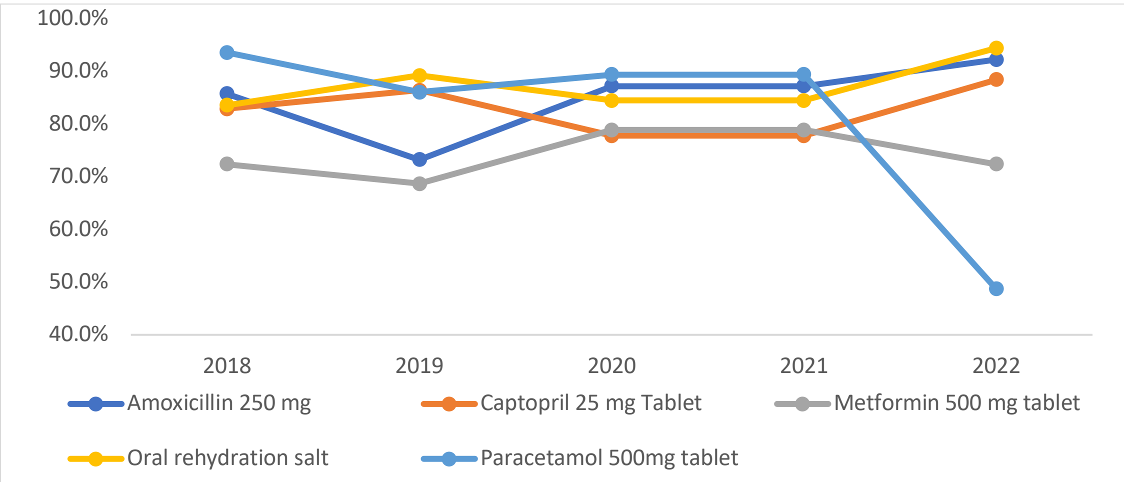

Figure 9 Maintenance of stock levels (Min/max)

By using 5 tracer commodities to assess the maintenance of stock levels; information depicted in figure 9 shows that the stock level maintenance improved with the creation of RMS Ltd. The respondents said that for quick moving products, RMS prefers to increase the level of stock as the system is not yet stable, and data are not fully accurate. The results revealed that following the creation of RMS, the availability of medicines increased. The stock management has improved following the creation of the RMS in 2020 where we found that the percentage of essential medicines stored with minimum and maximum stock has increased from 70 % to 90 % in the second years of RMS (2022) except on paracetamol 500 mg tablet that was out of norms at all levels.

4.3.3 Orders management and product availability

As per table 5, the emergency orders decreased generally and 36 % of respondents confirmed a decrease ranging between 10 % and 20 % while 43 % claimed a decrease of below 10 % of emergency orders. Medicines' availability has improved according to the results with an availability ranging between 70 %-90 %. Essential medicines have been the most positively affected by the creation of RMS Ltd compared to program products (see table 5 below).

Table 5 Availability of essential medicines and emergency orders

Variable	**Values**	**Frequency (%)**
Category of medicines availability	Both	15 (36)
	Essential medicines	17 (41)
	None of the above	5 (12)
	Program products	4 (9)
Rate of emergency orders decrease.	>50 %	2 (4)
	0 %-10 %	18 (43)
	10 %-20 %	15 (36)
	20 %-50 %	6 (14)
Rate of availability for health commodities	<70 %	4 (9)
	>90 %	2 (4)
	70 %-80 %	17 (41)
	80 %-90 %	18 (43)

The availability trend has increased consistently with the creation of RMS as observed within figure 10.

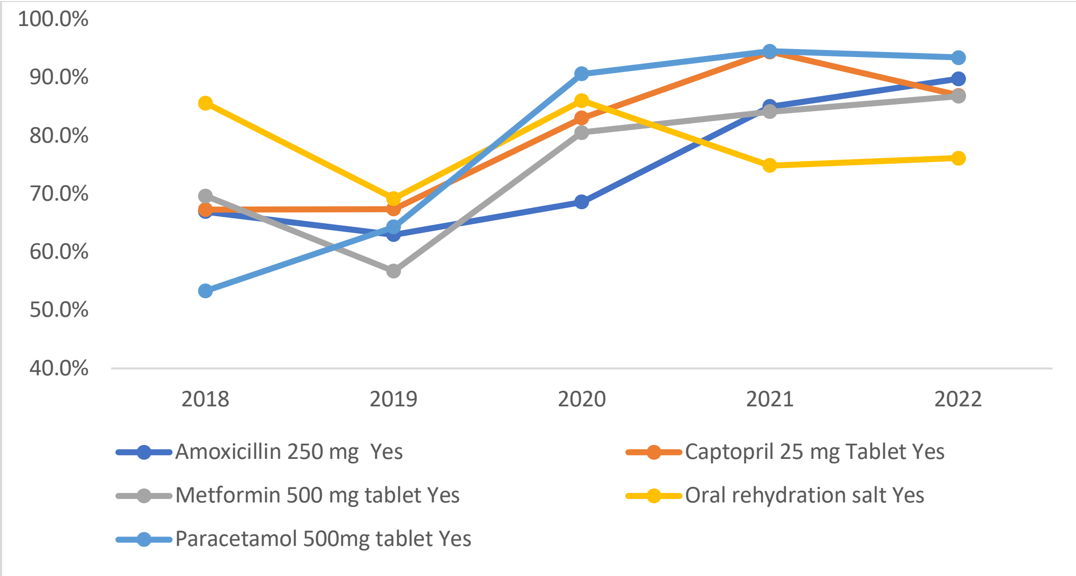

Figure 10 Trend on the availability of essential medicines

The results in figure10 show that all the five essential medicines have been available on a consistent basis since the creation of the RMS. The availability of metformin 500 mg tablet decreased in 2019 before the creation of RMS and has increased consistently up to an availability percentage of 90 % in 2022. The oral rehydration salt has slightly decreased between 2020 and 2021 but other medicines' availability has increased since 2020.

4.3.4 Perception of the RMS inventory practices

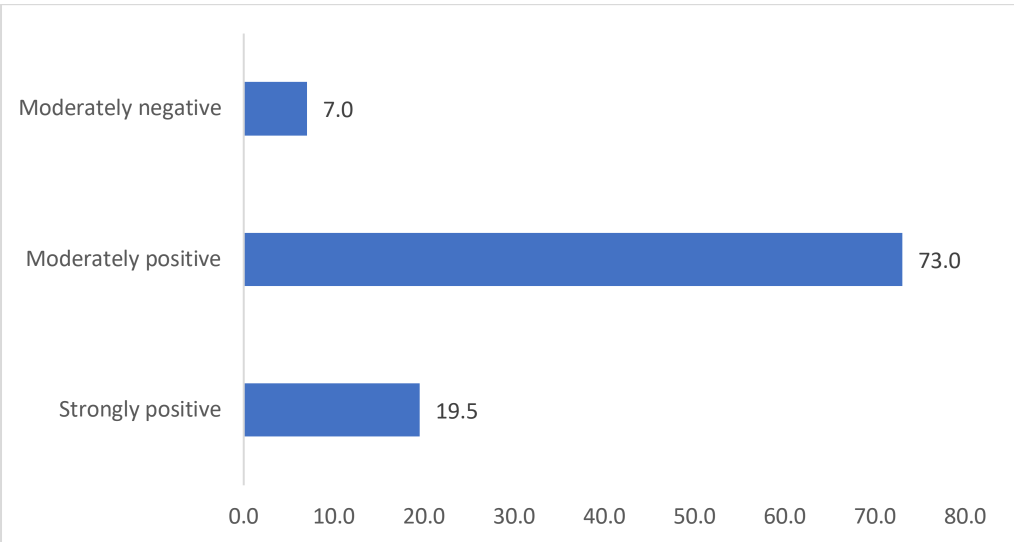

Figure 11 Perception of availability of inventory practices

Respondents have a positive perception of inventory changes practices on the availability of essential medicines. As illustrated in figure 11 below, 92.5 % of respondents confirmed that the current practices brought a positive result while 7 % still need to be satisfied by the changes.

4.4 Data record quality

This section presents the results on data record quality management of the health supply chain using electronic logistics management information systems. The study focused on the use and the reliability of data to inform decision making.

4.4.1 e-LMIS data quality and use

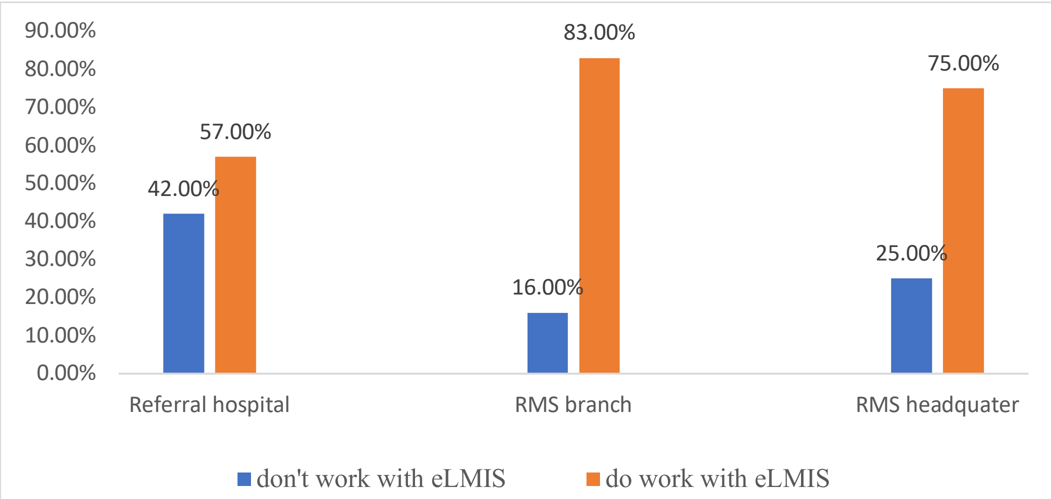

Figure 12 Use of e-LMIS data

Results depicted in figure 12 demonstrate that e-LMIS data are used at a rate of 83 %, 75 % and 57 % respectively at RMS Branches, RMS HQ and referral hospitals.

4.4.2 Mechanisms to ensure quality of recorded data

Table 6 presents the results on the mechanisms that are used to ensure the quality of data records at concerned levels.

Table 6 Mechanism to ensure data quality

Mechanism	Referral hospital (%)	RMS branch (%)	RMS headquarter (%)
No systematic mechanism	2 (28)	1 (4)	0
Period internal data review meetings	1 (14)	5 (16)	0
lower levels Feedback from higher level	2 (28)	4 (13)	0
Periodic data triangulation	1 (14)	5 (16)	3 (75)
Supervision of lower levels	1 (14)	15 (50)	1 (25)

The results in table 6 above show that in RMS headquarters the mechanisms used are data triangulation with a score of 75 % and supervision of lower levels with a score of 25 %. The same supervision is the most used at the RMS branches with a score of a 50 % followed by data triangulation with a score of 16 % whereas at referral hospital feedback from higher level dominates the mechanisms in combination with periodic internal data review and supervision of lower levels.

4.4.3 Appreciation of data quality management

Most of the respondents have always used the data quality management tools at a rate of 58 % and those that use e-LMIS data are estimated at 21 % while those that used rarely were only 4 % as described in figure 13 below.

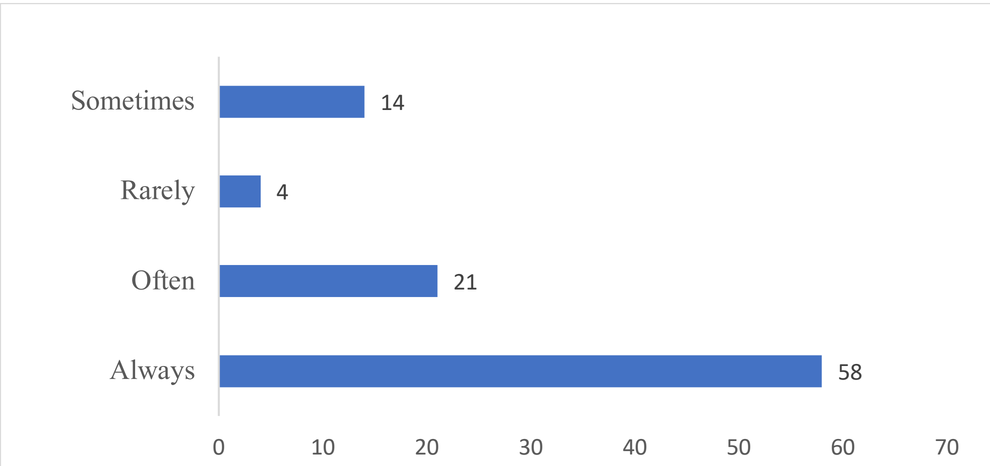

Figure 13 Appreciation on the use of e-LMS in data

4.5 Management of supply chain human resource

This section describes the change in staff management after the creation of RMS Ltd and portrays the staff turnover and maintenance, staff motivation and salary increment.

4.5.1 Change in staff management after the new supply chain

Table 7 Human resource change after creation of RMS

Variable	Values	Frequency (%)
Staff maintained	50 %-75 %	25 (61)
	75 %-85 %	12 (29)
	85 %-100 %	4 (10)
Staff turnover	>30 %	2 (5)
	0 -5 %	16 (39)
	20 %-30 %	9 (22)
	5-10 %	14 (34)
Average salary increases	<10 %	15 (36)
	10 %-20 %	13 (32)
	20 %-30 %	4 (10)
	30 %-50 %	6 (14)
	50 %-100 %	3 (7)

From table 7, it has been revealed that the creation of RMS has affected the staff management in terms of maintenance where 61 % of respondents have claimed that between 50 %-75 % of the existing, in both MPPD and DPs, staff have been maintained. The staff turnover has been described as low where it was confirmed to be between 0 %-5 % and 5-10 % respectively by 39 % and 34 % of the respondents. From the above results, the salary increase has been below 10 % for 36 % of the respondents.

4.5.2 Appreciation on the change in human resource management

The results in figure 14 show that 75 % of the respondents at RMS headquarter are motivated into their responsibility, 67 % confirmed to be motivated at RMS branches and 71 % of respondents from referral hospitals confirmed being motivated. Considering all the levels, an average of 71 % of respondents were motivated while 29 % are not motivated within their responsibilities. The information provided by staff at both RMS headquarter and RMS branches shows that the strategies in place to manage the staff are appreciated by the respondents.

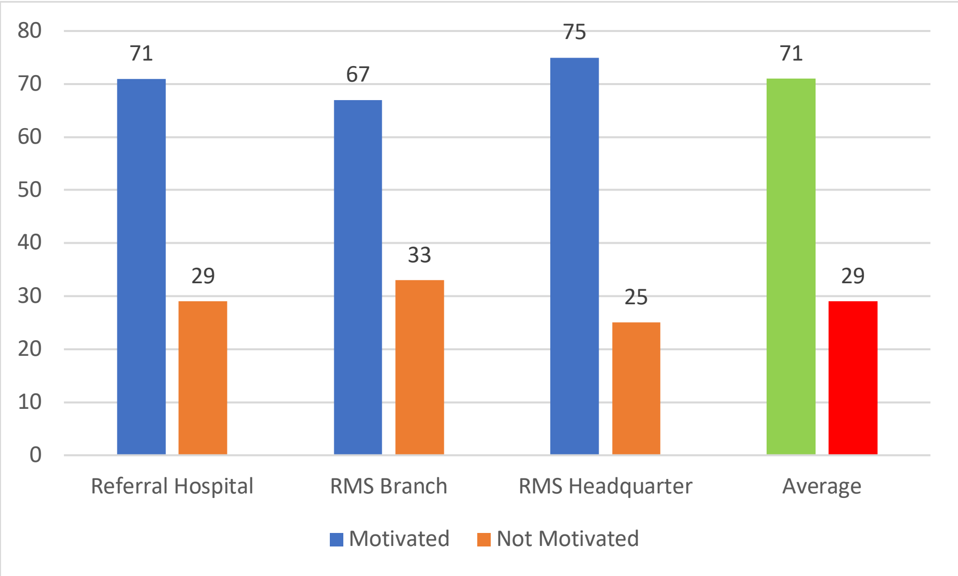

Figure 14 staff motivation status

Chapter V. Discussion

This chapter discusses the findings of the study on the effect of RMS's procurement processes, inventory practices, data records quality and human resources management on the availability of essential medicines.

5.2 Effect of RMS's processes on the procurement of essential medicines

The target of creating RMS was to have an entity which is autonomous and equipped with flexibility in procurement to achieve an optimum level of essential medicines availability. Before RMS creation, District Pharmacies and hospitals were autonomous regarding procurement and could procure themselves using various procurement methods such as open tender, restricted method, requestioning for quotation if the requested products were not found from the central medical stores (25). The results from our study demonstrated that, in contrast to the former public procurement system, the new system allows RMS branches (former DPs) to no longer go through procurement processes which considerably reduced the requisition and delivery cycle time of essential medicines. This is in contrast to what was revealed by the research of Mbonyinshuti which pointed the lead time as a root cause of essential medicines shortage before the creation of RMS Ltd and the implementation of the new approach(10). The procurement practices have been appreciated by over 90 % of the respondents which meet the will of the government of Rwanda to improve the procurement system of health commodities.

5.2 Effect of RMS's processes on inventory management practices

Well organized inventory practices are a very key component to achieve availability of healthy commodities. As per the results of this study, it was revealed that the products availability of Amoxicillin and captopril, two essential medicines, increased respectively to 89.9 % and 87 % with the creation of RMS contrary to what was revealed by the research conducted by Bizimana where the availability of these products was respectively less than 30 % and 80 % (9). The increase was observed for metformin and paracetamol as well. The results of this study showed that the creation of RMS resulted in the increase of the availability of some essential medicines and changes in other supply chain components as it has been demonstrated in Singapore, Benin and Zambia (8) (5) after the redesigning of the existing systems. The results showed that the inventory count changed where there are two mandatory inventories conducted to ensure accountability and 92.5 % of the respondents appreciated the inventory management influence on the availability of essential health products. It was demonstrated also that the stock levels of some essential health products are stocked between the minimum and maximum levels.

5.3 Effect of RMS's processes on data record quality

The results of the present study showed that the data record quality improved with regular implementation of clear mechanisms at different levels. In contrast to what was claimed within findings of the National Supply Chain Assessment conducted in 2017 where all levels in supply chain were not basing on e-LMIS records to decide about needs in essential medicines, the results of the present study showed that e-LMIS data are being used at a score of 83 %, 75 % and 57 % respectively at RMS branches, RMS headquarter and referral hospitals (29).From the results, it was demonstrated that over 79 % of the respondents appreciated the quality of e-LMIS data what justify its use for supply chain decision making.

5.4 Effect of RMS's processes on human resources management

The creation of RMS resulted in merging institutions that were autonomous before in terms of HR management. This study showed that a reduction of staff was implemented, and the working environment has become more conducive as 71 % of respondents claimed to be motivated in their supply chain responsibilities with the increase of salary. However, the results of the presents study on staff turnover showed no significant change because it was 8 %, 10 % and 7 % respectively at referral hospitals, DPs and MPPD(29) in the 2017's NSCA and it was found to be between 0-5 % and 5 %-10 % respectively by 39 % and 34 % of the respondents which is translated into an interval of 0 %-10 % by 73 % of the respondents. The increase of salary, conducive working environment and good practices which are in line with the recommendations of People that Deliver to retain capable and productive staff (35).

Chapter VI. Conclusion and recommendations

6.1. Conclusion

The results of this study firmly support moving from public to state-owned private health supply chain systems by merging MPPD and DPs to create the Rwanda Medical Supply Limited improved procurements, inventory management, data records quality and human resource management which resulted into the increase of the availability of some essential medicines.

Following the creation of RMS Ltd, the changes were observed in procurement practices where RMS branches and referral hospitals proceed mainly with the direct purchase resulting in a decrease of procurement cycle time, delivery lead time as well as contract method. The contribution of the inventory management practices was confirmed by a clear decrease in the number of emergency orders, an increase in products stocked according to plan, and the increase of essential medicines availability.

RMS headquarter and RMS branches base their ordering and reordering decision on e-LMIS data whose quality is ensured and improved through different mechanisms such as the supervision of lower level by upper level, getting feedback from high level, periodic data triangulation with high predominance of the supervision of the lower level by the upper level. The use of e-LMIS data in referral hospitals is still lower but it has increased with the creation of RMS Ltd as has been shown and discussed in chapter 5 of this research.

From the results of this study, the creation of RMS has not decreased the staff turnover but standard practices in staff management such as salary increase, and creation of a conducive working environment assisting to maintain competent, experienced, and motivated supply chain staff have been implemented.

6.2. Recommendations

From the above results and conclusion, the researcher strongly recommends the following to improve the well-functioning of the reformed supply chain system to achieve high availability of essential medicines.

EAC Supply chain bodies:

- Learn from the reform of health supply made in Rwanda and plan to implement them in other state members based on the good results they brought.

To the Ministry of Health:

- Strengthen the use of e-LMIS at referral hospitals to ensure that accurate and real time data are accessible.
- Plan regular supervision of health facilities with special attention to referral hospitals.

To Rwanda Medical Supply Limited:

- Review the guidelines regarding stock levels at both central and regional warehouses.
- Harmonize guidelines regarding the inventory count practices across the branches.

To Referral Hospitals:

- Strengthen the use of e-LMIS to avail real time data that will support the decision made for accurate national forecast and supply plan to avoid stock out.

To researcher:

- Further research may be carried out to deeply understand each component in a wide manner and extend it to the levels that were not considered including.

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Appendices

A. Research plan

Timeline	Activities
April-June 2022	Finalizing study proposal Application for ethic clearance Drafting literature review Drafting data collection tool
February- March 2023	Data collection Data processing
March-April 2023	Data analysis Draft first version of dissertation Submission of first draft of dissertation
April 2023	Addressing manuscript reviewer comments Second draft dissertation writing and submission. Addressing manuscript reviewer comments
May 2023	Defense of dissertation Final submission
June-July 2023	Publication in scientific journal

B. Proposed budget

Nº	Item	Persons/ Materials	No. of days/Quantity	Cost/Unit (RWF)	Total RWF
1	Transport allowance for data collectors	3	5	15,000	225,000
3	Accommodation allowance and meals for data collectors	3	4	35,000	420,000
	Data cleaning and data entry	2	3	35000	210,000
4	Data analysis	1	5	25,000	125,000
5	Printing of draft and final thesis	1	6	10000	60,000
	Publication in scientific journal	1	1	1,000,000	1,000,000
Total					**2,040,000**

C. Consent form

<u>Title:</u> EFFECT OF REDESIGNING PUBLIC TO STATE-OWNED PRIVATE HEALTH SUPPLY CHAIN SYSTEM ON THE AVAILABILITY OF ESSENTIAL MEDICINES IN RWANDA

Introduction

My name is **Evariste NARIBUMBYE**, a graduate student in Health Supply Chain Management at the University of Rwanda in the East African Community Regional Center of Excellence for Vaccines, Immunization, and Health Supply Chain Management and am currently seeking your kind support to participate in research.

Purpose of the research

This study aims to evaluate the effect of shifting from public to state-owned private health supply chain system on the availability essential medicines, vaccines, and technologies.

Voluntary participation

Your participation in this study is voluntary. It is your choice whether to participate or not. The choice that you make will have no bearing on your professional standing or your everyday life. You may change your mind later and stop participating even if you agreed earlier.

Procedures

A question was prepared to collect needed information and data about the effect of transforming the public supply chain into state-owned private supply chain on the availability of health products. Questions will focus on role of new procurement mechanisms, inventory management, data quality management and human resources on the current results the country has in terms of health products availability. We request that you ask as many questions as you wish to make sure that you understand the procedures for the study, the risks, and the benefits. After you are advised to choose to participate and sign this consent form freely, then the interview will commence.

Duration

The interview and information checking will take approximately 45 minutes of your time. And your answers will be put together with answers from other Community Health.

Risks and Discomforts

The risks to you as a participant in this study are minimal. During the interview, you may decide to share information. But, again, you may decline to answer any questions that you do not wish to answer or stop the interview at any time without giving any reasons.

Benefits and Reimbursements/ Incentives

There will be no direct benefit to you, but with your participation, we expect improvement of supply chain service level with decisions that targeting improvement in the availability of health products. You will not receive any payment or any other benefit from taking part in this study, but your participation in this research is essential.

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.

Sharing of Research Findings

We will in the future publish on the process and the results, but you and your feedback will remain anonymous.

To Whom to contact in case you have questions about your rights as research participant

All research on human volunteers is reviewed by Rwanda National Ethical Committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject, or if you would like to obtain information or offer input, you may contact the CMHS Institutional Review Board (IRB) through the:

Chairperson: ……………………………..
Mobile phone: ……………….
………………………

Secretary: ………………………………….
Mobile phone:

If you have any questions about this research, you may address your query to lead investigators:

Local Lead Investigator: Evariste NDARIBUMBYE **Tel**: 0788840915

Supervisor: Ass. Professor Raymond MUGANGA **Tel:** 0788531520

If you choose to be part of this research study, I will also give you a copy of this consent form to keep for yourself.

Do you have any questions?

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 to 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)**

D. Questionnaire

PART 0. IDENTIFICATION AND DEMOGRAPHIC INFORMATION

1. The level of facility?
   - ☐ RMS HQ
   - ☐ RMS Branch
   - ☐ Referral Hospital
2. The age group?
   - ☐ 20-29 years
   - ☐ 30-39 years
   - ☐ 40-49 years
   - ☐ Above 50 years
3. Gender?
   - ☐ Male
   - ☐ Female
4. Professional of the respondent?
   - ☐ Pharmacist
   - ☐ Human resource
   - ☐ Inventory officer
   - ☐ Data Manager/Data analyst
5. Highest education level?
   - ☐ Bachelor’s degree
   - ☐ Master
   - ☐ Other
6. Working experience?
   - ☐ Less than 2 years
   - ☐ 2-3 years
   - ☐ 4-5 years
   - ☐ Above 6 years

PART ONE: PROCUREMENT PROCESS

7. Has the procurement process method changed after the creation of RMS?
   - ☐ Yes
   - ☐ No
8. What is the procurement method that is most used at this level? (Select more than one)
   - ☐ Open tender
   - ☐ Restricted method
   - ☐ Request for quotation
   - ☐ Direct purchase

9. Has the type of contract method changed after the creation of RMS?
   - ☐ Yes
   - ☐ No
10. What is the type of contract method preferred/used by this level?
    - ☐ Mostly framework contract and less one-off contract
    - ☐ Mostly framework one-off contract and less framework contract
    - ☐ No contract

11. How has the lead time decreased compared to the period before the creation of RMS?
    - ☐ Less than one month
    - ☐ 1-2 months
    - ☐ 3-4 months
    - ☐ Above 4 months

12. How can you rate the effect of RMS procurement system on the availability of essential medicines compared to previous public supply chain system?
    - ☐ Strongly positive
    - ☐ Moderately Positive
    - ☐ Moderately negative

PART TWO: INVENTORY MANAGEMENT

13. Are there new SOPs for inventory management at this level of supply chain that consider inventory levels (Select one)
    - ☐ Yes
    - ☐ No
14. Are the stock levels based on during procurement or reordering of new stock?
    - ☐ Yes
    - ☐ No
15. What is the range of the availability rate of essential medicines?
    - ☐ <70 %
    - ☐ 70-80 %
    - ☐ 80-90 %
    - ☐ >90 %
16. Which category of medicines availability has been most positively affected by the new inventory management practices? (Select one or two)
    - ☐ Program products
    - ☐ Essential medicines
    - ☐ All
    - ☐ None of the above

17. How have RMS inventory management practices affected the availability of essential medicines? (Select one)
    - ☐ Strongly positive
    - ☐ Moderately positive
    - ☐ Moderately negative
    - ☐ Strongly negatively
18. Has the inventory count frequency changed after the creation of RMS? (Select one)
    - ☐ Yes,
    - ☐ No
19. At which rate have emergency orders decreased after the creation of RMS?
    - ☐ 0-10 %
    - ☐ 10-20 %

- ☐ 20-50 %
- ☐ >50 %

20. How have RMS inventory management practices affected the availability of essential medicines? (Select one)
    - ☐ Strongly positive
    - ☐ Moderately positive
    - ☐ Moderately negative

PART THREE: DATA RECORDS QUALITY

21. Does this level use e-LMIS data to support decision about ordering and reordering?
    - ☐ Yes
    - ☐ No
22. Which mechanisms are used at this level to ensure e-LMIS data records quality?
    - ☐ Periodic internal data review meetings
    - ☐ Supervision of lower levels
    - ☐ Feedback from higher level
    - ☐ Periodic data triangulation
    - ☐ No systemic mechanism
23. How frequently and confidently do you use e-LMIS data to make your decision?
    - ☐ Always
    - ☐ Often
    - ☐ Sometimes
    - ☐ Rarely

PART FOUR: HUMAN RESOURCE MANAGEMENT

24. What is the percentage of staff maintained during the merging of MPPD and DPs? (Question for HR)
    - ☐ 50 %-75 %
    - ☐ 75 %-85 %
    - ☐ 85 %-100 %

25. How can you rate staff turnover at this level of supply chain?
    - ☐ 5-10 %
    - ☐ 20-30 %
    - ☐ >30 %

26. What is the average salary increase for qualified supply chain professional compared to the former system?
    - ☐ 20-30 %
    - ☐ 30-50 %
    - ☐ 50-100 %
27. Do you feel motivated in your responsibilities?
    - ☐ Yes
    - ☐ No

To check availability of health products, data for five products will be recorded during data collection for 24 months before and 24 months after

- **data shall be collected from the accessible recording systems using checklist.**
- **If a product has been stocked out for more than 15 days in a quarter, then it is considered to be stocked during that period.**

Year	Quarter	Amoxicillin 250 mg Tablet/capsule	Captopril 25 mg Tablet	Metformin 500 mg tablet	Oral rehydration salt	Paracetamol 500mg tablet
2018	Q4					
2019	Q1					
	Q2					
	Q3					
	Q4					
2020	Q1					
	Q2					
	Q3					
	Q4					
2021	Q1					
	Q2					
	Q3					
	Q4					
2022	Q1					
	Q2					
	Q3					

To check if the product was stocked following stock level policy range, data for five products will be recorded during data collection for 24 months before and 24 months after (data shall be collected from the accessible recording systems using checklist)

Year	Quarter	Amoxicillin 250 mg tablet/capsule	Captopril 25 mg Tablet	Metformin 500 mg tablet	Oral rehydration salt	Paracetamol 500mg tablet
2018	Q4					
2019	Q1					
	Q2					
	Q3					
	Q4					
2020	Q1					
	Q2					
	Q3					
	Q4					
2021	Q1					
	Q2					
	Q3					
	Q4					
2022	Q1					
	Q2					
	Q3					

Data on procurement/ordering performance (the number may be less depending on the frequency of ordering at the site and one order is enough for two months

Period	Order	Issue date	Expected delivery	Actual delivery date
Before	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
After	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			

Ethical Clearance

UNIVERSITY *of* RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DIRECTORATE OF RESEARCH & INNOVATION

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali 9th/01/2023
Ref: CMHS/IRB/**027**/2023

NDARIBUMBYE Evariste
EAC Regional Centre Of Excellence For Vaccines, Immunization & Health Supply Chain Management
College of Medicine and Health Sciences, UR

Dear NDARIBUMBYE Evariste

RE: <u>ETHICAL CLEARANCE</u>

Reference is made to your application for ethical clearance for the study entitled ***"Effect Of Moving From Public To State-Owned Private Health Supply Chain on the Availability of Essential Medicines in Rwanda".***

Having reviewed your application and been satisfied with your protocol, your study is hereby granted ethical clearance. The ethical clearance is valid for one year starting from the date it is issued and shall be renewed on request. You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. In addition, at the end, the IRB shall need to be given the final report of your study.

We wish you success in this important study.

Prof Stefan JANSEN
Ag 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

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

Authorization to collect data in RMS Branches

RWANDA MEDICAL SUPPLY
Faster | Reliable | Affordable

Kigali, 14/2/2023

Ref: 445/ RMS/DCEO/BO/2023

Chief Executive Officer's Office

NDARIBUMBYE Evariste
KIGALI CITY
Student Reference: 220019121
E-mail : evariste.ndaribumbye@gmail.com

Dear Evariste,

RE: Response to the request for research of Data Collection

Reference is made to your letter received on 06th February 2023 applying for authorization to conduct research in Rwanda Medical Supply Ltd.

After thorough assessment of your study focus and methodology to be used, I have the pleasure to inform you that your request has been granted.

Sincerely,

Pie HARERIMANA
Chief Executive Officer of RMS

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