



**ASSESSMENT OF HEALTH SUPPLY CHAIN MANAGEMENT EFFICIENCY IN  
RWANDA: CASE OF NUTRITION AND NCD PRODUCTS**

By

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A THESIS

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**DECLARATION**

I, NDEKEZI Ignace, of my knowledge, hereby declare that the thesis titled “ASSESSMENT OF EFFECTIVENESS OF HEALTH SUPPLY CHAIN MANAGEMENT IN RWANDA: CASE OF NUTRITION AND NCD PRODUCTS” is my own work and has never been presented in any institution of higher learning for any academic degree.

Signature:

A handwritten signature in blue ink, consisting of several loops and a long horizontal stroke extending to the left.

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**SUPERVISORS' APPROVAL**

This research thesis was submitted for evaluation and review with my approval as a university supervisor.

Signature

A handwritten signature in blue ink, appearing to read 'Eric Nyirimigabo', written over a horizontal line.

**Dr. Eric NYIRIMIGABO**

## ABSTRACT

**Background:** In Rwanda, the supply of health commodities contains many items that we find out in supply chains, which present challenges and affect their efficient management. This study focused on two categories of products used in the non-communicable diseases program, and the mother, community, and child program. The objective of the study was to evaluate the management of the supply chain of these products.

**Methodology:** The present qualitative research was conducted towards different groups of the population from the central level including RBC/NCDs, RBC/MCCH, and RMS LTD to RMS branches as well as health facilities. The target population consisted of policy makers consisting of NCDs and MCCH staff, the quantification unit in charge of planning and inventory management from RMS headquarters, RMS branch managers and pharmacists chief of provincial and district hospitals. In total, the study was conducted among 79 respondents from central level to RMS branches, including hospitals, and the required information was saturated.

**Results:** Our study assessed the efficiency of supply chain management in Rwanda and was limited to NCDs and nutritional products, and the system was found to be efficient in providing products to customers even if it is facing different challenges to resolve in order to optimize its efficiency. At the central level, the policymakers in NCDs and nutrition, the supply chain is efficient and, at the peripheral level, its efficiency is low at the level of RMS branches and hospitals.

**Conclusion:** The Study participants highlighted challenges in managing the NCD and nutrition supply chain, including stock-outs, limited budget and poor quality data generated by hospitals. The management of the supply chain for nutritional and NCDs products is effective even though the obstacles still apparent, and once these difficulties are resolved, it will be effective at the highest possible level.

Keywords: *Supply chain, efficiency, NCDs products, Nutrition products.*

## **DEDICATION**

This thesis is dedicated to my lovely wife and to my Children.

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**LIST OF ACRONYMS**

HIV	: Human Immunodeficiency Virus
AIDS	: Acquired immunodeficiency syndrome
PFSA	: Pharmaceuticals Fund and Supply Agency
BPR	: Business Process Reengineering
MSD	: Medical Stores Department
MOPDD	: Malaria and Other Parasitic Diseases
STIs	: Sexually Transmitted Infections
TB	: Tuberculosis
NCDs	: Non-Communicable Diseases
MCCH	: Maternal, Neonatal, Child & Community Health
RBC	: Rwanda Biomedical Centre
CSB	: Corn Soya Blended
FBF	: Fortified Blended Food
RMS	: Rwanda Medical Supply Ltd
BUFMAR	: Bureau des Formations Médicales Agrées du Rwanda
MEDIASOL	: Medical and Allied Services Solutions
AIF	: Africa Improved Food
SC	Supply Chain
KII	Key Informants

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## CHAPTER I: INTRODUCTION

### 1.1 Background

Access to safe and affordable health products is important to improve the health system and achieve the Sustainable Development Goals (SDGs). For Low and Middle-Income Countries (LMICs) are at risk of undermined effectiveness of healthcare due to inadequate access to quality medical products [1][2]. Supply chain management system has an important role in making quality medical products available and affordable [3]. According to Haddad and al. (2019), the supply chain management is considered as the management of the process of activities regarding the flow of information, products, services and finance from upstream sources or manufacturers to downstream or end users essentially called clients. From a healthcare supply chain perspective, the upstream is the manufacturer of healthcare supplies while the customer is represented by the patient [4]. Parallel supply chains involve multiple parallel processes which are operated under the same structure or one organization or one sector serving the same customers [1]

According to Path Organization, the supply chain includes various programs, and each program is linked to a specific disease of national program/policy that the country needs to respond to. Hence, the most observed remark is that each program operates its activities, and needs to ensure to keep its supply chain and logistics even though they result in the same targeted population [5]. The supply chain integration involves the integration of all those activities, potential strategies, effective, efficient processes, and good practices in a common harmonized framework aiming at satisfying the customers, and patients. That integration includes the external stakeholders (suppliers, customers, and donors) and internal stakeholders [4].

As per the report on “Integration of Vaccine Supply Chains with Other Health Commodity Supply Chains” produced by OPTIMIZE, there are a lot of debates where some experts consider that those parallel fragmented supply chains help the programs to achieve their respective targets and others stress that those structures imply the unnecessary processes, complexity, and lack of coordination. Apart from these, the later experts keep supporting their statement that multiple parallel supply chains cause the waste of resources and scope which also increase the expenditure and, in the end, keeps observing the lack of efficiency. This lack of efficiency is a result of fragmented structures where coordination is a big challenge [5].

By Path Organization, one of the sources of parallel supply chains is programs' donor dependency whereby each program relies on a certain number of donors who/which imposes specific and separate product management reports [5]. In the same perspective as Path Organization, the literature shows that parallel supply chains are associated with redundant activities, lack of coordination, and poor sharing of information, which can lead to overstock and/or even expiries for some products and stock-outs as well.

The problem of a parallel health supply chain was observed in Nicaragua where all health supply chains were scattered. To address this concern of a parallel supply chain, Nicaragua took time to streamline the management of all essential medicines, contraceptives, HIV and AIDS commodities in one health supply chain management [6]. The problem was observed not only in Nicaragua, but also in different countries like Ethiopia, Tanzania, etc. To address those issues, Ethiopia streamlined the process by eliminating the parallel processes and forming one system. This removed unnecessary steps and established one point of entry and exists for all health supplies which is led by Business Process Reengineering (BPR) and implemented by the Pharmaceuticals Fund and Supply Agency (PFSA) [6]. The same approach had been adopted by Tanzania as well where the supply chain is managed by the Ministry of Health as the overall supervisor. Indeed, the flow is designed in the manner that the products are channeled from the Medical Stores Department (MSD) to hospitals and districts or other associated health facilities [6].

However, in Uganda, the healthcare supply chain is a structured, multi-tiered system that is established according to the administrative system in place. Which means that it is not technically built to respond to the expected healthcare performance [2]. In Kenya, the health supply chain is fragmented into three systems which include a public supply chain supported by the Kenya Medical Supplies Authority (KEMSA), a state corporation under the Ministry of Health, whose mission is to purchase and provide health products to the public and believers; while the Mission for Essential Medicines and Supplies (MEDS) supplies faith-based establishments and private wholesalers. [7].

## **1.2 Problem statement**

A proper supply of health commodities is essential to a robust health system [8]. In Rwanda, health commodities are supplied by Rwanda Medical Supply Ltd (RMS Ltd); Bureau des Formations Médicales Agréées du Rwanda (BUFMAR), Medical & Allied Service solutions (MEDIASOL), and other private wholesalers that supply pharmaceutical and medical products [9].

Apart from the countries mentioned above, the health supply chain in Rwanda still faces some challenges related to the management of the supply chain of health products and among these products are NCDs related products and nutrition.

Thus, a study assessed the factors which contribute to the expiration of medicines in Rwanda and found that the main cause was poor supply chain management [10], although it did not clarify the case of NCDs or nutritional products. Donors providing large quantities of medicines without effective collaboration with existing systems contribute to large numbers of expired medicines in many countries [10][11].

Rwanda receives donations of medicines and other medicines [10], but to our knowledge, no studies have been conducted out in Rwanda to assess the efficiency of supply chain management of health products specifically in nutrition and products against NCDs. Based on the above references, there was a need to conduct the assessment to highlight the efficiency of supply chains of health products in Rwanda and consider its integration which may solve the issue of lack of efficiency.

### **1.3 Purpose of the study**

In this regard, this study had the objective of assessing the efficiency of management of the health supply chain in Rwanda, especially, the supply chain of nutritional products and against NCDs. At the end of the evaluation, the results contributed to the overall assessment of the efficiency of supply chain management for nutritional and NCDs products.

### **1.4 Research objectives**

#### **1.4.1 General objective**

The general objective of this research was to assess the efficiency of the management of the health supply chain of nutrition and NCD products in Rwanda, from the central level to the RMS branches and up to the health facilities level.

### **1.4.2 Specific objectives**

The specific objectives were to:

- Assess the management of NCD and nutrition products at the central level in Rwanda.
- Assess the management of NCD and nutrition products at the peripheral level in Rwanda.
- Understand the mechanisms of mitigating challenges in supply chain management of those products products in Rwanda.

### **1.4.3 Research questions**

- How NCD and nutrition products are managed at the central level in Rwanda?
- How NCD and nutrition products are managed at the peripheral level in Rwanda?
- What are the mechanisms of mitigating challenges in supply chain management of NCD and nutrition products in Rwanda?

### **1.4.4 Significance of the study**

The objective of the study was to evaluate the supply chain management of health products. In Rwanda, the procurement of health products includes many elements, found in supply chains, which present challenges and affect the efficiency of their management. If the healthcare supply chain is integrated into a single supply system, products must be available in a timely manner and in maximum quantities to healthcare services. This study focused on two categories of products used in non-communicable diseases program, and mother, community, and child program.

### **1.4.5 Organization of the study**

This study is composed of three chapters where the first chapter relating to the context, the statement of the problem, the objectives, the research questions, the justification and the organization of the study. The second chapter concerns the literature review which highlights knowledge related to the management of the health supply chain in Rwanda. The third chapter discusses the research methodology used in this study.

## **CHAPTER II: LITERATURE REVIEW**

### **2.1 Introduction**

This chapter comprises a review of publications including papers from various authors which discuss mainly the management of supply chain, and supply chain integration, health programs in Rwanda and health products assessed in this study.

### **2.2 Supply chain management**

Supply chain management includes all synchronized activities involved in manufacturing a product from the early stage of raw material up to the final product and customer. It can be also defined as the management of these activities [12]. A well-organized supply chain management helps to quickly deliver a good service or product to the client [13]. The role of supply chain management is to perform systematic monitoring of the movement of goods or services purposely to optimize the efficiency and value of the supply chain [14]. The management of the supply chain objective is to get the added value, and to achieve this value. The most current companies' supply chain management includes "inventory management, transportation service procurement, materials handling, inbound transportation, transportation operations management, and warehousing management" [12], [15].

The organization of the health supply chain is essential to the health system which functions on optimum level. The health supply chain system includes all structures and processes for the supply, procurement, transportation and distribution of essential medicines and other health supplies to the end users. A good, well-functioning healthcare supply chain moves supplies and medications from manufacturers to end users in a way that maximizes availability and affordability [2].

### **2.3 Supply chain efficiency**

For an efficient supply chain, it is quite recommended to avoid all kinds of multiple supply chains, and hence avoid any duplicated supply chains. This approach can be beneficial to reduce the risk of stock out, but it needs to be planned. From this perspective, the efficient supply chain responds to all challenges encountered, like redundancy or duplication of activities and operations which are costly to the company and supply chain, the waste of resources, and lack of linkage among supply chain members and contributes to poor performance. In addition, the procurement is fragmented and done at different levels which leads to a lack of coordination which result in overstock and expiries for some products. Not only the overstock but also, the disruption of products due to a lack of coordination [6].

### **2.4 Integration of supply chain**

The integration of supply chain is related to all information and systems being exchanged to all stakeholders upstream and downstream. In other words, the information and systems are communicated from planning to the reception of the product by the customers [16]. Supply chain integration aims at integrating products in one system, to exchange the products and information throughout the supply chain. The efficient supply chain integration includes joint planning, effective collaboration, information sharing and teamwork that improve supply chain performance and ensure on-time patient expectations. The integration of supply chains is one of the solutions to ensure efficient supply chain management that streamlines all activities and efforts, which results in good health service delivery to the population. This is achieved through different changes such as improving quantification and procurement processes, improving data visibility and strengthening the capacity of human resources who manage that system [6].

Indeed, integration of the supply chain has at least valuable benefits compared to parallel supply chains. That integration includes some activities like information sharing, planning, coordination and finished goods throughout all levels of the supply chain. The benefits of integration of the supply chain are wide, and include improvement in profit and customs satisfaction [17], [18].

As per USAID Deliver Project (2009), the main objective of integration is to enhance the efficiency and reduce the activities which are redundant. The same literature offers the opportunity to

understand the way Nicaragua has improved the supply chain efficiency for contraceptives and HIV/AIDS commodities, which approach has been extended to essential medicines. This approach is being experienced by Ethiopia whose public health commodities are challenged through Pharmaceuticals Fund and Supply Agency (PFSA) and it is the case for Tanzania whereby the data and health products are consolidated and managed in one entity which is Medical Stores Department (MSD) [6]. The integration of the supply chain develops a better link between demand and supply, which can both enhance customer service and reduce costs.

## **2.5 Health Programs in Rwanda**

Rwanda, like other countries, has different health programs such as Malaria and Other Parasitic Diseases (MOPDD), HIV/AIDS, STIs and Viral Hepatitis (HIV), Nutrition, Mental Health, Tuberculosis, other respiratory communicable diseases, and leprosy (TB), Non-Communicable Diseases (NCDs), Maternal, Neonatal, Child & Community Health (MCCH) managed in various divisions of Rwanda Medical Center (RBC). All those programs are established to help the Ministry of Health and the Country, in general, to achieve the health and economic development standard of the Rwandan population [19]. To achieve the national objectives, each program has its own strategies to implement. Those strategies are mainly composed of various activities to be performed and several health products involved in life improvement.

Even if the list of those products is long, they are specifically inherited by the specific program, but sometimes they are cross-cutting to other programs. In other words, they flow in different supply chains. Indeed, in our health supply chain, we observe a few products like essential medicines, medical consumables, medical equipment, health commodities used in HIV, malaria, family planning, products for non-communicable diseases, and products for child and adult nutrition, etc. Considering some of the programs such as Non-Communicable Diseases (NCDs), Maternal, Neonatal, Child & Community Health (MCCH), we can highlight some cross-cutting products managed by those programs.

### ***a. Non-Communicable Diseases (NCDs)***

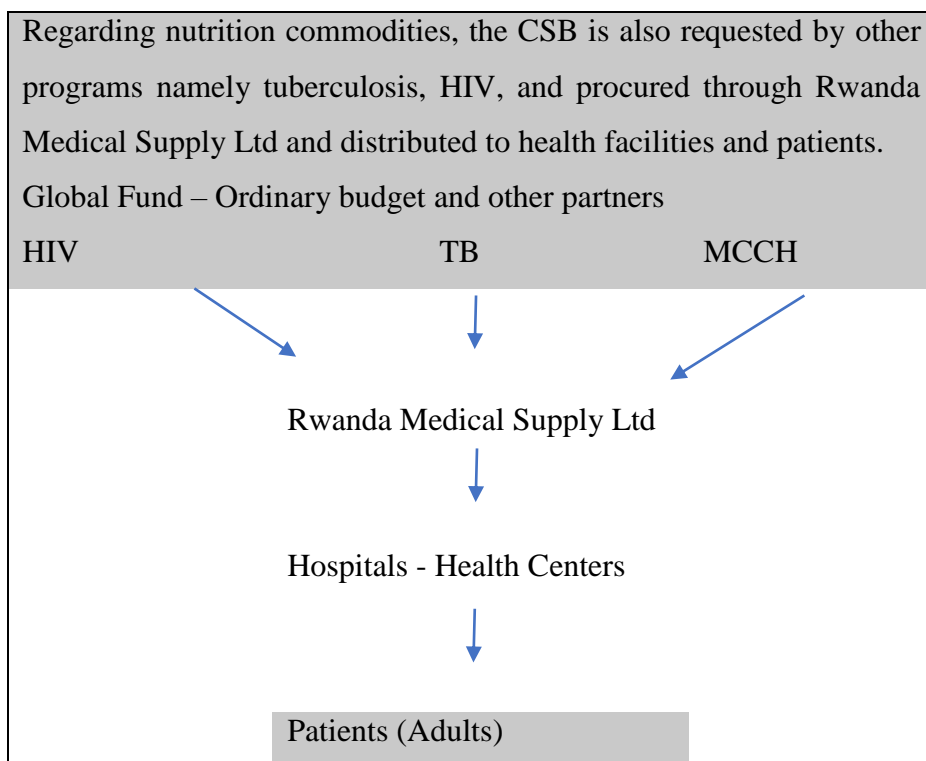
In NCD program, one of the adopted strategies is to ensure the regular availability of the diagnostic and required drugs. Therefore, the program is required to ensure the availability of NCD self-screening tests for diabetes, high blood pressure, etc and required treatment drugs [18]. Regarding

NCD self-screening tests for diabetes, there is a need to have blood glucose test strips and blood pressure machines for high blood pressure monitoring. For better management of NCDs, the program has to ensure that the community is getting the required treatment drugs like insulin for diabetic patients and warfarin for the medication of patients with blood clotting problems.

RBC/NCDs Division manages NCD products that include insulin injection and glucose test strips obtained from donors and distributed free of charge to diabetic patients countrywide using Central Medical Store (RMS Ltd) channel. The same products are quantified, procured and provided by RMS Ltd through the essential medicines supply chain [20]. For NCD products, the sources of funds are various. Indeed, some of the sources are donations from different NCD division partners like Novo Nordisk which provides the insulin. Another source is the ordinary budget from the national treasury.

***b. Maternal & Neonatal and Child Health (MCCH)***

The program is entitled to ensure that the nutrition commodities for children and adults are available at the national level. The program needs to ensure that children and adults have sufficient nutrition commodities, and that malnutrition is eradicated. The main nutrition commodities targeted availability is Corn Soya Blended (CSB) which is given to people living with TB, people living with HIV and to malnourished people. We have also Fortified Blended Food (FBF) (SHISHA KIBONDO) which is availed as direct support to nourish the children and mothers belonging to categories 1 (abject poverty) & 2 (very poor) because they were reported to be eligible for such support [21]. This initiative is opted for as one of the National Social Protection Strategy [22].



*Figure 1: Supply chain management of Corn Soya Blended*

Fortified Blended Food (FBF) (Shisha Kibondo) is mainly provided to malnourished people across the country and those people are children from 6 to 24 months and pregnant women belonging to categories 1 (abject poverty) & 2 (very poor) because were reported to be eligible for such direct support. For exhaustive management, various stakeholders are involved, and we can cite the Ministry of Health and Rwanda Biomedical Centre (RBC) which manage the product in terms of curing diseases caused by malnutrition.

We also have the Ministry of Local Government (MINALOC) involved as the ministry in charge of ensuring the population's well-being, and intervening to ensure that food is available in stunting fighting [21]. Another key stakeholder is the Ministry of Economics and Planning (MINECOFIN) with responsibilities to manage the national treasury and manage all funds related to product management where Clinton Health Initiative (CHAI) is the key partner and sponsor of the product. CHAI on its part has to put the funds into the national treasury [21]. In product management, the National Child Development Agency (NCDA) intervenes in the compilation and determination of the population in need.

Rwanda Medical Supply (RMS) Ltd is another actor in the program, which ensures the transport of the product from the factory (Africa Improved Food - AIF) to the public health facilities, namely Hospitals and Health Centers. Then those health facilities serve the product to the patients. RMS also ensures the reporting and requisition of needed quantities to CHAI and NCDA. At the end, NCDA is the one to submit that report and requisitions to AIF and MINECOFIN for order process and payment. The above captioned CSB have different partners: The Global Funds through HIV and TB programs also through other partners through MCCH while the FBF is funded by the national ordinary budget through the national treasury and other partners such as CHAI, etc.

## **2.6 Conceptual framework of the study**

Indeed, according to various publications, the duplicated supply chains have led to different challenges in their management and inefficiency [6] and uncertainties [23] or lack of linkage between supply chain actors [17].

The first challenge is the lack of coordination at the central level leading to the expirations. The second challenge is observed downstream of the supply chain at health facilities where the stock-outs are recorded, the redundant operations and waste of resources [5].

However, the literature provides that integration of the supply chain includes some activities like information sharing, planning, coordination and finished goods throughout the supply chain levels which explains that the supply chain integration are wide, and include improvement in profit and customs satisfaction [17], [18]. Hence, compared to other countries like Tanzania, Ethiopia, and Nicaragua, Rwanda had adopted the supply chain integration of all health commodities [24].

Therefore, the present conceptual framework is aimed at assessing the efficiency of supply chains of nutrition and NCD products in Rwanda.

## **2.7 Hypothesis**

Therefore, the efficiency of the supply chain management of nutrition and NCD products should depend on their respective integration in one supply chain from the central level to downstream at health facilities.

## **CHAPTER III: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter details the methodology which we used to assess the efficiency of health supply chains of nutrition and NCD products in Rwanda. It presents the design of research, the targeted population, its sample size, testing methods, the tool used to collect the data, the sampling method, and the data analysis. The ethical aspect was also considered in this study.

### **3.2 Study setting**

Indeed, the management of nutrition and NCD products includes the supply chain actors, namely RBC/MCCH which implements the MOH nutrition product-related policy, and RBC/NCD division which oversees the management of non-communicable diseases. Then, the study assessed the management of those products through RMS Headquarter, mainly in the quantification unit which manages those products on daily basis, and the RMS Branches level which oversees their distribution to hospitals. Lastly, the study assessed the management of those products at hospital levels which oversees their storage and dispensing to patients.

### **3.3 Research design**

This research is a descriptive cross-sectional study with a qualitative approach. Qualitative data were collected in order to understand how different groups of actors manage the supply chain of nutrition and NCD commodities. Ultimately, the research demonstrated the perceived effect of supply chain management for these products.

### **3.4 Target population**

The present qualitative research was conducted towards different groups of the population from the central level (RBC/NCD, RBC/MCCH, and RMS LTD) to health facilities (RMS Branches and hospitals). The target populations were policymakers (NCDs staff, and the MCCH staff), RMS Head Office (the unit of quantification which is charge of planning and stock management), RMS branches (managers), and the head pharmacists for regional and district hospitals. In total, the targeted population was 118 staff. Those different levels were chosen because each level should

provide a response which is different from another level due to its specificity in terms of the management of those products.

Indeed, the assessment started from the central level where the division in charge of NCDs as a policy maker who was considered to better understand how they manage the supply chain of those products (from program level, donors, up to end users – patients). This was applied also to MCCH which oversees mother, and child health as to understand how the supply chain of nutrition commodities is managed from their levels. In this regard, the questionnaire, as a tool of data collection, was designed and used specifically for individual group of participants to explain variables of management of supply chains and its perceived effect.

### **3.5 Purposive sampling technique**

The study participants were identified considering their role in the management of supply chain of those products. Indeed, the respondents were considered to provide accurate information on this assessment [25].

At Central Level, we have RBC/NCD and RBC/MCCH from which two (2) staff per division was interviewed for clarity in the management of their respective products. From central level, we also interviewed six (6) staff from RMS Headquarter quantification unit who provided an overview of the management of nutrition and NCDs products.

At RMS Branch's level, the targeted population was 60 staff which include 30 branch managers and 30 data quality officers as they are all involved in the management (storage and distribution) of those products.

The study interview was carried out with hospital pharmacists and store managers because most of the hospitals do not currently have pharmacists, who are the main managers of those products.

### **3.6 Data collection instruments**

The collection of data was made using interviews conducted at central and peripheral levels of the supply chain for nutrition products and NCDs. This study helped to describe and understand the challenges perceived in the supply chain [26], and those interviews were customized to assess the health supply management in Rwanda for selected products. Thus, the interviews were done physically on the field at the respondents' workplace where possible, and phone calls were used

for respondents residing in a remote area. During the interview and where necessary, the probes questions helped to gather much more information about the management of those supply chains [26]. The key informants were interviewed, and information was recorded on questionnaires. However, the information received through phone calls was recorded by a voice recorder and then transcribed.

### **3.7 Data collection**

The collection of data was done from the respondents using a guided questionnaire addressed to each group of people. The questionnaires were designed in a manner of getting real information on the management of the supply chain, and aimed at highlighting their benefits, if any, the challenges, if any and proposed solutions.

Additionally, the survey was conducted simultaneously within two (2) weeks, with part of the study focusing solely on blood pressure devices, insulin and warfarin tablets, strips to test the blood glucose for NCDs, while the second part focuses on the supply chain assessment of Corn Soya Blends (CSB) and Fortified Blended Foods (FBF) (SHISHA KIBONDO) as nutritional products.

### **3.8 Data analysis**

To analyze the data, we used thematic analysis. The data collected were used to make transcriptions of digital recordings and notes collected during key informant interviews. All transcripts were thoroughly read and analyzed to identify common keywords, phrases, and observations. The differences and similarities were highlighted in the text, sub-categories, categories, and themes.

## **CHAPTER IV: RESULTS**

### **4.1 Characteristics of participants**

For this study, 79 professionals working at different levels of the health supply chain participated in this study. Indeed, at the central level, on the policy maker part, we recruited two (2) participants at RBC/NCD division but one of them oversees diabetes disease and another one for hypertension. Due to that fact, both respondents provided mostly different responses. We recruited also two (2) RBC MCCH staff, as policymakers and RMS headquarter (5) as policy implementers. We launched the questionnaires to 30 RMS branches to obtain the responses from Branch Managers and data officers. Hence, the interviews were conducted with branch managers who represent the whole branch team and therefore collected the responses from 60. However, at the district hospital level, we were limited to 10 respondents from different country's corners because at that number no further new ideas were being received: 4 hospitals from Kigali City and 6 hospitals from rural sites (Masaka, Nyarugenge, Muhima, Kibagabaga, Munini, Nyanza, Rutongo, Rwamagana, Karongi and Remera-Rukoma).

During this study, we discovered various challenges throughout the supply chain that are perceived from the central level to the peripheral level, and that prevent the supply chain management from achieving the expected effectiveness, although it turned out to be an integrated supply chain. Hence, for the supply chain for NCD products to be integrated or the way nutrition products are managed, we noticed challenges at all levels from policymakers, central level implementers, and peripheral level.

#### 4.2 Supply chain management of NCD and nutrition products in Rwanda at the central level

Policy makers and implementers at the central level highlighted the main challenges they face including delay of supplies, poor quality of data provide by the health facilities, irrational distribution of products across RMS Ltd branches, and management of unexpected donations. Not only our study reported challenges and but also it reported the mitigation mechanisms in supply chain management of nutrition and NCDs products. MCCH, a division of RBC that helps manage nutritional products, has faced various challenges, including dependence on donors and lack of long-term planning. Normally, donors help RBC to acquire CSB and FBF products by funding procurement, but the amount of money they provide varies. There is no long-term planning for the budget that will be used for the acquisition of products. In the event of a lack of funding, the government uses its own budget to purchase the products, but this is limited due to high demand. Continuing efforts are being made to involve as many donors as possible to ensure future needs for nutritional products. ***“Funding mechanism is not sustainable; we rely on donor’s money. That’s why we go by what they gave us at the time, but in the years to come we won’t know what will happen.”*** KII.

In the NCDs division, some products are sponsored while others are not. Policy makers in the NCDs division actively develop partnerships that help increase sufficiently the budget, but sponsors often align their donations according to their own objectives. The products that appear on the list of essential medicines are often funded. In this case, the Division takes responsibility for purchasing products that are not on the essential medicines list using the ordinary budget despite the increasing their needs. The highlighted example is glycated hemoglobin, which is bought only with sponsorship. Some donors also provide products with conditions that limit equitable access among target population of NCDs division. For instance, the NCDs division receives donations of insulin, glucose test strips with conditions of distribution to children under 25 years old, while the division should use the products according to medical needs, without any selection based on social factors. This causes NCDs division to buy the same products to be distributed in uncovered groups of people. ***“...they are the ones who give us insulin for free, but for children under 25 years of age, and we are responsible for discussing with the partner who gives it to us to align the donation with insulin that RMS buys.”***

At RMS headquarter, policy implementers, participating in quantification and procurement of NCD products at the central level (RMS ltd), expressed that normally, NCD products are purchased by one national medical store (RMS ltd) using its ordinary budget. Most of the policy implementers perceive funding as insufficient due to the unstable budget that depends on limited purchasing power of health facilities. ***“NCD products are purchased by RMS ltd from its ordinary budget at the same time health facilities buy these products from their own funds, hence the***

*consumption of these products is affected by buying power of health facilities which leads to inconsistent consumption rates for those products”* KII. Some policy implementers perceive irregular donations which important in improving availability of essential medicines but this is also a challenge in the management of stock.

Poor inventory management practices at RMS Ltd branches result in irrational distribution of products, which can result in an imbalance in the quantity in stock between branches. The imbalance is accelerated by the fact that the branches determine the quantity they need and the central level supplies all the quantities requested depending on the level of available stock. *“All branches can request whatever quantity of medicines they propose, and the validation of their orders doesn’t consider inventory control parameters of branches as well as the consumption rates in respective branches.”* KII.

#### **4.3 Supply chain management of NCD and nutrition products in Rwanda at the peripheral level**

The study revealed the challenges in supply chain management at RMS Ltd branches and health facility level. The problems reported by professionals working in RMS Ltd branches include limited storage space for nutrition products and their transportation, inconsistent availability of the products with persistence stock out of some products, unplanned additional costs on the products, poor quality of data. Management of nutrition products require large storage area, and improved transportation system. The central level management procure and sends the nutrition products to the RMS Ltd branches, which overloads the existing storage spaces. *“The products are supplied in big volume and require much space which is difficult to accommodate in our small storage space with other health products.”* This also caused RMS Ltd branches to distribute bulk quantities of the products to the health facilities. Therefore, handling such larger quantities of the products than usual constitutes a challenge to both RMS Ltd branches and health facilities.

The transportation of products from RMS Ltd branches to health facilities also constitutes a major challenge linked to the availability of vehicles as well as the poor road infrastructure. *“For the FBF, the district manages transport but sometimes, the vehicles are not available on time and sometimes do not reach all areas due to road problems.”*

Health facilities experience stock-outs resulting from supply chain management issues often at high levels. Nutritional products have been reported to be out of stock for a long period of time. *“Experiencing a persistent and generalized stock out of both products (FBF and CSB). For FBF, the factory is in stock out because of its limited production capacity; however, CSB has been out of stock for a long time and the reasons are not known.”*

#### **4.4 Mechanisms of mitigating challenges in supply chain management**

MCCH division manages challenges by increasing communication with stakeholders, managing available resources, trying to make early planning, and increasing sponsorship. At the beginning of each fiscal year, the division communicates with RMS Ltd to procure the quantities in alignment with the current financial. This facilitates early negotiation of the required products and the bulk procurement that reduces the needed budget. They communicate also with health facilities, about the expected products and quantities, to get prepared for long-term storage of the products. The division also increases efforts of finding partners who can sponsor product procurement, and if the budget for needed products is not obtained, the Government will use its own budget, which is mostly limited due to the other issues that wait for the Government's expenses. *“We work with RMS Ltd to develop a procurement plan so that they can approach the factory early and have a plan. We communicate with the regional hospitals or pharmacies to secure the place where these products should be stored while waiting for their distribution to beneficiaries.”*

Most of the products in the NCDs division, which appear on list of essential products list, are bought with RMS's own generated budget, except warfarin, which can get donors. The main challenge raised in the NCD division is the poor quality of data from health facilities. To overcome this problem, they have strengthened the supervision and training of health facilities staff. The central level of RMS Ltd mitigates challenges by improving the quality of supply chain, evaluating and selecting reliable suppliers and improving communication with stakeholders. *“The main mechanism for mitigating this challenge is to improve the regular communication between RMS and RBC/NCD division to find priority in case of understock, risk of stock out, and stock out”*.

#### **4.5 Trustworthiness**

Different studies have discussed NCDs and nutrition products in Rwanda where some challenges in their availability were pointed out.

A study conducted in 2020 found that NCD products are insufficiently available among the public and faith-based sectors and there is a need to improve their availability [27]. Another study revealed that frequent stock outs in rural and decentralized facilities are still observed [28].

Other publications demonstrated the gaps in availability of nutrition products and lack of appropriate data which could help to build their robust supply chain[29].

Based on previous research, the responses collected from respondents across the country regarding the management of nutritional products and NCDs should be trustworthy and credible.

## **CHAPTER V. DISCUSSIONS, CONCLUSION, AND RECOMMENDATIONS**

### **5.1 Discussions**

The management of Supply chain of health products is coordinated at the central level by RBC in close collaboration with RMS Ltd, but supervised Rwanda Ministry of Health. We assessed the levels of management of health supply chain and responsibilities at each level, and we found that the system is decentralized from the Ministry of Health, RBC, RMS Ltd central level, RMS Ltd branches, hospitals, health centers, health posts, community health workers, and individual patients. In Rwanda, the management of that system is comparable to the management system used in other African countries like Nigeria, where its Ministry of Health set up a semi-autonomous entity called National Level Medical Store (NLMS) [3] and Zambia that set up Medical Stores Limited (MSL) to procure, store, and distribute medicines and medical supplies across the entire country [3].

A study conducted in Nigeria reported several donor-funded programs that are parallel to the national system [3]but our study found that donors align their supply chain with the national system. This improves the integration of supply chain management in Rwanda and points out that the management system can effectively manage donations avoiding the duplication of efforts or other problems associated with parallel supply chain management. Challenges in the management of nutrition products were found comparable to the NCDs products.

We found that the main challenges to effective health supply chain management are donor instability, limited ordinary budget, unreliable suppliers, inaccurate data, stock-outs, limited storage capacity in health facilities and a dependence on imports. These challenges are also comparable to the study conducted by Anna Schöpferle in relation with the analysis of challenges of medical supply chains in sub-Saharan Africa, especially in regard with the inventory

management, transport and distribution [26]. Before the management of supply chain was managed by the Medical Procurement and Production Division, which was top management level reported in previous studies where its main responsibilities were taken over by RMS Ltd in August 2020. Currently, RMS Ltd coordinates the supply chain management of health products in Rwanda [9].

The poor quality of data generated at the health facility level was revealed to be the biggest challenges to the whole health supply management system. In our study, key informants highlighted that the challenge is associated with high workload in hospitals and health centers, which implies that those facilities do not get sufficient time to produce the quality data. This has been highlighted in previous studies conducted on performance of the health system in Rwanda [30]. Our results are comparable to the study conducted in Ghana, which highlighted the poor performance of health facilities in terms of inventory management practices. The similarity could be associated with the fact that Rwanda and Ghana, where the data is a challenge due to lack of training in data reporting [26].

At the central level, health supply chain management has highlighted the need to train staff involved in inventory management at health facility level but also the increase in field visits, as one of the mechanisms to mitigate the problem of poor data quality. The same mechanism is comparable to that found in the recommendation emanating from a study conducted in Ghana, which recommended a systemic assessment of supply chain and inventory management practices as a means of improving quality [31].

Our study reported the limited capacity for local production of nutritional products by a factory named Africa Improved Food (AIF), which is a challenge to effective supply chain management. Our findings are also supported by a study which reported a lack of local manufacturing of medicine and medical supplies in Ghana which as a challenge to the efficiency of supply chain management in that country. This is comparable with a study conducted on Local Manufacturing of generics Production in Rwanda, which reported the lack of manufacturing capacity which has much impact to the availability of health products [32]. Because of the imports, the suppliers delay to deliver the products, and risks of stock are increased as reported in our studies. The findings are

in line with the report of Woodburn in Nigeria (24), which reported the long delivery times of manufacturers and suppliers.

## **5.2 Conclusion**

This study assessed the efficiency of supply chain management in Rwanda, particularly for NCDs and nutrition products. The challenges at the central level include delay of shipments, poor quality of data, and unsustainable commodity funding. Hence, because of those challenges, the expected efficiency of supply chain management for NCDs and nutrition products, at central level, is not optimized. The main challenges to the efficiency at the peripheral level are limited storage, stock-outs, and lack accurate data on the patients.

Despite all of these obstacles, the analysis showed that effective mitigation strategies had been implemented through improved communication throughout the supply chain, early planning, and financial resource mobilization.

Nevertheless, the supply chain management for NCDs and nutrition products is effective despite those obstacles that are still apparent, and once those difficulties are overcome, it will be effective at the highest possible level.

## **5.3 Recommendations**

To increase the effectiveness of supply chain management for NCDs and nutrition goods, the central level should establish methods to sustain funding mechanisms.

Strong measures should be put in place at the central level to ensure dependable suppliers and encourage data quality.

In order to address numerous issues linked to the management of those products, the central level should maintain close communication amongst stakeholders from the central level to health facilities.

A reporting solution that ensures data visibility from the central level to health facilities should be implemented.

Health items' continuous availability should be guaranteed, and their supply chain management efficiency should be optimized. Since efficiency of supply chain management system is the

primary objective, the Government will continue to consider extending the storage space at health facilities. Consider the NCDs program to be a vertical program since it is an emerging sensitive program.

To ensure that all prescribers and nurses have received training on how to report patient counts, calculate dosages, and determine reporting standards. This should be applied to NCDs and nutrition products management to optimize the data reporting.

In order to promote the quality of the data, the health facilities should immediately and appropriately record information about clinical data and NCDs consumption.

Finally, given that these lower levels of the health system—health centers, health posts, and community health workers—play a significant role in the supply of health commodities to patients, we advise further research that will evaluate the effectiveness of supply chain management at these locations.

#### **5.4 Limitations of the study**

Our study did not assess the efficiency of supply chain of medicines and medical supplies, at the lowest levels, namely at the health centers, community health workers and health posts which provide a part of the data related to the consumption of the products.

## VI. BIBLIOGRAPHY

1. Simangunsong E. Analysing Parallel Interaction in Supply Chains: A Supply Chain Network Perspective. *Int Res J Bus Stud.* 2013;6:171–84.
2. Lugada E, Komakech H, Ochola I, Mwebaze S, Olowo Oteba M, Okidi Ladwar D. Health supply chain system in Uganda: current issues, structure, performance, and implications for systems strengthening. *J Pharm Policy Pract. BioMed Central;* 2022;15:1–11.
3. Yadav P. Health product supply chains in developing countries: Diagnosis of the root causes of underperformance and an agenda for reform. *Heal Syst Reform.* 2015;1:142-154,.
4. Haddad H, Nagy J, Popp J. The Impact of Supply Chain Integration and Internal Control on Financial Performance in the Jordanian Banking Sector. 2019;
5. Prashant Yadav 1, Patrick Lydon 2, Julianna Oswald 3, Modibo Dicko 4 MZ 5. Integration of vaccine supply chains with other health commodity supply chains. 2014;
6. Project UD. Supply Chain Integration : Case Studies from Nicaragua , Ethiopia , and Tanzania. 2011;
7. Science H, Kariuki J, Njeru MK, Wamae W, Mackintosh M, Productivity I, et al. African Centre for Technology Studies Local Supply Chains for Medicines and Medical Supplies in Kenya : Understanding the Challenges. 2015.
8. Uwizeyimana T, Hashim HT, Kabakambira JD, Mujoyarugamba JC, Dushime J, Ntacyabukura B, et al. Drug supply situation in Rwanda during COVID-19: issues, efforts and challenges. *J. Pharm. Policy Pract. BioMed Central Ltd;* 2021.
9. Rwanda Ministry of Health. Health Supply Chain Management Module for RMS branches and Central level REPUBLIC OF RWANDA MINISTRY OF HEALTH. Kigali; 2021.
10. Hakuzimana T, Kayumba PC, Hahirwa I, Kabalisa M. Assessment of Factors Contributing to Medicine Expiry in Rwanda: Case of the Medical Procurement and Production Division. *Rwanda J Med Heal Sci.* 2021;4:281–91.

11. Gebremariam ET, Gebregeorgise DT, Fenta TG. Factors contributing to medicines wastage in public health facilities of South West Shoa Zone, Oromia Regional State, Ethiopia: A qualitative study. *J Pharm Policy Pract. Journal of Pharmaceutical Policy and Practice*; 2019;12:1–7.
12. Zigiari S. SUPPLY CHAIN MANAGEMENT. 2000;0–26.
13. Gorman KO, Macintosh R. *Research Methods for Business & Management*. 2015;
14. Movahedipour M, Yang M, Zeng J, Wu X, Salam S. Optimization in Supply Chain Management, the Current State and Future Directions - A Systematic Review and Bibliometric Analysis. 2016;
15. Movahedipour M, Zeng J, Yang M, Wu X. An ISM approach for the barrier analysis in implementing sustainable supply chain management: An empirical study. *Manag Decis*. 2017;55:0.
16. Sadler I. *Logistics and Supply Chain Integration*. London: SAGE Publications; 2546.
17. Lee JSL. Benefits and barriers of supply chain integration: Empirical analysis of liner shipping. *Int J Shipp Transp Logist*. 2013;5:13–30.
18. Zhang A, Lam JSL, Huang GQ. Port strategy in the era of supply chain management: the case of Hong Kong. *Marit Policy \& Manag*. Routledge; 2014;41:367–83.
19. HEALTH MO. FOURTH HEALTH SECTOR STRATEGIC PLAN. 2018;
20. Health MOF. REPUBLIC OF RWANDA MINISTRY OF HEALTH INTEGRATED QUANTIFICATION REPORT FOR PUBLIC HEALTH COMMODITIES.
21. United Nations Children’s Fund (UNICEF) Rwanda. *Situation Analysis of Children in Rwanda*. 2017.
22. MINALOC. REPUBLIC OF RWANDA NST-1 Social Protection Sector Strategic Plan ( SP-SSP ). 2018;

23. Simangunsong E. *Analysing Parallel Interaction in Supply Chains : A Supply Chain Network Perspective*. 2017;
24. MOH. *Health Supply Chain Management Module for RMS branches and Central level*. REPUBLIC OF RWANDA MINISTRY OF HEALTH. 2021;
25. Macdonald S, Headlam N. *Research methods handbook : introductory guide to research methods for social research*. 2008.
26. Schöpferle A. Analysis of challenges of medical supply chains in sub-Saharan Africa regarding inventory management and transport and distribution. *Int J Health Plann Manage*. 2017;97:710–21.
27. Bizimana T, Kayumba PC, Heide L. Prices, availability and affordability of medicines in Rwanda. *PLoS One* [Internet]. 2020;15:1–14. Available from: <http://dx.doi.org/10.1371/journal.pone.0236411>
28. Mukundiukuri JP, Irakiza JJ, Nyirahabimana N, Ng'ang'a L, Park PH, Ngoga G, et al. Availability, costs and stock-outs of essential ncd drugs in three rural rwandan districts. *Ann Glob Heal*. 2020;86:1–15.
29. Dusingizimana T, Weber JL, Ramilan T, Iversen PO, Brough L. A mixed-methods study of factors influencing access to and use of micronutrient powders in Rwanda. *Glob Heal Sci Pract*. 2021;9:274–85.
30. Kamanzi J, Degree H. Motivation Levels Among Nurses Working. *Afr J Nurs Midwifery*. 2011;13:119–31.
31. Boakye G, Gyedu A, Stewart M, Donkor P, Mock C, Stewart B. Assessment of local supply chains and stock management practices for trauma care resources in Ghana: a comparative small sample cross-sectional study. *BMC Health Serv Res*. *BMC Health Services Research*; 2021;21:1–13.
32. United States Agency for International Development (USAID). *Local Manufacturing : a Case for Generics*. 2016;1–3.

## VII. APPENDICES

### a. Ethical approval



UNIVERSITY of  
RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DIRECTORATE OF RESEARCH & INNOVATION

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#### CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 9<sup>th</sup> /January/2023

No 024/CMHS IRB/2023

**Ignace NDEKEZI**  
Principal Investigator

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

**Re: Amendment of ethical clearance**

**Dear**

We thank you for submitting your request for research project amendments in the project previously titled "*Assessment of Health Supply Chains Management Efficiency in Rwanda: Case of Nutrition and NCDs Products*".

After reviewing your request, the amendments of the project have been approved as follows:

1. The project title has changed from "*Assessment of Parallel Health Supply Chains in Rwanda: Case of Nutrition and NCDs Products*" to "*Assessment of Health Supply Chains Management Efficiency in Rwanda: Case of Nutrition and NCDs Products*".
2. The problem statement has been reviewed
3. The whole proposal has undergone a harmonization

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 Innovations, UR

Republic of Rwanda



MINISTRY OF HEALTH

National Health Research Committee  
Ref: NHRC/2022/PROT/047

To: **Mr. NDEKEZI Ignance,**  
**Principal Investigator**

### Scientific Review Approval Notice

With reference to your request for approval of the Research Protocol entitled; **“Assessment of Health Supply Chains Management Efficiency in Rwanda: Case of Nutrition and NCDs Products”**

We are pleased to inform you that, following a thorough review and critical analysis of your proposal (NHRC/2022/PROT/047), National Health Research Committee has approved your Research Protocol.

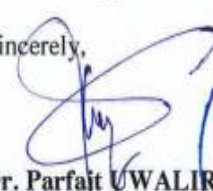
However,

- 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 using the attached template 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.

Your final approval reference number is **NHRC/2022/PROT/047**.

Sincerely,

  
**Dr. Parfait UWALIRAYE**  
Chairperson of NHRC



Date : 07/11/2022

## b. Consent forms

Title: *Assessment of efficiency of health supply chains in Rwanda case of nutrition and NCDs products*

### PART I: Information Sheet

#### Introduction

Introduction of the researcher and the research project:

How are you? My name is NDEKEZI Ignace, I am a student at the University of Rwanda - College of Medicine and Health Sciences going after a master's degree in health supply chain management. I am currently conducting a study on the topic "ASSESSMENT OF HEALTH SUPPLY CHAIN MANAGEMENT EFFICIENCY IN RWANDA: CASE OF NUTRITION AND NCDs PRODUCTS" as partial fulfilment of the requirements for graduation.

#### Research purpose

This study intends to assess the efficiency of health supply chains in Rwanda, especially the supply of nutrition and NCDs products.

#### Type of Research Intervention

The finding from this study will help in making an evidence-based recommendation to the government on the best way of efficiently management of nutrition and NCDs products which ensures better health service.

#### Selection of participants

- a. As someone who plays a role in the supply chain of nutrition products in your division, we would like you to contribute as respondents in this study because your division is one leading the program in Rwanda.
- b. As someone who plays a role in the supply chain of NCDs products in your division, we would like you to contribute as respondents in this study because your division is one leading the program in Rwanda.

- c. As someone who plays a role in the supply chain of NCDs products in RMS Ltd/HQ, we would like you to contribute as respondents in this study because RMS is leading the supply chain
- d. As someone who plays a role in the supply chain of NCDs products and nutrition products in RMS Branch, we would like you to contribute as respondents in this study because RMS is leading the supply chain.
- e. As someone who plays a role in the supply chain of NCDs products and nutrition products in your hospital, we would like you to contribute as respondent in this study because your hospital is one of the beneficiaries of those products.

### 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

This study will be a face-to-face interview and you will only have to answer the close-ended questions. Participation in the study will not require recording of the voice or taking of photos.

### Duration

And the interview will take approximately 20 minutes of your time.

### Risks and Discomforts

Participation in this study is by free will. During the interview, you may decide whether to answer certain answers. But again, you may stop the interview at any time, without giving any reasons.

### Benefits

There will be no direct benefit to you for participation in this study, but with your participation, we hope to improve the efficient supply chain management of nutrition and NCDs products as to deliver a better health service to the population of Rwanda.

### Reimbursements/Incentives

You will not receive any payment or any other form of incentive to participate in to take part in this study, but your participation in this research is essential.

#### Confidentiality

The information you give us will never be shared with anyone else not even in the report of this study. They will be known by the research team only and the team will never share them with anyone else. They will only be used in addition to other respondents to make a general report of the findings without identifying who said this or that.

#### Findings sharing

The findings from this study will be shared with all people who participated in this study. We will in the future publish on the process and the results, but you and your feedback will remain anonymous.

#### Right to refuse or withdraw

To reiterate, you do not have to take part in this research if you do not wish to do so, and choosing to participate will not affect your job or job-related evaluations in any way. You may stop participating in the interview at any time that you wish without your job being affected.

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

All research on human volunteers is reviewed by Rwanda National Ethics Committee (RNEC) which 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 ...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: .....

Supervisor: ..... Tel.....

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?

PART II: Certificate of Consent

I have been asked to participate in .....

I have read the information provided above. I have asked all the questions; I have at this time. I agree to participate in this research study voluntarily. I may withdraw my consent at any time and stop participation without penalty. By agreeing to be in this research, I have not given up any of my legal rights.

I consent voluntarily to be a participant in this study: Yes / No

Print name of participant:

Signature of participant:

Date:

Print name of Researcher:

Date:

*If illiterate:*

*A literate witness must sign (if possible, this person should be selected by the participant, not be a parent, and should have no connection to the research team). Illiterate participants should include their thumbprints as well.*

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness:

Signature of witness:

Date:

The thumbprint of participant:

I have accurately read or witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of Witness:

Signature of Witness:

Date

Copy provided to the participant.

c. Data collection tool: Interview Questionnaire

## **BACKGROUND INFORMATION**

Dear Respondent,

I am NDEKEZI Ignace, a student at the University of Rwanda - College of Medicine and Health Sciences going after a master's degree in health supply chain management. The goal of our study is to assess the efficient supply chain management of nutrition and NCDs products in Rwanda. Kindly spare some minutes to answer these questions. All provided information will be confidential and will be used only for this study.

## QUESTIONNAIRE

### i. NCDs DIVISION

THE ASSESSMENT FOR HOW THE POLICY IMPLEMENTERS MANAGE THE SUPPLY CHAIN OF THOSE PRODUCTS (FROM PROGRAM LEVEL, DONORS, UP TO END USERS – HEALTH FACILITIES)

#### General Information

##### a. Gender

- Male
- Female

##### b. Job Position: .....

1. If Insulin injection, Warfarin tablets, Glucose test strips and Blood pressure machines are among NCDs products in your responsibilities, how do you participate in quantification of needed quantities?
2. How do you perceive the funding mechanism or interaction of donors and NCDs Division?
3. What are the main challenges do you face in the supply chain management of those products?
4. What are the mechanisms that you use to mitigate those challenges in supply chain?
5. How do you consider the supply chain integration for NCDs products?
6. Do you believe that the supply chain management of NCDs products is efficient compared to the principles of integrated supply chain?
7. Considering the way this supply chain is managed, what would you recommend for its efficient management?

**ii. MCCH DIVISION**

THE ASSESSMENT FOR HOW THE POLICY IMPLEMENTERS MANAGE THE SUPPLY CHAIN OF THOSE PRODUCTS (FROM PROGRAM LEVEL, DONORS, UP TO END USERS – HEALTH FACILITIES)

## General Information

a. Gender

Male

Female

b. Job Position: .....

NB: The products study is assessing, of which the answers shall be directed are Nutrition products (CSB and FBF).

1. If CSB and FBF are among Nutrition products in your responsibilities, how do you participate in quantification of needed quantities?
2. How do you perceive the funding mechanism or interaction of donors and MMCH Division?
3. What are the main challenges do you encounter in the chain management of those products?
4. What are the mechanisms that you use to mitigate challenges in supply chain?
5. How do you consider the supply chain integration for Nutrition products?
6. Do you believe that the supply chain management of Nutrition products is efficient compared to the principles of integrated supply chain?
7. Considering the way this supply chain is managed, would you recommend for its efficient management?

iii. RMS LTD HEAD OFFICE

THE ASSESSMENT FOR HOW THE POLICY IMPLEMENTERS MANAGE THE SUPPLY CHAIN OF THOSE PRODUCTS (FROM PROGRAM LEVEL, DONORS, UP TO END USERS – HEALTH FACILITIES)

NCDs PRODUCTS (WARFARIN, INSULIN, GLUCOSE TESTS STRIPS, BLOOD PRESSURE MACHINE)

a. General Information

Gender

Male

Female

b. Job Position: .....

1. If Insulin injection, Warfarin tablets, Glucose test strips and Blood pressure machines are among NCDs products in your responsibilities, how do you participate in quantification of needed quantities?
2. How do you perceive effect of the funding mechanism of NCDs products to RMS Ltd?
3. What are the main challenges do you encounter in the chain management of those products at RMS Head Office?
4. What are the mechanisms that you use to mitigate challenges in supply chain?
5. How do you consider the supply chain integration for NCDs products?
6. Do you believe that the supply chain management of NCDs products is efficient compared to the principles of integrated supply chain?
7. What would be other comments regarding this study towards the management of NCDs products?
8. Considering the way this supply chain is managed, would you recommend for its efficient management?

#### iv. RMS BRANCHES

THE ASSESSMENT FOR HOW THE POLICY IMPLEMENTERS MANAGE THE SUPPLY CHAIN OF THOSE PRODUCTS (FROM PROGRAM LEVEL, DONORS, UP TO END USERS – HEALTH FACILITIES)

NCDs PRODUCTS (WARFARIN, INSULIN, GLUCOSE TESTS STRIPS, BLOOD PRESSURE MACHINE)

##### a. General Information

Gender

Male

Female

##### b. Job Position: .....

1. If Insulin injection, Warfarin tablets, Glucose test strips and Blood pressure machines are among NCDs products in your responsibilities, how do you participate in quantification of needed quantities?
2. How do you get those NCDs products?
3. What are the main challenges do you encounter in the chain management of those products at RMS branch?
4. What are the mechanisms that you use to mitigate challenges in supply chain?
5. How do you consider the supply chain integration for NCDs products?
6. Do you believe that the supply chain management of NCDs products is efficient compared to the principles of integrated supply chain?
7. Considering the way this supply chain is managed, would you recommend for its efficient management?

THE ASSESSMENT FOR HOW THE POLICY IMPLEMENTERS MANAGE THE SUPPLY CHAIN OF THOSE PRODUCTS (FROM PROGRAM LEVEL, DONORS, UP TO END USERS – HEALTH FACILITIES)

a. General Information

Gender

Male

Female

b. Job Position: .....

1. If CSB and FBF are among Nutrition products in your responsibilities, how do you participate in quantification of needed quantities?
2. *(Do you know where those products are delivered from?)*
3. What are the main challenges do you encounter in the chain management of those products at RMS branch?
4. What are the mechanisms that you use to mitigate challenges in supply chain?
5. How do you consider the supply chain integration for Nutrition products?
6. Do you believe that the supply chain management of Nutrition products is efficient compared to the principles of integrated supply chain?
7. Considering the way this supply chain is managed, would you recommend for its efficient management?

v. HOSPITAL LEVEL

THE ASSESSMENT FOR HOW THE POLICY IMPLEMENTERS MANAGE THE SUPPLY CHAIN OF THOSE PRODUCTS (FROM PROGRAM LEVEL, DONORS, UP TO END USERS – HEALTH FACILITIES)

NCDs PRODUCTS (WARFARIN, INSULIN, GLUCOSE TESTS STRIPS, BLOOD PRESSURE MACHINE)

a. General Information

Gender

Male

Female

b. Job Position: .....

1. If Insulin injection, Warfarin tablets, Glucose test strips and Blood pressure machines are among NCDs products in your responsibilities, how do you participate in quantification of needed quantities?
2. How do you get those NCDs products?
3. What are the main challenges do you encounter in the chain management of those products at Hospital?
4. What are the mechanisms that you use to mitigate challenges in supply chain?
5. Do you believe that the supply chain management of NCDs products is efficient?
6. What would be other comments in regard to this study towards the management of NCDs products?
7. Considering the way this supply chain is managed, would you recommend for its efficient management?

THE ASSESSMENT FOR HOW THE POLICY IMPLEMENTERS MANAGE THE SUPPLY CHAIN OF THOSE PRODUCTS (FROM PROGRAM LEVEL, DONORS, UP TO END USERS – HEALTH FACILITIES)

THE ASSESSMENT OF NUTRITION PRODUCTS AT HOSPITAL LEVEL (CSB AND FBF)

a. General Information

Gender

Male

Female

b. Job Position: .....

1. If CSB and FBF are among Nutrition products in your responsibilities, how do you participate in quantification of needed quantities?
2. What are the main challenges do you encounter in the chain management of those products at Hospital?
3. What are the mechanisms that you use to mitigate challenges in supply chain?
4. How do you consider the supply chain integration for Nutrition products?
5. Do you believe that the supply chain management of Nutrition products is efficient?
6. What would be other comments regarding this study towards the management of Nutrition products?
7. Considering the way this supply chain is managed, would you recommend for its efficient management?