



UNIVERSITY of
RWANDA

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

**ASSESSMENT OF FACTORS CONTRIBUTING TO MEDICINES EXPIRY IN
RWANDA: Case of Central medical store; MPPD**

*Thesis submitted to the University of Rwanda, in partial fulfillment of the
Requirements for the degree of Masters in Health Supply Chain Management (MSc HSCM)*

By

Theogene HAKUZIMANA (B. Pharm)

218014652

**SCHOOL OF PUBLIC HEALTH
COLLEGE OF MEDICINE AND HEALTH SCIENCES
EAC REGIONAL CENTRE OF EXCELLENCE FOR VACCINES, IMMUNIZATION AND
HEALTH SUPPLY CHAIN MANAGEMENT**

UNIVERSITY OF RWANDA

Supervisors:

Prof. Dr. Pierre Claver KAYUMBA, PhD

Dr. HAHIRWA Innocent, PhD

Mr. Max KABALISA, B. Pharm, MSc

Academic year 2018-2019

STUDENT DECLARATION

I declare that this Dissertation is my Original Work and has not been presented for a Degree at University of Rwanda or in any other University.



October, 2019

STUDENT NAME: Theogene HAKUZIMANA

STUDENT NO: 218014652



October, 2019

Supervisor: Prof. Dr. Pierre Claver KAYUMBA, PhD
Course Manager

-----SIGNED----- Date

Co-supervisor: Dr. HAHIRWA Innocent



October, 2019

Mr. Max KABALISA, B. Pharm, MSc (Epidemiology)

ABSTRACT

Since many years, medicines' supply chain in Rwanda knew many inefficiencies—from poor quantification, fragmented distribution, and inexistence of a harmonized logistics information system in health. This has led to a disruption in the health commodity supply chain and the government's ability to achieve its health goals has been compromised. The remediation of these problems, has been the establishment of new strategies by the Government of Rwanda (GOR) and the partnership with stakeholders to make more strong and sustainable its supply chain management. Regardless of the significant efforts that used and put in place to enhance supply chain performance in Rwanda, reports done by the Auditor General, have revealed consistent problems related to poor inventory management and big loss due to expiry of medicines at MPPD. From there, it's important that in-depth exploration be done to understand the status of expiry in detail at Central medical store and identify the factors that contribute to expiry of medicines at that level. The aim of this research was to assess the factors that contribute to or cause expiry of medicines at MPPD and from there formulate some recommendations for the improvement of the current situation. The questionnaire containing closed-ended items has been used during this study. Multiple choices have been given and the respondents were asked to tick appropriate choices. The study found that the total expired products were RWF 6,046,777,655 for all program categories: HIV commodities had the largest share 53.3%, Essential Medicines 22.5%, Malaria 13%, Maternal Child Health commodities 5.7%, Products used for Community health workers 4.5%, TB products 1% and 0.1% for Family Planning products. The study indicated that 60% of the respondents agree that excess drug supply affects the expiry of medicines at MPPD, 20% agreed that poor storage conditions affect the expiry of medicines at MPPD against 56% who disagreed that poor conditions affect the expiry of medicines at MPPD, 32% of respondents agreed that supply chain management affects the expiry of medicines at MPPD and for other factors all the statements were agreeable with a percentage above 60 (Rare diseases affect the expiry of medicines at MPPD 88%, Abrupt cessation of use/treatment policy change affects the expiry of medicines at MPPD 80%, Short shelf life affect the expiry of medicines at MPPD 72%, Expensive medicine affects the expiry of medicines at MPPD 72% and donation of management affects the expiry of medicines at MPPD 68% and). The study recommended that further research should be done on the factors that contribute to or cause expiry of medicines at MPPD concerning especially how the institution is accountable on the

management of products subsidized where Government is funded by donors because they are many that expire at MPPD. Further research should also be conducted on the contribution of customer relationship management on the expiry of medicines at MPPD. There is a need for other researchers to undertake similar studies to ascertain how different institutions (public or private) deal with the issues of medicine expiry

CONTENTS

STUDENT DECLARATION	i
ABSTRACT	ii
List of Figures	v
List of Tables	vi
List of Appendices	vii
ACKNOWLEDGEMENT	viii
DEDICATION	ix
ACRONYM	xi
CHAPTER ONE: INTRODUCTION	1
Background	1
1.1 Problem Statement	4
1.2 Purpose of the Study	5
1.3 Specific Objectives	5
1.4 Study Questions	5
1.5 Significance and Output of the research	6
1.6 Delimitations	6
1.7 Limitation	6
CHAPTER TWO: LITERATURE REVIEW	7
2.1 Theoretical Review	7
2.1.1 Resource Based Theory	7
2.2 Empirical Review	7
2.3 Conceptual Framework	11
CHAPTER THREE: RESEARCH METHODOLOGY	12
3.1 Research Design	12
3.2 Location of the Study	12
3.3 Target Population	12
3.4 Sample Design	13
3.5 Data Collection Instruments	13
3.6 Validity and Reliability Test	14
3.7 Data Analysis and Presentation	14
3.8 Ethical Consideration	14
CHAPTER FOUR: RESULTS AND DISCUSSION	15

4.1 Demographic information	15
4.1.1 Gender of the Respondents.....	15
4.1.2 Age of the Respondents.....	16
4.1.3 Educational Qualification.....	17
4.1.4 Years of Service.....	18
4.2 Factors contributing to the expiry of medicines at MPPD	19
4.2.1 Expired Products by Program Category per year	19
4.2.2 Value of Expired Product in Rwanda Francs during the period 2014-2018.....	20
4.2.3 The share of expired products by Product Category	21
4.2.4 Effect of excess drug supply on the expiry of medicines at MPPD	22
4.2.5 Effects of poor storage conditions on the expiry of medicines at MPPD.....	22
4.2.6 Supply Chain Management.....	23
4.2.7 Other factors that have Effects on the expiry of medicines at MPPD	25
4.2.8 Staff’s understanding on the major contributing factors for expiry of health commodities at MPPD	26
CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS	28
5.1 Conclusion	28
5.2 Recommendations	29
REFERENCES	30
16. Michael Dawson (1994). Expiry dates (01 April 1994). [Internet] Available on.....	31
APPENDICES	32
APPENDIX I: LETTER OF INTRODUCTION	32
APPENDIX II: QUESTIONNAIRE	33

List of Figures

Figure 2.1: Theoretical Framework

Figure 4.1 Expired Products by Program Category per year

Figure 4.2. The share of expired products by Product Category

List of Tables

Table 3.1: Target Population

Table 3.2: Sample Size

Table 4.1: Gender

Table 4.2: Age

Table 4.3: Educational Qualification

Table 4.4: Years of Service

Table 4.5: Value of Expired Product in Rwanda Francs during the period 2014-2018

Table 4.6: Excess Drug Supply

Table 4.7: Poor Storage Conditions

Table 4.8: Supply Chain Management

Table 4.9: Other factors

Table 4.10: Staff's understanding on the major contributing factors for expiry of health commodities at MPPD

List of Appendices

APPENDIX I: LETTER OF INTRODUCTION

APPENDIX II: QUESTIONNAIRE

APPENDIX III: RESEARCH WORK PLAN

APPENDIX IV: ESTIMATED RESEARCH BUDGET

ACKNOWLEDGEMENT

First and foremost, I will thank The Almighty God, the compassionate, who kindly helped me to reach this step in my studies. I would like to express my sincere appreciation especially to my supervisors **Prof. Dr. Pierre Claver KAYUMBA, PhD, Dr. HAHIRWA Innocent, PhD** and **Mr. Max KABALISA, B. Pharm, MSc** for their valuable support, encouragement and kindness to me towards the successful completion of this research project.

My gratitude also goes to **EAC REGIONAL CENTRE OF EXCELLENCE FOR VACCINES, IMMUNIZATION AND HEALTH SUPPLY CHAIN MANAGEMENT** at **University of RWANDA**, Academic staffs for their continued support and knowledge acquired from them during my studies.

I am grateful for the assistance and support from my Employer, the **Mayor of GAKENKE DISTRICT NZAMWITA Deo**, he used to ask where I am with my studies, I really appreciated.

I am also grateful for the assistance and support from my house the lovely Wife **Pelagie NIRAGIRE** and my offspring, my lovely kids **Isimbi H. Sereine, Ajeneza H. Chana** and **Ntwari H. Eben** your love, motivation and support when much needed; helped me to come out with this beautiful work.

My warm gratitude also goes to my **Colleagues of Class at University of Rwanda**, you have been a blessing and encouragers to this work.

Finally, this research project is dedicated to my working team and my different friends, I will always appreciate all you have done, your encouragement and different kinds of support. I am sure you accept my deepest and humble thanks.

DEDICATION

I most humbly dedicate this research project to my mother in remembrance of her caring treatment, my lovely wife **Pelagie NIRAGIRE**, and my children **ISIMBI H. Sereine**, **AJENEZA H. Chana** and **NTWARI H. Eben**. Without them, this work would not have come into existence.

ACRONYM

GOR Government of Rwanda

SDPs Service Delivery Points

DPs District Pharmacies

HC Health Center

DH District Hospital

HF Health Facility

MPPD Medical Procurement and Production Division

CHAPTER ONE: INTRODUCTION

Background

It has been revealed that all medications received by patients are not used because of side effects, modification of dosage, feeling healthy, medicines reaching the expiry date, different practices of manufacturers that are promoting prescription practices, or dispensation practices. According to World Health Organization (WHO) (2004), several medications are prescribed inappropriately, prescribed and sold inappropriately, which leads to unnecessary storage and of course environmental threat (1). Non-adherence to medication also causes storage of non-used medicines at home. Literature shows that 50% of patients do not take medicine correctly. Therefore, without contestation, families and patients always are possessing unused or expired medications in their stock and its risks need more attention all over the world (2).

According to Tull (2018), when defining an expiration date you base on a drug that is maintained under “ideal manufacturer-suggested conditions of temperature, humidity, light exposure, and packaging integrity” (3). The expiry date as defined by the manufacturer of drug wants to express that a drug should always be up to the concerned standard of identity, purity, strength and quality during the time of use, and it is kept under storage conditions defined by the main manufacturer. Most products are distributed to pharmacies expiring in 1 to 5 years from the date they have been manufactured. In case of drugs stored in temporary, provisional warehouses as in emergency settings. However, it is very hard to rely on the quoted expiry date. Normally, there may be extension of the initial expiration date based on further test of stability. In countries with low- or low- and middle-income, it is always possible to extend the use of medications which will pass tests to know their efficacy and safety that helps to save both money and the environment at the same time, via Shelf Life Extension Programmes. Therefore, the expiration date that we see may not necessarily be the real shelf life of a drug(3).

Globally, in 2004, at almost 10 years when WHO first revealed its guidelines, the Indonesia has been supplied in excess drugs after the period of tsunami. Pharmaciens Sans Frontières reported that “extremely large quantities” of cough medicine and the antibiotic tetracycline

had to expire without being used, which caused “more problems to the authorities than they help the population.” 60% of the donations received were not on the list of essential medicines in Indonesia, and most of them about 70% were not labeled in a language of Indonesian people (4). In china, after the 2008 Sichuan earthquake, at least 97% of all drug donations came from China itself, however it was a large proportion of inappropriate donations. This caused financial loss for hospitals and doctors due to donations of excessive amounts of free drugs. This is because the income of hospitals and doctors in China is mostly generated by selling drugs (5). The government hired a company to organize and monitor the medical supply after the disaster period, concluding that there were more drugs donated than needed for the emergency situation. Twenty tons of drugs, 10 tons of medical devices and 724.5 tons of disinfection materials had to be destroyed because they were inappropriate (mostly expired) and could not be used (3).

In Africa, according to an investigation by the Paris-based International Institute of Research Against Counterfeit Medicines (IRACM), Eritrean, Togolese, Kenyan and Uganda markets have been overflowing with expired drugs in 2017 and 2018 (3). In 1989 during the Eritrean War of Independence, it is reported that donors sent “seven truckloads of expired aspirin tablets that took six months to burn” (4). For several years since then, humanitarian aid has been refused. Recent government acceptance of aid does not include essential drugs or medical attention. In Kenya, Tull (2018) confirms that a drug repackaging scam was stopped by the Kenyan police in April 2018, according to media reports. The Kenya Medical Supplies Authority lost drugs valued at Sh352 million (USD3.47 million) due to expiry or damage last year alone. The 2016/17 KEMSA report gave no explanation for stocking expired drugs, thereby causing unnecessary loss to the authority when numerous hospitals in the country were complaining of a shortage of drugs(3). In Uganda, a cross-sectional study of six public and 32 private medicine outlets in Kampala and Entebbe municipality was conducted. Results revealed that drugs and medicines that are highly expiring include those for vertical programs, donated drugs, and those that are used at lowest rate. Even essential medicines the study revealed that most of time expire in the supply chain (6).

In developing countries, the budgets allocated to medicines are always high and are even the second category of expense after human resource(7), that is why the supply chain needs to be improved and sustained to prevent any type of loss, including pilferage, misuse and expiry. This is reflected in the case of Rwanda as stipulated by USAID-DELIVER Final Report 2016 that, since many years, medicines' supply chain in Rwanda knew many inefficiencies—from poor quantification, fragmented distribution, and inexistence of a harmonized logistics information system in health(8). USAID-DELIVER Final Report 2016 continues to say that, this has led to a disruption in the health commodity supply chain and the government's ability to achieve its health goals has been compromised(8). The remediation of these problems, has been the establishment of new strategies by the Government of Rwanda (GOR) and the partnership with stakeholders to make more strong and sustainable its supply chain management(8). While in Rwanda, the public health supply chain knew substantive gains in availing products and strengthening information visibility, the MOH still recognizes that satisfying the needs of the future population requires a very powerful and continuous review of activities and new investments in supply chain. Literature shows that from 2008, there had been an increase of the value of the health commodities treated per year; it raised from \$3.3 million to \$50 million and the trends is gradually increasing (8). This might explain clearly why having a robust supply chain represents an essential strategy for a satisfying availability of necessary health commodities in Rwanda and therefore sustainable availability of essential medicines with less or no expiry of medicines.

Regardless of the significant efforts that used and put in place to enhance supply chain performance in Rwanda, reports done by the Auditor General, have revealed consistent problems related to poor inventory management and big loss due to expiry of medicines at MPPD. It has been reported that Drugs and medical consumables worth Frw 1,213,019,238of RBC/MPDD own stock expired and in addition, donor stock under the management of RBC/MPDD worth Frw 2,672,054,413expired between 2012 and 2015 (9). From there, it's important that in-depth exploration be done to understand the level of expiry in detail at Central medical store and identify the factors that contribute to expiry of medicines at that level.

The Supply chain in Rwanda, is categorized into three main levels: Central level (2 central supply entities which are MPPD and BUFMAR), District Pharmacies (30) and services delivery points (Health Centers, District hospitals, provincial and referral hospitals) and the fourth one which is Community level. Central medical store is the main supply entity by which big volume of medicines are flowing through the system of course for availing these medicines at all decentralized level (Provincial, District and Community).

In Rwanda, there are two central medical stores in supply chain of medicines. Medical production, procurement and distribution (MPPD) is the only one central medical store which is named as public. Based on its mandate of availing all medical supplies in the Rwanda, MPPD might be encountering challenges in producing, procuring and distributing medical supplies that might lead to medicines expiry. And hence, conducting a study on factors that are contributing to medicines expiry in MPPD seem to be highly needed as there is no kind of research has been conducted in Rwanda.

1.1 Problem Statement

Several reasons or factors in the supply chain may lead to expiration of medicines. They might be but not limited to the following: Poor quantification, poor inventory management, insufficient knowledge of basic tools for expiry prevention, non-participatory of different departments in medicine quantification in different institutions, out sourced procurement by vertical programs without including the beneficiaries, uncoordinated supply of donated health commodities procured with short time of use. Other factors may be the interruption or cessation of using drugs due to treatment guidelines and policy change, drugs that are expensive, drugs to treat rare diseases.

According to the report by Gahigi (2016), Rwanda is one of the developing countries that is struggling with health financing options, with a big number of the poor unable to afford out-of the pocket health care, while others can't access community based health insurance scheme for their households because they claim to have been grouped as rich in Ubudehe classifications (10). The country continues to incur losses due to the increasing volumes of drugs expiring in Rwanda Biomedical Centre (RBC) storage, something the auditor-general has attributed to failure by the body to “set and monitor appropriate stock levels. The auditor-general's report

pointed out that drugs and medical consumables worth Rwf1.2 billion (\$1.5 million) expired between 2010 and 2015, while donor stock under the management of RBC worth Rwf2.7 billion (\$3.4 million) expired between 2012 and 2015 (9)(10).

The condition threatens the quantity and quality of medicine available to patients. Towards the end of 2015, at the height of malaria resurgence, the country suffered a severe shortage in malaria drugs,

and for the auditor-general to report that whole consignments of drugs that the country spends money on expires in storage sends a really bad message. In most instances drugs are ordered without properly determining the quantities needed at a particular time, hence the stockpiling drugs which end up expiring (9).

Medicines expiry in the supply chain highlights a problem, which may include medicine selection, quantification, procurement, storage, distribution, use and the entire supply chain management and policies. Therefore, the current study has given answers to the following questions: What are the factors that contribute to expiry of medicines at MPPD?

1.2 Purpose of the Study

The main objective of this study is to assess the factors that contribute to expiry of medicines at MPPD.

1.3 Specific Objectives

- i) To find out the most expiring medicines at MPPD
- ii) To determine effects of excess drug supply on the expiry of medicines at MPPD
- iii) To examine the effects of poor storage conditions on expiry of medicines at MPPD
- iv) To examine the effects of supply chain management on expiry of medicines at MPPD
- v) To find out other factors that have Effects on the expiry of medicines at MPPD

1.4 Study Questions

- i) What are the most expiring medicines at MPPD?
- ii) What are the effects of excess drug supply on the expiry of medicines at MPPD?
- iii) What are the effects of poor storage conditions on expiry of medicines at MPPD?

- iv) What are the effects of supply chain management on expiry of medicines at MPPD?
- v) What are other factors that have effects on the expiry of medicines at MPPD?

1.5 Significance and Output of the research

The study determined the factors that are contributing to the expiration of health commodities in Rwanda. The study will help different health professionals to be aware to what extent medicines are expiring and the way they can be managed to prevent any kind of loss due to expirations.

The study will help the Government of Rwanda, especially Ministry of Health and its institutions to make decisions on how to prevent the expiry of drugs at health facilities.

The study helped the researcher to realize the extent of expiration rate or value of health commodities in Rwanda. Other researchers and scholars also interested in the area the study will help as the findings from it added new literatures to drugs expiration.

1.6 Delimitations

The study went beyond secondary data and covered only data of last five years from 2014 up to 2018, this is because the main data source for the study was from inventory reports on expiries done at MPPD. Key actors have been contacted to collect information about expiry of medicines and the contributing factors in MPPD.

1.7 Limitation

The limitation was limited to the target population concerned with the study as it focused on one entity only in the entire supply chain; public central medical store (MPPD) due to resource constraints; findings are not generalized on the whole health care framework in Rwanda as they may differ from one level to another.

CHAPTER TWO: LITERATURE REVIEW

This chapter discusses theoretical and empirical literature of the study. The chapter further describes the conceptual framework.

2.1 Theoretical Review

A theoretical context provides the investigator the lens to view the world. The theoretical context relates to the philosophical basis on which the investigator takes place and forms the connection between the theoretical aspects and practical components of the research problem. The analysis was based on the theory of resource basis.

2.1.1 Resource Based Theory

The resource-based view theory was developed by Barney in 1991, Resource Based View (RBV) is a business management tool used to determine the company's strategic resources(11). The advocates of this view claim that organizations should search within the company to find the sources of competitive advantage, rather than looking at a competitive environment. Robert (1991) describes the organization as a mix of capital and capacities(11). Such resources and skills consist of assets that are physical, economic, human, and in tangible. The theory is based on the fact that resources are not homogeneous and that mobility is limited. Such assets and skills can be converted into a strategic advantage by the organization if they are important, unique, inimitable, and structured to leverage such resources. It was found that RBV or the company's competitive advantage is one of the key strategic management theories for understanding organizational success and is also part of the broader management theory. Danneels, (2002) argues that a dynamic perspective is important for the Resource Based View (RBV) to understand how organizations evolve over time through their implementation and resource acquisition (12). This theory is relevant in study procurement of medicines.

2.2 Empirical Review

According to WHO (2001), few countries have appropriate administrative arrangements for the collection of pharmaceutical stocks(13).

Drugs in the public sector, are the property of the state, which requires strict accounting procedures. If there are any procedures, they tend to be complicated and time-consuming, and the disposal of expired stocks is difficult in practice. It refers to both medications procured via normal channels and donated medicines. Administrative and protocols for the safe disposal of pharmaceuticals in accordance with national legislation on drugs and the environment should be introduced and enforced in countries receiving drug donations. Overall, it would probably be the best solution to simplify procedures. One of the solutions would be to state that donated drugs, unless specifically accepted as such, are not entered into the government inventory or considered state property. In this situation, any medicines that are not officially accepted may be destroyed without government approval; however, proper disposal protocols must be followed. Another solution would be to set up special, simplified administrative procedures for the collection of unwanted donations(13).

Drugs are part of the patient-health service relationship. Their availability or absence will therefore contribute to the positive or negative health impact. Second, poor drug control, particularly in developing countries' public sector, is a critical issue, but substantial improvements can be made that can save money and improve access. Poor coordination seems to be responsible for some incidents involving expiry. Expiry due to changes in care policy and duplicate procurement, for example, can be avoided by sound communication between key stakeholders. Motlanthe (2010) noted factors that may lead to the expiry of pharmaceutical products such as: medicines procured with short shelf life, medicines impacted by abrupt cessation of use or changes in care policy, costly slow-selling medicines and medicines that treat rare diseases. Anecdotal evidence suggests poor storage conditions, such as excessive heat, humidity and light, and poor assessment of needs and control of stocks are the main causes of expiry of medications in health facilities. Large buffer stocks are among the factors that, due to expiry, can cause high stock losses. The drug supply management system has four core functions; selection, procurement, distribution and use(14). Nakyanzi *et al.* (2010) posit that the main factors include failure of inventory control, lack of knowledge of elementary expiry prevention methods, nonparticipation of clinicians in medicine quantification in health facilities, profit- and incentive-biased quantification, third party procurement by vertical programs and overstocking(6).

Given that drugs are no longer the sole responsibility of health workers, social, cultural, financial and conventional factors in health care have become so critical that it is important to look at drugs and health care from these perspectives. Drugs should be adequately managed to contribute to: adequate financial expenditure, avoid waste, increase access and ensure proper use of drugs. Proper management of drugs can also be a source of income that can be used to meet other healthcare needs, particularly for disadvantaged people(1). Nakyanzi *et al.* (2010), argue that proper coordination between government projects or vertical programs and public medical stores will address the problem of over-storage associated with duplicate procurement and harmonize the quantification of medicines with consumer habits in prescription and expectations to ensure that procurement suits turnover(6). This can be done by including prescribers in deciding the range and quantity of supplies and by using customer taste and preferences surveys to assess, for example, acceptable dosage forms. Medicines with a slow and unpredictable turnover, normally will always tend to expire (6).

According to Medsafe (2016), depending on the drug, the expiry dates may be determined for a fixed period after fabrication and during use, however are unique to the container used in the stability studies(15). Different packaging provides different protection, such as the incorporation of desiccants in containers to capture moisture and improve stability. At the manufacturer's discretion, additional tests conducted on the drug outside of its immediate bottle or in other packaging materials. Most medicines are repackaged in individual delivery forms, such as blister packs, to encourage adherence to medication and safe administration. When a medication is repackaged, its characteristics can change in ways not assessed during the approval process. Consequently, the expiry dates of the manufacturer are no longer applicable and a pharmacist may apply a new expiry date which is shorter than the original date to account for these variables. Some medicines' stability will be further influenced by their place of storage at home. In some cases, these are usually bathrooms and kitchens that can suffer extremes of temperature and humidity(15).

According to NPS MedicineWise (2019), the shelf-life of a medicine is the duration it is considered to stay within appropriate potency and other relevant parameters specifications. The expiry date is the specific date a lot or batch hits the end of its shelf life. The expiration date

depends on the storage conditions specified(16). Not all medicines have the same decomposition rate, so the expiry dates will vary. Only stability studies estimate the shelf-life. The core of the stability study design is temperature, humidity, lighting, temperature fluctuations, container type, opening and closing and microbial content.

Nakyanz, Kitutu, Oria & Kamba (2010) conducted a research on Expiry of medicines in supply outlets in Uganda and noted the expiry of health commodities in the supply chain is a major threat to the already restricted access to drugs in developing countries (6). Their findings indicate the expiration of health products was popular among commodities for vertical health programs (with the percentage of outlets that report expiry). Slow turnover is a possible explanation for the expiry of anticancer drugs as they treat rare diseases and are costly. After examination of factors contributing to the supply chain, Nakyanz, Kitutu, Oria & Kamba (2010) claim that the main ones included failure of inventory control, lack of knowledge of elementary expiry prevention methods, nonparticipation of multidisciplinary team in medicine quantification in health facilities, profit- and incentive-biased quantification, third party procurement by vertical programs and overstocking(6).

WHO, (2004) asserts that Pharmacists prefer large-scale acquisitions for economies of scale, but this can lead to overstocking and thus intensify expiry(17). Nevertheless, this can be mitigated by phasing out effective sourcing, lean supply and turnover of stocks. A lean supply strategy would clearly avoid the expiry of short-lived goods, although its efficacy requires a comprehensive information system for logistics management (*Drug management manual, 2006*) (17). Medicines with a slow and unpredictable turnover, will always tend to expire. The Basic approach to balancing the order for economic quantities to maximize stock levels works only for predictable drugs and is unacceptable for those with unpredictable demand. Rigorous diligence in inventory management and limited stock maintenance is the best way to reduce the expiry of these medicines. While there have been comprehensive global guidelines for the donation of medicines since 1996, national medicine regulators need to take charge and implement them in their own country(13).

2.3 Conceptual Framework

The conceptual framework reveals the connection between the variables of the study; a variable is a measurable characteristic that assumes specific values among topics. The relationships between the variables of the analysis are shown in the following figure 2.1.

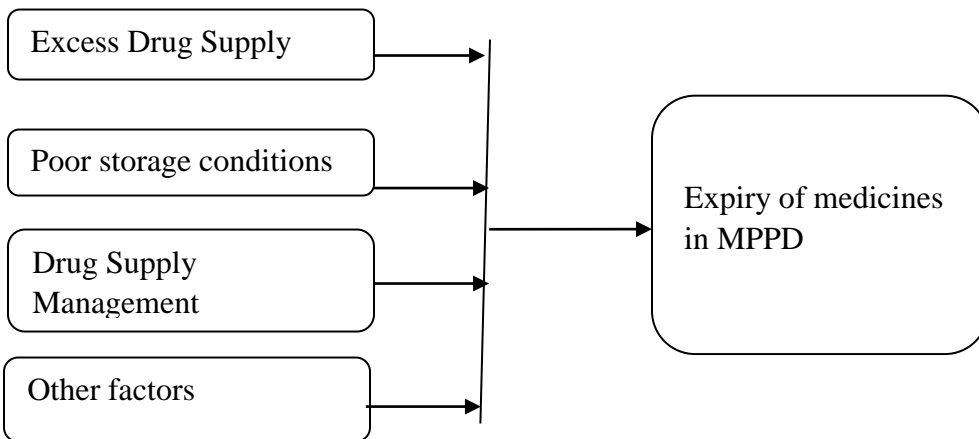


Figure 2.1: Theoretical Framework

CHAPTER THREE: RESEARCH METHODOLOGY

Chapter three constitutes the research tools used in the study by the researcher. It presents procedures for research design, target population, sample size and sampling. This discusses the data collection instruments and how they were tested, the methods to be used to assess the pilot test of the instruments, the procedures of data collection and the techniques of analysis.

3.1 Research Design

Descriptive research design has been used in this study. Descriptive research accurately describes the participants (Crossman, 2013). In both quantitative and qualitative research projects, descriptive research design can be used. The study considered this design as the research variables are identified and their relationship with the dependent variable is therefore determined. Descriptive study was also deemed appropriate when the target population was large and respondents could be obtained by using random sampling such as a stratified random sampling technique.

3.2 Location of the Study

The location of study was in Kigali, at central medical store of Rwanda Medical Procurement Production Division (MPPD).KG 509 ST, Towards National Police Headquarters; Village: Virunga; Cell: Kibaza; Sector: Kacyiru; District: Gasabo; Kigali City

3.3 Target Population

The target population consisted of MPPD staff. The population of the study consisted of pharmacists and other personnel. The study was conducted within one month. Table 3.1 presents the details of the target population.

Table 3.1: Target Population

Category	Target population
Pharmacists	20
Procurement officer	20
Management	10
Total	50

3.4 Sample Design

The researcher used stratified sampling methods. The sample size was 50% of the target population selected as shown on table 3.2.

Table 3.2: Sample Size

Category	Target population	Sample Size	Percentage
Pharmacists	20	10	40
Procurement officer	20	10	40
Management	10	5	20
Total	50	25	100

3.5 Data Collection Instruments

The research used a questionnaire which containing closed-ended items and a confectioned excel tool to collect data on expired drugs during the last five years from 2014 to 2018. There were multiple choices where respondents were asked to tick suitable choices in the questionnaire. The tool was designed to include all the things that helped to achieve the research objectives. Questionnaire was chosen because it is an active data collection method that enables respondents to give much of their opinion on the research question. According to Kothari (2006), the information derived from questionnaires is free of bias and influence of researchers and therefore accurate and valid data have been collected (18).

3.6 Validity and Reliability Test

Reliability requires the standard of measurement as quoted by Kothari (2006), who continues to say that reliability is the accuracy or repeatability of the measurements in their daily senses, while validity concerns whether the concept that really measures the study's main purpose (18). For the confirmation of validity and accuracy of research tool, 5 questionnaires were distributed to the staff of MPPD to check the process of data collection. Once the questionnaires have been returned, the accuracy of the research tool used has been correctly evaluated.

3.7 Data Analysis and Presentation

The investigator collected large amounts of data in order to facilitate further study and interpretation of the results in an easy way. The data was edited, coded and classified so as to present the results of the data analysis in a systematic and clear way. In the data analysis, the researcher used descriptive statistics and quantitative techniques. The data was presented in a diagrammatic manner using pie charts and tables. The data from the questionnaire was analyzed using the Statistical Package for the Social Sciences (SPSS) and MS excel. Data on expired medicines has been filtered and treated to find significant information to present in tables and pie charts.

3.8 Ethical Consideration

Ethical considerations have been observed. This meant obtaining the requisite approval from both the university administrators and the authorities concerned. Their permission is useful in ensuring that this research study was completed successfully so that the results obtained in the subsequent stages do not contravene the rules and regulations laid down in the conduct of this research. The authorizations have also helped to guarantee the confidentiality of responses from respondents who participated in the study.

CHAPTER FOUR: RESULTS AND DISCUSSION

This section includes the results obtained from the field. The chapter begins with the general information provided by the respondents who took part in the study. Data on the research questions of the study are subsequently presented. The chapter also presents the analysis of collected data through questionnaires. The analysis of data has been then done using the SPSS and displayed in tables and bar graphs. The study focused on a sample size of 25 participants of whom all completed and returned the questionnaires at a response rate of 100%.

4.1 Demographic information

4.1.1 Gender of the Respondents

This part of the questionnaire sought to find out the gender the respondents.

Table 4.1: Gender

Gender	No of respondents	Percentage
Male	14	56
Female	11	44
Totals	25	100

It has been noted from the data collected that 14 of the participants were males which made 56 % and 11 were female which made 44% as displayed in the table 4.1 above. This shows that most of the respondents are males.

4.1.2 Age of the Respondents

This section of the questionnaire sought to determine the ages the respondents belong to.

Table 4.2: Age

Age	No. of respondents	Percentage
20 – 30	0	0
31 – 40	16	64
41 – 50	6	24
51 – 60	3	12
Above 60	0	0
Totals	25	100

Result indicates that the large number of the respondents have the ages between 31-40, who were presenting a rate of 64% of respondents. The second mostly presented ages between 41-50 presented by 24%, followed by age between 51–60 years presented by 12%. The ranges above 60 years and those between ages of 20–30 had no respondent. This indicates that most of staff at MPPD are of the ages above 30 years.

4.1.3 Educational Qualification

This section sought to determine the Highest Qualification in education.

Table 4.3: Educational Qualification

Educational Qualification	No of respondents	Percentage
Secondary	0	0
Diploma	0	0
Bachelor	16	64
Masters	9	36
Others	0	0
Totals	25	100

Result indicates that the large number of the respondents have attained the bachelor's degree level of education and above as shown in the above table 4.3. Bachelor was found to have highest education number at 16 represented by 64% followed by master education with 36%. Secondary, diploma and other education levels did not have a respondent. This may be explained by the qualification needed to join any medical facility in Rwanda.

4.1.4 Years of Service

This parameter sought to find how long respondents have worked in the Organization.

Table 4.4: Years of Service

Years of Service	No. of respondents	Percentage
Less than 1 year	0	0
1 – 5	6	24
6 – 10	7	28
Above 10	12	48
Totals	25	100

The findings above show that most of the respondents have more than 10 years of service at MPPD as shown in table 4.4 above. This was indicated by 12 respondents representing 48% and the those with 6-10 years of service at 28% while those with 1-5 years of service were representing 24%. None of the respondent had less than 1 year of service.

4.2 Factors contributing to the expiry of medicines at MPPD

4.2.1 Expired Products by Program Category per year

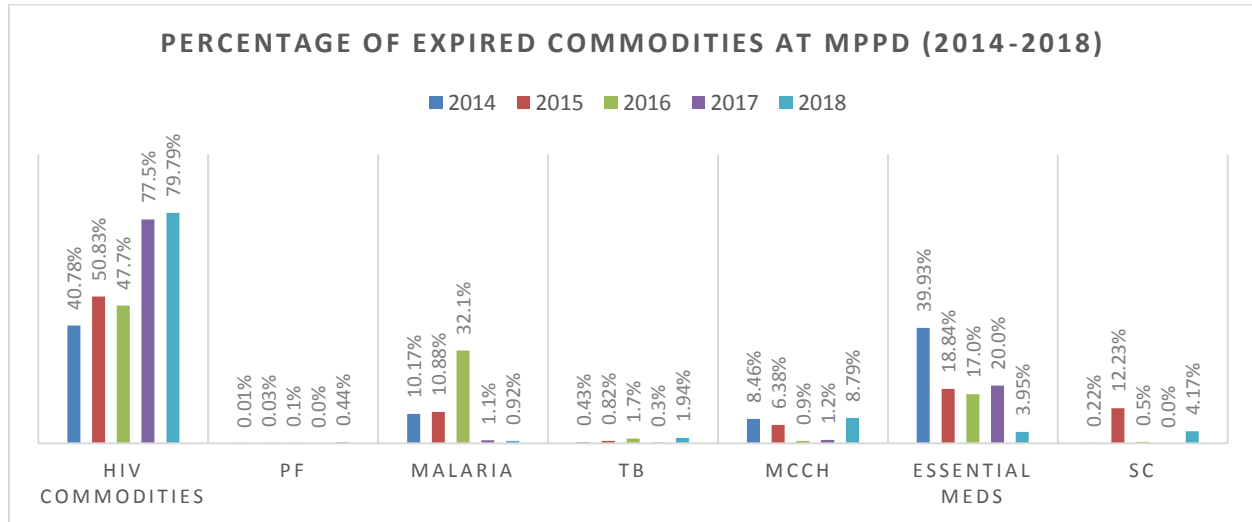


Figure 4.1 Expired Products by Program Category per year

The figure 4.1 above shows that during the period of this study, every year, HIV commodities are the most expiring in the store of MPPD followed by the drugs called essential medicines at MPPD and at the third position there is Malaria commodities. Family planning and Tuberculosis commodities are the last when considering the expiration with even a percentage reaching zero expiry.

4.2.2 Value of Expired Product in Rwanda Francs during the period 2014-2018

Table 4.5: Value of Expired Product in Rwanda Francs during the period 2014-2018

Product Category	Value of expired Products in RWF (2014-2018)				
	2,014	2,015	2,016	2,017	2,018
HIV commodities	677,034,979	957,440,365	589,952,163	402,547,714	596,676,468
PF	228,735	554,125	857,585	-	3,258,472
MALARIA	168,872,759	204,876,911	397,038,318	5,583,762	6,894,068
TB	7,170,512	15,516,848	20,740,857	1,494,560	14,501,322
MCCH	140,490,047	120,100,555	10,775,441	6,021,672	65,766,702
ESSENTIAL MEDs	662,873,254	354,927,582	210,339,351	103,711,470	29,507,649
SC	3,620,471	230,334,283	5,882,810	-	31,186,845
Total	1,660,290,757	1,883,750,669	1,235,586,525	519,359,178	747,791,526

Results above in the table 4.5 shows that the total value of expired drugs in 2014-2018 is 6,046,777,655 FRw for all program categories and was high in 2014 and 2015 and began to decrease gradually since the two last years in the stores of MPPD especially for essential medicines which are bought by own revenues from MPPD. Other products that are bought by funds from donors, some knows a systematic decrease in controlling their expiry others no. This value is very high considering the economic status of Rwanda and health spending. This amount is equivalent to almost 10% of the total National pharmaceutical health sector spending. Although there is a remarkable reduction in expiry for the last two years of almost two folds still a lot needs to be done to avoid this level of wastages.

4.2.3 The share of expired products by Product Category

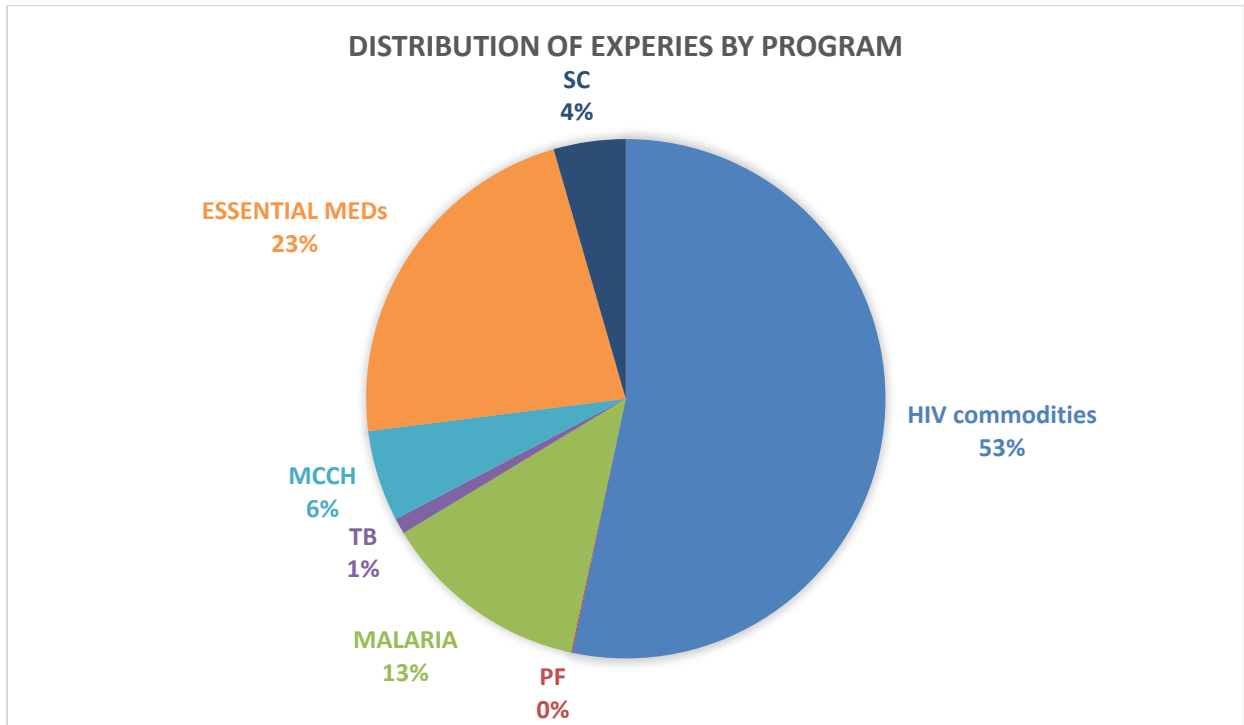


Figure 4.2. The share of expired products by Product Category

Results in the above figure 4.2 are showing that during last five years, the total amount of expired products were 6,046,777,655 FRw for all program categories and HIV commodities had the largest share 53.3%, Essential Medicines 22.5%, Malaria 13%, Maternal Child Health commodities 5.7%, Products used for Community health workers 4.5%, TB products 1% and 0.1% for Family Planning products.

4.2.4 Effect of excess drug supply on the expiry of medicines at MPPD

To achieve the first study objective, the effect of excess drug supply on the expiry of medicines at MPPD, the respondents were asked to react on the statements provided by using the scale given, where (-5, -4, -3, -2 and -1) stand respectively for Strongly Agree, Agree, Not Sure, Disagree and Strongly Disagree.

Table 4.6: Excess Drug Supply

Statement	Frequency of Answers									
	5	%	4	%	3	%	2	%	1	%
Excess drug supply affects the expiry of medicines at MPPD	8	32	7	28	2	8	3	12	5	20
Drug name is displayed for record purposed	10	40	9	36	3	12	1	4	2	8
All drugs procured are given drug Code	20	80	3	12	1	4	0	0	1	4
Drugs are only procured at known reorder levels	4	16	6	24	8	32	4	16	3	12

The results presented with the table 4.6 above shows that 60% of the participants agreed that excess drug supply affects the expiry of medicines at MPPD. The rest of activities done in the stock are well done at MPPD as shown in the above table. Drug name is displayed for record purposed, 76% of participants agreed with the statement. All drugs procured are given drug code 92% of participants agreed with the statement and drugs are only procured at known reorder levels, meaning correctly as agreed by 40% of respondents.

4.2.5 Effects of poor storage conditions on the expiry of medicines at MPPD

The second specific objective of this study was to assess the effects of poor storage conditions on the expiry of medicines at MPPD. Respondents were asked to react on the statements provided by using the scale given, where (-5, -4, -3, -2 and -1) stand respectively for Strongly Agree, Agree, Not Sure, Disagree and Strongly Disagree.

Table 4.7: Poor Storage Conditions

Statement	Frequency of Answers									
	5	%	4	%	3	%	2	%	1	%
Poor storage conditions affect the expiry of medicines at MPPD	4	16	1	4	6	24	6	24	8	32
The methods of storage of drug are appropriate	12	48	13	52	0	0	0	0	0	0
Drugs are stored according to the date procured	3	12	5	20	7	28	6	24	4	16
All drugs are stored according to the prescribed storage conditions	13	52	10	40	0	0	2	8	0	0
Room temperature is always monitored	18	72	6	24	1	4	0	0	0	0

The findings in table 4.7 show that only 20% agreed that poor storage conditions affect the expiry of medicines at MPPD against 56% who disagreed that poor conditions affect the expiry of medicines at MPPD, that is matching with the fact that MPPD is also in charge of supervising other public institutions like District Pharmacies and other health facilities to adhere to good storage practices. Findings also show that 100% agreed that methods of storage of drugs are appropriate at MPPD. 92% agreed that all drugs at MPPD are stored according to the prescribed storage conditions, 96% agreed that room temperature is always monitored at MPPD. Considering all these statements and the answers from the respondents, you may come with conclusion that poor storage conditions do not affect expiry of medicines at MPPD.

4.2.6 Supply Chain Management

As the third research question of this study was to examine the effects of supply chain management on the expiry of medicines at MPPD. Respondents were asked to react on the statements provided by using the scale given, where (-5, -4, -3, -2 and -1) stand respectively for Strongly Agree, Agree, Not Sure, Disagree and Strongly Disagree.

Table 4.8: Supply Chain Management

Statement	Frequency of Answer									
	5	%	4	%	3	%	2	%	1	%
Supply chain management affects the expiry of medicines at MPPD	3	12	5	20	13	52	2	8	2	8
Date of drug expiration recorded	5	20	8	32	12	48	0	0	0	0
Date manufactured or Batch number are always recorded	9	36	9	36	1	4	5	20	1	4
Unit from which drug was recorded is easy to know	13	52	8	32	3	12	1	4	0	0

The findings displayed with the table 4.8 above show that 32% of participants agreed that supply chain management affects the expiry of medicines at MPPD and 52% of respondents said that they are not sure. This might be explained by the facts that among respondents there were ones that working in finance and administration that may not be aware of how supply chain management is exactly done at MPPD. 52% agreed that date of drug expiration is recorded and 48% said that they are not sure. The reason is that among the respondents there were ones working in finance and others in administration; they may not master the supply chain management and its activities. 72% of respondents agreed that date manufactured and batch number are always recorded which meaningful at a level of central medical store. 84% of respondents agreed that unit from which drug was recorded is easy to know. With the findings about the factors that are contributing to the expiry of medicines at MPPD, it seems that excess drug supply is the only one that is more expressing at MPPD. That is why the researcher has gone beyond and tried to know if there may be other factors that may contribute to the expiry of medicines at MPPD as shown in the next objective.

4.2.7 Other factors that have Effects on the expiry of medicines at MPPD

The fourth objective was about the other factors that have effects on the expiry of medicines at MPPD.

Respondents were asked to react on the statements provided by using the scale given, where (-5, -4, -3, -2 and -1) stand respectively for Strongly Agree, Agree, Not Sure, Disagree and Strongly Disagree.

Table 4.9: Other factors

Statement	Frequency of Answers									
	5	%	4	%	3	%	2	%	1	%
Donation of management affects the expiry of medicines at MPPD	4	16	13	52	7	28	0	0	1	4
Short shelf life affect the expiry of medicines at MPPD	10	40	8	32	1	4	6	24	0	0
Expensive medicine affects the expiry of medicines at MPPD	11	44	7	28	1	4	3	12	3	12
Abrupt change in policy of use / treatment affects the expiry of medicines at MPPD	12	48	8	32	3	12	1	4	1	4
Rare diseases affect the expiry of medicines at MPPD	12	48	10	40	0	0	2	8	1	4

In determining other factors that have effects on the expiry of medicines at MPPD, percentage has been calculated as shown in the table 4.9 above. The findings show that all the statements were agreeable with a percentage above 60 (Rare diseases affect the expiry of medicines at MPPD 88%, Abrupt change in policy of use / treatment affects the expiry of medicines at MPPD 80%, Short shelf life affect the expiry of medicines at MPPD 72%, Expensive medicine affects the expiry of medicines at MPPD 72% and donation of management affects the expiry of medicines at MPPD 68% and). These findings are the explanation of a huge amount of expiries during last five years at MPPD.

They said that among the drugs they used to have their stock some of them have been removed in the protocols of treatment before being used and they were very expensive. They said during the data collection that the expired drugs they knew many of them were reagents with short shelf life and testing devices that have been abruptly ceased to be used in testing especially for HIV status.

4.2.8 Staff's understanding on the major contributing factors for expiry of health commodities at MPPD

Factors contributing to Expiries	Strongly agree	Agree	Not sure	Disagree	strongly disagree	Total
	%	%	%	%	%	% (n)
1. Excessive Drug Supply						
Excessive inventory results in expiries	32	28	8	12	20	100 (25)
Knowledge of Quantification and supply planning	40	36	12	4	8	10 (25)
Knowledge of Distribution of Medicines	80	12	4	0	4	100 (25)
Coordination between procurement and Warehousing team at MPPD	16	24	32	16	12	100(25)
2. Poor Inventory Management						
Poor storage conditions affect the expiry of medicines	16	4	24	24	32	100 (25)
The methods of storage of drug are appropriate	48	52	0	0	0	100 (25)
Drugs are stored according to the date procured	12	20	28	24	16	100 (25)
All drugs are stored according to the prescribed storage conditions	52	40	0	8	0	100 (25)
Room temperature is always monitored	72	24	4	0	0	100 (25)
3. Supply Chain Management						
Standard operating procedures	90	10	0	0	0	100 (25)
Skills in supply chain Management	70	10	10	10	0	100 (25)

Management Information system	50	35	10	5	0	100 (25)
Active Distribution of products	80	5	0	0	15	100 (25)
Procurement	90	0	5	0	5	100 (25)
Communication with stakeholders	80	5	0	5	5	100 (25)
4. Other factors						
Donations management	16	52	28	0	4	100 (25)
Short shelf life products especially Lab commodities	40	32	4	24	0	100 (25)
Expensive medicines that are not utilized due to none ordering or bought for emergency	44	28	4	12	12	100 (25)
Abrupt cessation of use/treatment policy change/new treatment protocol	48	32	12	4	4	100 (25)

Table. 4.10: Staff’s understanding on the major contributing factors for expiry of health commodities at MPPD

While measuring the staff’s understanding on the major contributing factors for expiry of health commodities at MPPD, the respondents ranked them as follows: supply chain management 92%, Other factors 80%, poor storage management 67% and excessive drug supply 65%. Key questions were asked to deeply understand why there were significant large amount of money on expiries at MPPD. The study revealed that although there is a strong knowledge on the cause but there were no gaps in these areas as shown on the table 4.10 above. These results shown above in the table 4.10 are in accordance with the literature that says that drugs expiration many times is linked to the inefficiencies of supply chain and the result is always higher costs or lower patients service levels (19).

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The main aim of this study was to assess the factors that are contributing to the expiry of health commodities but also determine the extent of expired commodities at MPPD during the period 2014-2018.

This study is a step towards understanding those factors that contribute to or cause expiry of medicines in MPPD. The study has revealed that 60% of the participants agree that excess drug supply affects the expiry of medicines at MPPD, 20% agreed that poor storage conditions affect the expiry of medicines at MPPD against 56% who disagreed that poor conditions affect the expiry of medicines at MPPD, 32% of respondents agreed that supply chain management affects the expiry of medicines at MPPD and for other factors all the statements were agreeable with a percentage above 60 (Rare diseases affect the expiry of medicines at MPPD 88%, Abrupt change in policy of use / treatment affects the expiry of medicines at MPPD 80%, Short shelf life affect the expiry of medicines at MPPD 72%, Expensive medicine affects the expiry of medicines at MPPD 72% and donation of management affects the expiry of medicines at MPPD 68% and). The study revealed also, although there is a strong knowledge on the cause of expiry of medicines (supply chain management 92%, Other factors 80%, poor storage management 67% and excessive drug supply 65%) and there were no gaps in many areas at MPPD such a well-conceived warehouse in box, standards operation procedures well designed and in place, strong trained staff in quantification and even well-structured coordinated procurement and distribution system (CPDS) but in contrast of the results, there is always a huge amount of drugs expiring every year. Literature says that a well-managed drug supply chain management will reduce the frequency and the quantity of expired drug. This is in line with Nakyanzi *et al.* (2010), who is of the view that best coordination of government projects or vertical programs and public stores of health commodities can improve the problem of overstocking which is mainly associated with duplicated procurement, and of course the harmonization of medicine quantification with habits in prescription and preferences of patients to ensure supply matches turnover(6). This has lead the researcher to think that maybe there are other factors that contribute to the expiry of medicines at MPPD that may be out of what he has worked on during the research and may be

linked to the leadership and accountability of the institution and may be how customer relationship management is done at MPPD.

5.2 Recommendations

Further research about the factors contributing to or causing expiry of medicines at MPPD should be carried out concerning especially how the institution is accountable on the management of products subsidized where Government is funded by donors because they are many that expire at MPPD. Further research could also be conducted about the contribution of customer relationship management on the expiry of medicines at MPPD. Revisions and strategic drug monitoring is with high recommendation too in order to timely tackle drug expiry that might occur. The flexible supply chain management is recommended to facilitate that the MPPD adjust to opportunities and threats may coming from the uncertainties of the external environment. Continuous coordination should be strengthened among staffs to reduce the high level excess drug supply. The provision of policy framework in attempt to reduce the rate of drugs expiring is also recommended. In the meantime , the government must develop effective monitoring systems to ensure that aid is successful in accordance with international drug control standards. This supports WHO (2001) that explains that administrative and guidelines for safe disposal of pharmaceuticals in accordance with national legislation on drugs and the environment should be introduced and enforced in countries receiving donations of drugs (20). The best solution would probably be to simplify procedures in general.

There is a need for other researchers to undertake similar studies to ascertain how different institutions (public or private) deal with the issues of medicine expiry.

REFERENCES

1. WHO (2004). The world medicines situation. [Internet] Available on <http://apps.who.int/medicinedocs/pdf/s6160e/s6160e.pdf> (Accessed 30 June 2019)
2. Bashaar M, Thawani V, Hassali MA, Saleem F. Disposal practices of unused and expired pharmaceuticals among general public in Kabul. *BMC Public Health* [Internet]. 2017;(December). [Internet]. Available from: <http://dx.doi.org/10.1186/s12889-016-3975-z> (Accessed 01 September 2019)
3. Tull, K. (2018). Drug expiry standards in developing countries. University of Leeds Nuffield Centre for International Health and Development
4. Burns, M. (2010).RX FOR HUMANITARIAN RELIEF. 24 April 2010. [Internet]. Available on <https://psmag.com/health-and-behavior/rx-for-humanitarian-relief-14634>. (Accessed 01 September 2019)
5. Xu, J.-K., Deng, X.-G., Li, H., Xie, H., Lu, J., Lu, Y., Zhang, L., Li, Y.-P., Shen. J. (2008). https://www.researchgate.net/publication/298184649_Ensuring_medical_supplies_for_the_medical_rescue_after_the_Wenchuan_earthquake. (Accessed 01 September 2019)
6. Nakyanzi, J.K., Kitutu, F.E., Oria, H., & Kamba, P.F. (2010). Expiry of medicines in supply outlets in Uganda. *Bulletin of the World Health Organization*, 88, 154-158.
7. Sauls C. Trend in revenue loss due to expired medication at a large urban hospital in Johannesburg , South Africa. 2016;(June).
8. USAID/DELIVER PROJECT (2016). Final Country report. 2016: 8-22 [Internet] Available on http://deliver.jsi.com/wp-content/uploads/2016/12/FinaCounRepo_RW.pdf (Accessed 17 September 2019)
9. Auditor General (2015). Report of the auditor general of state finances for the year ended 30 JUNE 2015;(June): 61
10. Gahigi, M. K. (2016). Drugs worth \$5m expire in storage in Rwanda. [Internet]. Available on <https://www.theeastafrican.co.ke/rwanda/News/Drugs-worth--5m-expire-in-storage-in-Rwanda---report-/1433218-3243564-ov8454/index.html> (accessed on 1/08/2019)
11. Grant, Robert M., (1991) "The resource-based theory of competitive advantage: implications for strategy formulation" from *California Management Review* 33 (3) pp.114-135, Berkeley, Calif.: University of California

12. Danneels, E. (2002). "The Dynamics of Product Innovation and Firm Competences," (September):109–121.
13. WHO (1999). Guidelines for Drug Donations. 1999; [Internet] Available on https://www.who.int/hac/techguidance/guidelines_for_drug_donations (accessed on 01/08/2019)
14. Motlanthe, E. K. (2010). A study on medicine expiry within the supply chain in Limpopo Province (master Dissertation, University of Limpopo)
15. Medsafe. Medicines expiry dates (2016). [Internet]. Available on <https://www.medsafe.govt.nz/profs/PUArticles/March2016/MedicineExpiryDates.htm> (accessed 1/08/2019)
16. Michael Dawson (1994). Expiry dates (01 April 1994). [Internet] Available on <https://www.nps.org.au/australian-prescriber/articles/expiry-dates>. (accessed 1/08/2019)
17. Timmermans A.; Sharma A. (2006). UNHCR Drug management manual 2006: 53-57
18. Kothari, C.R. (2006). Research methodology: Methods & techniques. (3rd Ed). New Age International Publishers
19. Kgabo A. Mashishi (2015). Expiration of drugs in public hospital pharmacies of Sekhukhune District , Limpopo Province , South Africa. University of Limpopo. Jan 2015: 5-7.
20. Ii P, Iii P. Pharmaceutical donations. 2012: 7-10 [Internet] Available on <https://www.msh.org/sites/msh.org/files/mds3-ch15-donations-mar2012> (Accessed 24 September 2019)

APPENDICES

APPENDIX I: LETTER OF INTRODUCTION

Theogene,
Kigali,

Dear respondent,

I am a post graduate student pursuing a Master's Degree in Health Supply Chain Management at University of Rwanda.

I am conducting an academic research focused at assessing the factors that contribute to the expiry of medicines in MPPD. This questionnaire is aimed at obtaining more information about your opinions, perceptions, experiences and particular issues on expiry of medicines.

My request is that you try and answer the questions as comprehensively as possible by using the available space provided. If you need more space, you can add the same as an attachment.

Your response will be treated with utmost confidentiality it deserves and no name will be disclosed without your consent.

Thank you in advance.

Yours faithfully,

Theogene HAKUZIMANA

Researcher

APPENDIX II: QUESTIONNAIRE

This questionnaire is intended to gather information to assist in analyzing the research under the current study. Kindly help me out to fill in this questionnaire accordingly.

Part One: Demographic Information

1. What is your Gender?

Male ()

Female ()

2. What Age group do you belong to in (years)?

20-30 ()

31-40 ()

41-50 ()

51-60 ()

60+ ()

3. What is your Highest Educational Qualification?

Secondary ()

Diploma ()

Bachelors ()

Masters ()

Others ()

4. How long have you worked in this Organization?

Less than 1 year ()

1– 5 years ()

6 – 10 Years ()

Above 10 years ()

Part Two: General Questions

5. Effect of excess drug supply on the expiry of medicines at MPPD

React on the statements provided by using the scale given. Please tick (√) appropriately, where Strongly Agree - 5, Agree - 4, Not Sure - 3, Disagree - 2, Strongly Disagree – 1

S/No.	Section A: Excess drug supply					
	Questions/Statement	1	2	3	4	5
1	Excess drug supply affects the expiry of medicines at MPPD					
2	Drug name are displayed for record purposed					
3	All drugs procured are given drug Code					
4	Drugs are only procure at known reorder levels					

6. Effects of poor storage conditions on the expiry of medicines at MPPD

React on the statements provided by using the scale given. Please tick (√) appropriately, where Strongly Agree - 5, Agree - 4, Not Sure - 3, Disagree - 2, Strongly Disagree – 1

S/No.	Section B: Poor storage conditions					
	Questions/Statement	1	2	3	4	5
1	Poor storage conditions affect the expiry of medicines at MPPD					
2	The methods of storage of drug are appropriate					
3	Drugs are stored according to the date procured					
4	All drugs are stored according to the prescribed storage conditions					
5	Room temperature is always monitored					

7. Effects of supply chain management on the expiry of medicines at MPPD

React on the statements provided by using the scale given. Please tick (√) appropriately, where Strongly Agree - 5, Agree - 4, Not Sure - 3, Disagree - 2, Strongly Disagree – 1

S/No.	Section C: Supply chain management					
	Questions/Statement	1	2	3	4	5
1	Supply chain management affects the expiry of medicines at MPPD					
2	Date of drug expiration recorded					
3	Date manufactured or Batch number are always recorded					
4	Unit from which drug was recorded is easy to know					

8. Other factors that have Effects on the expiry of medicines at MPPD

React on the statements provided by using the scale given. Please tick (√) appropriately, where Strongly Agree - 5, Agree - 4, Not Sure - 3, Disagree - 2, Strongly Disagree – 1

S/No.	Section D: Other factors that have Effects on the expiry of medicines					
	Questions/Statement	1	2	3	4	5
1	Donation of management affects the expiry of medicines at MPPD					
2	Short shelf life affect the expiry of medicines at MPPD					
3	Expensive medicine affects the expiry of medicines at MPPD					
4	Abrupt cessation of use/treatment policy change affects the expiry of medicines at MPPD					
5	Rare diseases affect the expiry of medicines at MPPD					

9. Staff's understanding on the major contributing factors for expiry of health commodities at MPPD

React on the statements provided by using the scale given. Please tick (√) appropriately, where Strongly Agree - 5, Agree - 4, Not Sure - 3, Disagree - 2, Strongly Disagree – 1

SECTION E: STAFF'S UNDERSTANDING						
S/No	QUESTIONS/STATEMENTS	1	2	3	4	5
1	Excessive Drug Supply					
	Excessive inventory results in expiries					
	Knowledge of Quantification and supply planning					
	Knowledge of Distribution of Medicines					
	Coordination between procurement and Warehousing team at MPPD					
2	Poor Inventory Management					
	Poor storage conditions affect the expiry of medicines					
	The methods of storage of drug are appropriate					
	Drugs are stored according to the date procured					
	All drugs are stored according to the prescribed storage conditions					
	Room temperature is always monitored					
3	Supply Chain Management					
	Standard operating procedures					
	Skills in supply chain Management					
	Management Information system					
	Active Distribution of products					
	Procurement					
	Communication with stakeholders					
4	Other factors					
	Donations management					
	Short shelf life products especially Lab commodities					
	Expensive medicines that are not utilized due to none ordering or bought for emergency					
	Abrupt cessation of use/treatment policy change/new treatment protocol					

Thank you