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

FACTORS ASSOCIATED WITH THE HIGH EXPIRY RATE OF MEDECINES AND SUPPLIES IN PUBLIC HEALTH FACILITIES IN JUBEK STATE, SOUTH SUDAN

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

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DECLARATION

I, Lokosang Emmanuel Alex, declare that the Thesis Report **"Factors Associated with high rate of expiry of Medicines in Public Health facilities in Jubek State, South Sudan"** hereby submit to University of Rwanda for degree of master of Health Supply Chain Management, has not previously been submitted by me for a degree at any university, that this is my work in design and in execution.

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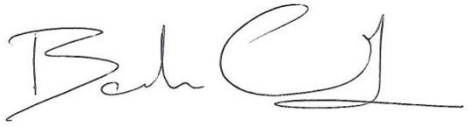
Signature  Date: Oct 17, 2019

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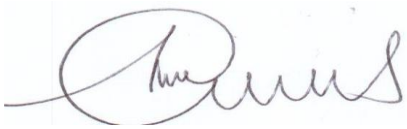

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ABSTRACT

Background: The World Health (WHO) recognizes access to safe and adequate medicines as one of the building blocks of the public health system. This entails having adequate supply and availability of provision of medicines, vaccines and medical innovations that do not pose hazards to patients. However, of great concern is the rate of expiry of medicines within health facilities, which exposes patients to preventable health risks. Available evidence indicated that in 2013 alone, medicines worth over SSP 8 million (800,000 USD) expired in South Sudan at the same time, over 80% of health facilities were reported to have no stock of essential medicines. Thus, the study established the factors associated with high rate of expiry of medicines & supplies at health facilities in Jubek State, South Sudan.

Methods: An analytical cross-sectional study was conducted at selected public health facilities level within the Jubek State, South Sudan. Quantitative and qualitative data on the factors associated with high expiry of medicines and supplies in public health facilities was collected using structured questionnaire and key informant interview guide (KIIG). Descriptive analysis using EXCEL and STATA version 13 was done to determine the associations between predictors and factors associated with high expiry rate of medicines and supplies at the public health facilities.

Results: Twenty-three participants from 6 health facilities were enrolled in the study in 2019. The study revealed that the majority 18(78.26%) of the respondents said that their health facilities had expired medicines and supplies. The quantitative data reveal the medicines that expired range from essential medicines 13(56.5%), family planning products 2(8.7%), meanwhile, 15(65.2%) donated medicines were found to be expired. The qualitative results revealed essential medicines, family planning products, and donated medicine expired at the health facilities. The poor storage facilities low consumption of medicines by the patients, and supply of medicines close to expiry date and unpredictable lead time, and the limited supervision role of Ministry of Health and poor disposal of expired medicines and supplies, including and poor supervision contributed to high expiry of medicines and supplies at the health facilities.

Conclusion: In this study overstocking of essential medicines and donated medicines and supplies at the health facilities was found to be statistically significant with high expiry of medicines and supplies

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LIST OF ABBREVIATIONS AND ACRONYMS

DTC DRUG AND THERAPEUTICS COMMITTEE

EML ESSENTIAL MEDICINE LIST

FEFO FIRST TO EXPIRE FIRST OUT

FIFO FIRST IN FIRST OUT

GOSS GOVERNMENT OF SOUTH SUDAN

KIIG KEY INFORMANT INTERVIEW GUIDE

MOH MINISTRY OF HEALTH

PHCC PRIMARY HEALTHCARE CARE CENTRE

SMOH STATE MINISTRY OF HEALTH

SOPS STANDARD OPERATING PROCEDURES

SSP SOUTH SUDANESE POUNDS

USAID UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

WHO WORLD HEALTH ORGANIZATION

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DEDICATION

I dedicate my thesis to my family and friends, without their support and understanding; this should not have been possible. Special thanks to Dr. Gulom Godfrey for his motivation and encouragement throughout the process of this thesis project.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This study is focused on establishing factors associated with medicines & supplies expiry in Jubek State, South Sudan. The study variables include; medicines and supplies expiry as the dependent variable while health workers, cold-chain, and logistic and regulatory factors associated with medical and supplies expiry as the independent variables.

1.2 Background to the study

Medicines make up a significant proportion of the health care system. The World Health Organization (WHO) recognizes access to safe and adequate medicines as one of the building blocks of the public health system(Manyazewal, 2017). This entails delivery of health services that is intertwined with the provision of medicines, vaccines and medical innovations that do not pose hazards to patients(WHO, 2010). The need for such quality medicines is enshrined in the government of South Sudan's health policy/constitution, where the expenditure is about 28 USD per capita on the health of its population (WHO, 2019). Though small, this allocation is relatively higher than other developing countries including the Central African Republic, the Democratic Republic of Congo, Madagascar and Niger, among others (WHO, 2019). Much as the extent to which this proportion is spent on medicines is not clear, this allocation alone implies a relatively smaller expenditure by governments on the procurement of essential medicines, while the remaining proportion is by procured by donors and out of pocket.

Health expenditure commitment is further manifested in the majority of the South Sudanese population who show willingness to pay health-related insurance expenses (Basaza et al., 2017). On the other hand, research has argued that higher out-of-pocket expenditure on essential medicines, especially in developing countries like South Sudan could be a pointer to two things: It may imply higher cases of multi-morbidities in a population, or it may simply indicate low access to medical insurance. Similarly it would also mean low availability of medicines in public health facilities, and therefore high prices (Sum et al., 2018).

Of great concern, however is the rate of expiry of medicines within health facilities, which expose patients to preventable health risks. Research has shown that in 2013 alone, medicines worth over SSP 8 million (800,000 USD) expired in South Sudan(Sudan Tribune, 2013).Reliant on such weakened healthcare systems increasingly exposed patients and client's burden from preventable health diseases and conditions like malaria and respiratory infections. It also forces people to spend more on medical bills in the private sector at the expense of basic needs.

Public health facilities in South Sudan, particularly in Juba, lack enough medicines, and patients are sometimes forced to buy medicines prescribed in public health facilities from private pharmacies (Ebaidalla & Ali, 2017).However, study in Pakistan showed that presence of expired medicines from the public healthcare system in private outlets is prevalent(Bashaar et al., 2017). According to Mathew & J Other (2013), study findings have pointed to the need for understanding of the medicines inventory management by health professionals (pharmacists, nurses, and others) in order to minimize expiration of medicines(Mathew & John, 2013). As such, this study will investigate the proportion of health facilities with expired medicines & supplies, assess the health workers factors associated with medicines & supplies expiry, establish the cold-chain and logistic factors associated with medicines & supplies expiry and determine the regulatory factors associated with medicines & supplies expiry in public health facilities in Jubek state, South Sudan.

1.3 Problem statement

The South Sudanese supply chain system has implemented the push system where quantities of medicines to be supplied to health facilities are determined at the national level, with small or no contribution from lower levels (Management Sciences for Health, 2014).The push system has been associated with higher rates of medicines expiry (and shortages), as orders are initiated at national level without usage patterns information from the receiving facilities (Management Sciences for Health, 2014). Likewise, the kit system of medicines distribution equally contributes to expiry through excess stock in the package (Republic of South Sudan, 2016). The kit system is where medicines and supplies are parked from the central stores by Ministry of Health (MoH) in Juba and sent

to the facilities including; State Hospitals, County General Hospitals, Primary Healthcare Centres and the Primary Health Care Centre Units at the Boma / Village level. The kits are sent using the 'push' system and not necessarily based on the demand at the respective health facilities.

With this understanding, the South Sudan's Ministry of Health instituted various initiatives to reduce medicines expiry (and shortages) in health facilities, including the introduction of guidelines for redistributing excess stock among healthcare centres in 2016 (WHO, 2016). By 2018, this was reaffirmed by the directive from the Under-secretary in the Ministry of Health. Additionally, the National Guidelines for the Donation of Medical Supplies and Equipment requires a minimum shelf life of at least one-year for donated stock. Nevertheless, reports indicate that medicines expiry is still rampant and occurring frequently (Republic of South Sudan, 2016). Thus, the expiry of medicines in public health facilities gives an indication that there are challenges in the health supply chain. This study seeks to identify the underlying and prevailing factors associated with medicines expiry. Moreover, the recent guidelines on storage and distribution require that these expired medicines be destroyed once every year. This study will therefore, also strive to understand the extent to which this is implemented.

1.4 Justification

Expiry of medicines is a concern to the health sector, as medicines cost significant amount of money. It is also a health concern, as not all expired medicines get destroyed. Research has shown likelihoods of expired medicines being recirculated into private markets(Kamba et al., 2017). Not only are these medicines ineffective, they may also result in resistance in human bodies (Mani & Thawani, 2019).

In public health facilities expiration of medicines before they are dispensed to patients results from failure to adhere to supply chain guidelines, among other things (Mhlongo, 2014). For instance, failure to adhere to First Expiry First Out (FEFO) principles implies that susceptibility of medicines expiry is increased (Hertog et al., 2014). Other factors include huge orders of rarely used medicines placed with suppliers, lack of supervision by pharmacist when placing medicines orders, ineffective rotation and redistribution of medicines among health facilities, poor use of computer systems and preference to

prescribe particular medicines to others (Mashishi, 2015). There are limited studies looking at factors contributing to expiration of medicines in public health facilities or not yet published especially in Juba, Jubek state of South Sudan and hence the need to conduct this research.

1.5. Research Objectives

The main objective of this study is to establish factors associated with medicines & supplies expiry at health facilities in Jubek State, South Sudan.

Specific objectives

i. To determine the proportion of medicines that are expired at health facilities in Jubek State, South Sudan.
ii. To assess the health workers factors associated with medicines & supplies expiry at health facilities in Jubek State, South Sudan.
iii. To establish the cold-chain and logistic factors associated with medicines & supplies expiry at health facilities in Jubek State, South Sudan.
iv. To determine the regulatory factors associated with medicines & supplies expiry at health facilities in Jubek State, South Sudan.

1.6. Hypotheses

H_0 – There is no significant relationship between level of medicines expiration and its perceived factors.

H_1–there is a significant relationship between level of medicines expiration and its perceived factors.

1.7 Delimitations

The study was limited to selected public health facilities located in Juba, Jubek State, and South Sudan.

1.8. Limitations

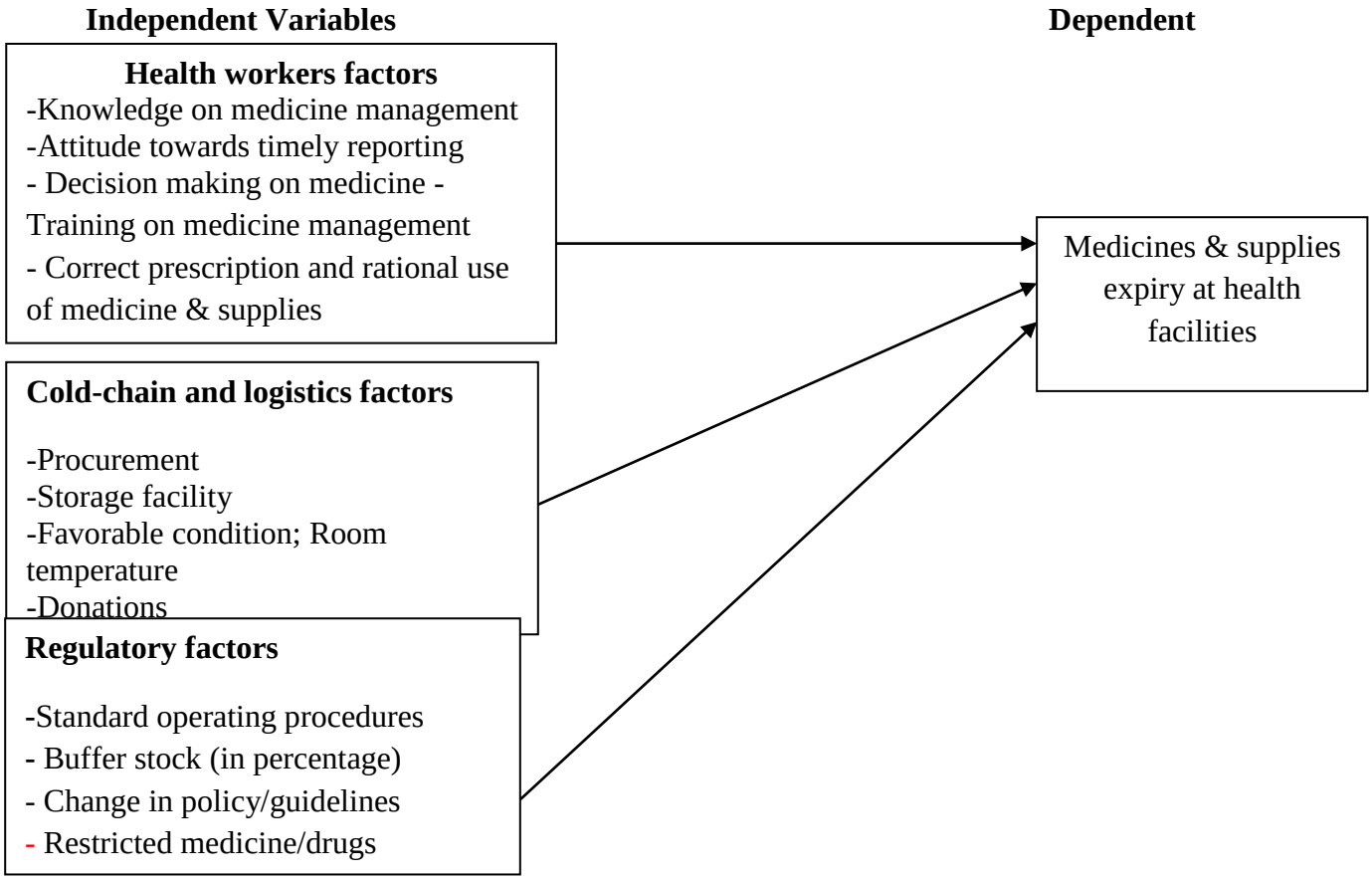
Lack of financial resources limited the study only to Jubek State. The findings of this study were not generalized to other states since the study was only conducted in Juba, Jubek state.

There was limited period and literature review on factors associated with high expiry of medicines and supplies at health facilities. Since the study setting was health facility

based, there was limited number of health workers working in those selected health facilities thus, very small sample size.

2.5 Conceptual framework

Figure 1 shows factors associated with high expiry of medicines and supplies



CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter discusses the literature associated with medicines & supplies expiry at health facilities. The review of literature is structured according to global, regional (Saharan Africa), national (South Sudan) and local (study area) perspective where literature, data and records exist. Data was obtained from reputable journals, hospital and medical reports among others.

2.1 Health workers factors associated with medicines & supplies expiry at health facilities

Knowledge and implementation of First Expiry First Out; FEFO is a stock rotation method to ensure that medicines with the earliest expiry date are used first, whereas First In First Out (FIFO) focuses on using stock that was received first regardless of expiry date. The implication for confusing the two terms (FEFO vs. FIFO) may result in medicines expiring.

A study conducted by Celeste Sauls (2016) on "Trend in revenue loss due to expired medication at a large urban hospital in Johannesburg, South Africa" established that whilst the majority of the participants claimed that they knew what the acronym means, almost half explained FEFO according to principles of First in First out (FIFO). Although respondents were aware of the acronym, their knowledge itself was incorrect although the end result may be the same. Sometimes, medicines that were received first may expire first, and may be used before expiry. This may be different from respondents accurately knowing what to do but not being able to practice this due to constraints or practical issues.

Literature from other studies conducted elsewhere have noted that poor medicines quantification, lack of observing donation guidelines and poor knowledge of health workers on stock management are some of the reasons for the expiration of medicines in the health facilities (Romero, 2013). In many situations, medicines are pushed to the

facilities regardless of the facilities need hence leading to the expiration(Tumwine et al., 2010).

The guidelines on use of high alert medication developed by the Ministry of Health Government of Malaysia recommended that all personnel must read the High Alert Medication labels carefully before storing to ensure medications are kept at the correct place. All High Alert Medications should be kept in individual labeled containers (MoH, 2011). Whenever possible avoid look-alike and sound-alike medicines or different strengths of the same medicine from being stored side by side. The guidelines clearly highlighted that not using TALL-man lettering to emphasize differences in medication names, for instance; DOPamine and DOBUTamine) causes confusion and may lead to expiry of pharmaceutical products.

Similarly, the Malaysian-pharmaceutical services guidelines on Safe use of High Alert Medications recommended use of standardized forms for written orders of cytotoxic medicines and parenteral nutrition. Otherwise if healthcare workers and dispensers use abbreviations when prescribing High Alert Medications, it may lead to missing out the medicines and they could end up lying on the shelves without being dispensed (MoH, 2011). Thus, there is need to specify the dose, route and rate of infusion for High Alert Medications prescribed for instance IV Dopamine 5mcg/kg over 1 minute. Other instances are to prescribe oral liquid medications with the dose specified in milligrams and avoid using trailing zero when prescribing 5.0 mg; otherwise it can be mistaken as 50 mg).

A study conducted in South Africa by Celeste Sauls (2016) established that according to the Standard Operating Procedures (SOPs) in the hospital, the pharmaceutical storage area must be under the control of the responsible pharmacist and delivery of medicines must be made directly to the pharmacy. It was however found out that the responsible pharmacist was not present at all departments all the times, hence different staffs were assigned to unpack and store medicines. Who these staff members are and how medicines are received and stored is mainly dependent on the department. The SOP also encouraged

someone to always be present to receive medicines and ensure the packing and storing thereof. At this facility, a 'Ward Medicine Champion' and pharmacists assistant is elected to fulfill this role. Observations showed that in some cases the person responsible for packing the stock did not verify the number of items received in relation to the orders placed. Additionally, in some instances the same items were ordered again with the next order placed by the ward, Celeste Sauls (2016).

Presentation, packing and labeling of medicines in a language not commonly understood by the health professional in the country can lead to expiry of medicines as it may be difficult to monitor on the expiry date (1). As donations come from different countries, the labeling of medicines may not be consistent as per required standard in the country. This also poses challenges which can contribute to medicines expiry while being stored because other medical personnel may not be aware on the exact date when the medicines will expire and issuing of medicines may not be done in an appropriate manner of FEFO. In Indonesia during the tsunami it was found that 60% of the donations received were not on Indonesia's list of essential medicines and 70% were labeled in foreign language (Tull, 2018).

Medicine Management Training; Celeste Sauls (2016) established that medicine management training is a critical aspect in enhancing stock management. Such trainings emphasize the principles and implications of use, selection, distribution and overall effective management of medicines. In her study Celeste found out that only two participants were confident in reporting that they received medicine management training and were actively implementing it. Medicines are not only managed by the pharmacists, but include pharmacy assistants, nurses and other healthcare personnel who also need to be trained.

2.2 Cold-chain and logistic factors associated with medicines & supplies expiry at health facilities

According to Kraiselburd et al, (2013), access to essential medicines is dependent upon well-established and functioning supply chain systems. The cold-chain system should be able to move medicines from the manufacturer through to end user at the health facilities. Supply chain management in public sector health systems has received increasing

attention in recent years, as both a priority and a challenge for many countries, as governments struggle to deliver an increasing number of products.

According to a study conducted by AWOL Jemal et al., (2019), in Ethiopia on "Unused and Expired Medications, It was established that the most common problem reported by all of the respondents was regarding to Pharmaceuticals Fund and Supply Agency (PFSA) pushing program products and sometimes Revolving Drug Fund items that were near-expiry and or sometimes not needed at the health facilities. The other notable reasons reported by the study participants were different prescription patterns by prescribers, quantification problems (specially for seasonal products), poor data quality, poorly functional Drug and Therapeutics Committee (DTC), lack of data during service expansion, problems in reporting consumption data from wards, not considering quantity on order and lack of inventory management skill by the store man/woman.

Expiry of medicines is a serious threat to the already constrained access to medicines in developing countries. According to (Mwesigwa, 2006 and MoH, 2006), volumes of valuable medicines have expired at the National Medical Stores in Entebbe and in some Ugandan district hospital stores. While in a report published by (WHO, 2010) it was noted that similar challenges were also experienced in countries such as Botswana, India and the United Republic of Tanzania. Through asking questions on expiry-related actions to explore the scope of the problem, the same study established that in five public outlets, four had disposed off (destroyed) medicines, two had exchanged medicines with their supplier, customers returned medicines in one outlet and all had received medicines at reduced prices or as donations in the previous year, due projected expiry. Expiry of medicines therefore appears to be a universal problem in all medicine supply outlets.

Similarly, high inventory levels also increase the chance of medicines to expire (Bukhari et al., 2010). This could be due to poor quantification of medicines where facilities receive more medicines than their needs. In South Sudan a reproductive security situation

analysis conducted in 2014 by United States Agency for International Development (USAID), found that some Primary Health Care Centres (PHCC) where over stocked, and medicines were likely to expire(USAID, 2014). Therefore, having high volumes of medicines is not advisable as it may lead to waste through expiry in the health facilities.

In Indonesia, in 2014 a report by Pharmacies' Sans Frontiers stated that "extremely large quantities" of cough medicines and antibiotic tetracycline would expire before they were used , which caused more problems to the authorities than they help the population.(Tull, 2018)

Pharmacy inventory management is a complex but critical process within health care delivery system. Without adequate pharmacy inventory management practices, health care facilities run the risk of not being able to provide patients with most appropriate medication when needed most. Addressing pharmacy inventory management and the revenue cycle effectively can enable organizations to improve financial performance, adhere to regulatory requirements and reduce risk relating to patient safety and ensure availability of medicines with less-frequent stock outs. Many health facilities and healthcare organizations utilize pharmacy organization management system as a means of ensuring appropriate accountability of pharmaceuticals and ensure traceability of inventory from purchase through administration to patients or disposal level. Effective and transparent tracking systems that allow pharmacies to accurately record inventory components such as medication expiration dates and physical quantities also have the potential to reduce adverse patient outcome (Iqbal, Geer, & Dar, 2017).

Donated medicines which are supplied on a push-basis contribute to the expiry of medicines before they are dispensed to patients (Dias, 2012). This happens where facilities receive medicines which they did not order. The assumption from the donor's view is that since the health facilities do not have money to procure enough medicines, they will accept whatever is donated. Medicines that are supplied in quantities higher than the average usage patterns will result in expiration if all of it is not used by the date of expiry. Despite the existing guidelines by the Christian Medical Commission and the WHO, on rational use of medicine, large amounts of expired or inappropriate medicines

are found among the donation stock from various donors including humanitarian originations, pharmaceutical industries and governments (Tters,L,E, 1995).

Expiry date is the date appearing on a product and established by the manufacturer beyond which the manufacturer will not guarantee the potency, purity, uniformity of the products (Dias, 2012) and medicines will be considered expired beyond this date. There is shortage of medicines in public health facilities as the government depends mostly on donor funds to procure its medicines. These medicines are procured and pushed to facilities without their approval and hence the cases were medicines also expire in the public health facilities at the same time. As medicines are costly, and a public health hazard, there is need to minimize expiry of medicines in public health facilities to ensure appropriate use of the limited resources.

2.3 Regulatory factors associated with medicines & supplies expiry at health facilities

Nakyanzi*et al.,* (2009) in a study conducted in Uganda on Expiry of medicines in public health facilities and stores established that expiry of medicines in supply facilities was common among medicines for vertical health programmes (with percentage of outlets reporting expiry) including vitamin A capsules, antiretroviral medicines, anti-tuberculosis agents, chloroquine, sulfadoxine/pyrimethamine and nystatin tablets, though expiry of medicines such as anti-cancer agents, tetracycline eye ointment and mebendazole was also common.

It was also noted that, all these top-expiring medicines are either essential (with a high consumption rate, because they are used by the majority of the population) or vital (without them, the patient would die). A possible explanation for the expiry of anti-cancer medicines is slow turnover because they treat rare diseases and are expensive. Similarly, tetracycline eye ointment and mebendazole have plenty of better substitutes, which may explain their slow turnover. Some of the study findings were corroborated with the respondents' perceived features of medicines that commonly expire in their stores Nakyanzi*et al.,* (2009).

The poor management and coordination of a change in treatment policy contributed to the expiry of huge stock of chloroquine, sulfadoxine/pyrimethamine and isoniazid in some

public health facilities in Uganda (MoH, 2006). For example, expiry due to treatment policy change and duplicate procurement can be prevented by sound coordination between key stakeholders.

In South Sudan in 2010, an assessment of availability of tracer medicines found that 67% of health facilities, implementing pull system had lack of pharmaceutical management capacities in states and counties. Poor inventory management often leads to accumulation of expired medicines *(Building Pharmaceutical Management, 2017).*

In terms of rotational policy of medicines, there should be system of medicine usage based on expiry date to ensure appropriate stock rotation for example FEFO. Expired stock should be separated from the usable ones to avoid mixing the two categories which might end up being picked unknowingly. Expired medicines should be disposed-off frequently in line with disposal policies to free up space as well as a preventative measure of avoiding dispensing expired medicines. Effective medicine regulation in public service is necessary to ensure that the quality of pharmaceutical products remain good (Perspectives W.H.O.P, 2004).

SUMMARY OF LITERATURE REVIEW

Health workers factors associated with high expiry of medicines & supplies at health facilities

The terminologies for inventory issuance systems; like FEFO and FIFO can lead to high expiry of medicines and supplies in the stores. Thus, confusing the two can lead to high expiry of medicines and supplies in the stores. Although respondents were aware of the acronym, their knowledge itself was incorrect although the end result may be the same. Sometimes, medicines that were received first may expire first, and may be used before expiry.

Knowledge on the names of the medicines and supplies which are close to each other make the health workers to confuse them when issuing and lead to expiry in the store for example whenever possible avoid look-alike and sound-alike medicines or different strengths of the same medicine from being stored side by side.

In addition, poor knowledge of health workers on stock management leads to high expiry of medicines and supplies being pushed to the health facilities regardless of the facility's needs.

Lack of verification of orders during receipting by unqualified staff may lead to having orders not according to the Standard operating procedures for example receiving without consider the minimum shelf life stated on the SOP hence expiry store.

Labeling of medicines in language not commonly understood by health workers which mostly happen with donated supplies lead to expiry of medicines and supplies in store.

Medicine management training, such trainings emphasize the principles and implications of use, selection, distribution and overall effective management of medicines. This also poses challenges which can contribute to medicines expiry while being stored because other medical personnel may not be aware on the exact date when the medicines will expire and issuing of medicines may not be done in an appropriate manner.

Cold-chain and logistic factors associated with medicines & supplies expiry at health facilities

Increase in number of products as a result of poor supply chain systems. Poor Supply chain management in public sector health systems poses a challenge for many governments as they struggle to deliver an increasing number of products

Over stocking; High inventory levels also increase the chance of medicines to expire. This could be due to poor quantification of medicines where facilities receive more medicines than their needs, having high volumes of medicines is not advisable as it may lead to waste through expiry in the health facilities

Parallel funding which is available by donors pushing near to expiry products: Donated medicines which are supplied on a push-basis contribute to the expiry of medicines before they are dispensed to patients. For example, facilities receive medicines which they did not order for leading to high expiration.

Regulatory factors associated with medicines & supplies expiry at health facilities

Poor management of a change in medicines, supplies and treatment policy contributes to high expiry of medicines and supplies. Expired stock should be separated from the usable one to avoid mixing the two categories, which might end up being picked unknowingly.

CHAPTER THREE: METHODS

3.0 Introduction

This chapter presents the procedures used in this study. It consists of research design, area of study, study population, sampling procedures, sample size, sampling techniques, data collection methods and instruments, quality control methods, data management and processing, data analysis, ethical considerations and study limitations.

3.1 Research Design

This study adopted a cross sectional survey/design that involves mixed methods that is; gathering of both quantitative and qualitative data. It allowed for data collection at one point in time to determine the level and factors associated with medicines and supplies expiry in health facilities in Jubek State. According to Uradhi (2009), a survey method of gathering information by interviewing a respondent through a questionnaire is the most often used method for data collection on people's habits in a variety of education and social issues.

3.2. Study location

In Juba city Jubek state, there are nineteen (19) primary health care centres (PHCCs) and of those, six were selected for the study because of easy accessibility by the researcher. See table 1 below for the list of health facilities visited for the study.

Table 1: Name, Level and Location of Health Facilities Considered for the Study

Name Of Health Facilities	Level	Location
Munuki PHCC	PHCC	Luri –munuki
Malakia PHCC	PHCC	Malakia
Kimu PHCC	PHCC	Luri-Gudele
Usratuna PHCC	PHCC	Juba county
Kator PHCC	PHCC	Rajaf county
Nyakuron PHCC	PHCC	Nyakuron

3.3. Data Sources

Primary data was got through administering of the structured questionnaire and interviewing key informants using a Key Informant interview guide

3.4. Study Population and Sample Size

Study Population: The study population was health care workforces who handle, dispense and manage medicines and supplies in the study area. A census of all health care workers who have worked at the health facility for at least six months prior to the study were considered. The nurses, midwifes, laboratory technicians, clinical officers, medical officers, cold-chain officers, dispensers, pharmacist and cold-chain managers. A total of 25 respondents in the 6 health facilities were asked to complete the questionnaire to obtain the quantitative data. (See Table 2).

For the key informant interview guide, PHCC administrators, in-charges of the PHCCs and PHCC directors were considered. However, a total of 18 respondents three respondents per health facility from these cadres (administrators, in-charges or directors) were selected for the key informant interviews the key informant interview guide, we did not consider number of respondents but rather considered total number of responses given per question out of the total 18 respondents. (See Table 2)

Sampling size determination

There were six health facilities out of the total nineteen primary health care centers (PHCCs) that were selected for this study and each primary health care Centre had varying total number of health workers though the total staffing number in the PHCC`s as per the

Ministry of Health guidelines stand at 11 per facility as a maximum. For example, Munuki had 9, Malakia 8, Kimu 8, Usratuna 8, Kator 9, and Nyakuron 10 health workers.

See table 2 below that shows the number of health workers who filled the questionnaire and those interviewed per health facility respectively.

Table 2: Shows the number of health workforces who filled/ interviewed per health facilities

Names of health facilities	Number of health workers per health facilities	Number that filled questionnaire	Number interviewed per health facility

Munuki PHCC	9	4	3
Malakia PHCC	8	4	3
Kimu PHCC	8	4	3
Usratuna PHCC	8	4	3
Kator PHCC	9	4	3
Nyakuron PHCC	10	5	3
Total	**52**	**25**	**18**

Sampling procedures

A convenient non-probability sampling method was used to select the study sites. This method of sampling was suggested because of easy accessibility of the health facilities. In addition, it saves times and money spent travelling to long distance health facilities.

Sampling of respondents from the health facilities, a simple random probability sampling method was used to select the participants. This method was suggested because it allows equal chance to participate in the study and prevents selection bias.

3.5 Data collection Instruments

This is mixed methods study where both quantitative and qualitative data collection tools were used.

Quantitative data were collected used a structured questionnaire with closed ended questions (see Appendix 2), while qualitative data on factors associated with high expiry of medicines and supplies at the health facilities were collected using a key informant interview guide (see Appendix 3).

Data collection technique

In this study, the researcher employed self-administered technique to gather data regarding factors associated with high expiry of medicines and supplies at the health facilities in juba city.

3.6 Pre-Testing

The data collection instruments (questionnaires) were pre-tested at one of the near-by health facilities with similar characteristics like those selected for the study.

3.7 Validity

For validity of the findings, data collections tools have been designed and were applied to obtain data on expiry of medicines and supplies in Jubek State. The researcher abstained from unethical manipulation of pharmaceutical and medicines data obtained from the study respondents. Data collection tools were designed so, that each question and the scale have a relationship with the objectives, research questions and covered a full range of issues to be measured so as to ensure relevance (Mugenda and Mugenda 2003, p. 99). The researcher further used more than one method of data collection instrument (triangulation) and such studies would yield results with broader applicability. The two methods used were structured questionnaire and Key Informant Interview Guide. The researcher used a representative sample of the population of participants in the study to determine appropriate interpretations and draw valid conclusions (Leedy & Omorod 2001, p.106).

3.8 Reliability

Pre-testing of the questionnaire on expiry of medicines and supplies was done afore the start of the research to ensure its comprehensiveness and consistency in providing the information required. The data collection tools were constructed in simple language, and clear instructions appropriate for the respondents were provided. The researcher personally administered the questionnaires to the participants and was available for consultations and explanations while participants were collecting the data.

Their responses were used to triangulate feedback from the study participants obtained through the questionnaire.

3.9. Study variables

This study had two major variables;

Dependent Variable: It is the "Expiry of medicines and supplies" measured through – Expired and or Non-Expired medicines and supplies in the study area**.**

Independent Variables: while the Independent variables included;

Health workers factors: Measured through - Knowledge on medicine management; - Attitude towards timely reporting; decision making on medicine & supplies; and practicing rational use of medicine & supplies.

Cold-chain and logistics factors: Measured through; storage facility, favorable condition; room temperature and, expiration of medicine and donations

Regulatory factors: Measured through; standard operating procedures, buffer stock (in percentage), lead time and restricted medicine/drugs

3.10 Data Analysis

Quantitative Data

The quantitative data was edited for accuracy, readability, consistency and completeness; thereafter it was coded and entered into a computer using software STATA version 13 and EXCEL and several levels of analysis were performed.

The levels of doing qualitative data analysis and presentation of the results using STATA version 13 and EXCEL are explained below.

The first level of Analysis was conducted at the Uni-variate level. Data was analyzed in form of proportions, frequency distribution of the study participants that show their demographic characteristics. The results are presented in tables, charts and graphs among others.

The second level of Analysis was conducted at bivariate analysis. Bivariate analysis was carried out to measure if there is any association between the dependent variable which is expiry of medicines and supplies and the independent variables. This level of analysis was used to determine if any, what could have likely caused the expiry of medicines in the health facilities. The level of significance of the association is set at p-value of (<0.05) at the Confidence interval of (CI=95%) giving a margin of error of (5%). Conclusions to the findings from this study and recommendations were made based on the results from the bivariate analysis.

Qualitative data

The transcribed text and written notes were read several times to clear any ambiguity. Data was then coded and the themes were presented according to their relation to study objectives for triangulation purposes. However, key informant results were transcribed and converted to word text then exported to Microsoft excel for analysis. Here, the common responses have been coded and frequency generated using the excel command of COUNTIF while frequency distribution of the most frequent response were generated from the frequencies.

3.11 Logistical and Ethical Considerations

Permission to conduct the research was obtained from University of Rwanda. While, ethical clearance was sought from the Research Ethics Committee at MoH/GoSS. Similarly, administrative clearance was sought from health facility prior to the commencement of the study.

Informed consent was sought from the participants before any interview or a data collection instrument was administered.

Confidentiality: All data pertaining to this study was kept confidential under key and lock and was used for the purpose of this study only.

CHAPTER FOUR: PRESENTATION OF STUDY RESULTS

4.0 Introduction

This study was piloted among health workers to assess factors associated with high expiry rate of medicines and supplies in public health facilities in Jubek state, South Sudan. Twenty-five respondents from six public health facilities participated in this study of which, two questionnaires were found invalid due to incomplete responses on the majority of the questions by the two respondents implying that the response rate was 100%. However, 92% of the questionnaires were considered for analysis and due to the small sample size, only Uni-variate (frequency distribution) and bivariate analysis (chi-square test) were performed in the analysis and logistic regression analysis was excluded since it required sample size of at least 50 respondents.

4.1 Section A: Proportion of respondents in health facilities who reported expired and non-expired Medicines and Supplies

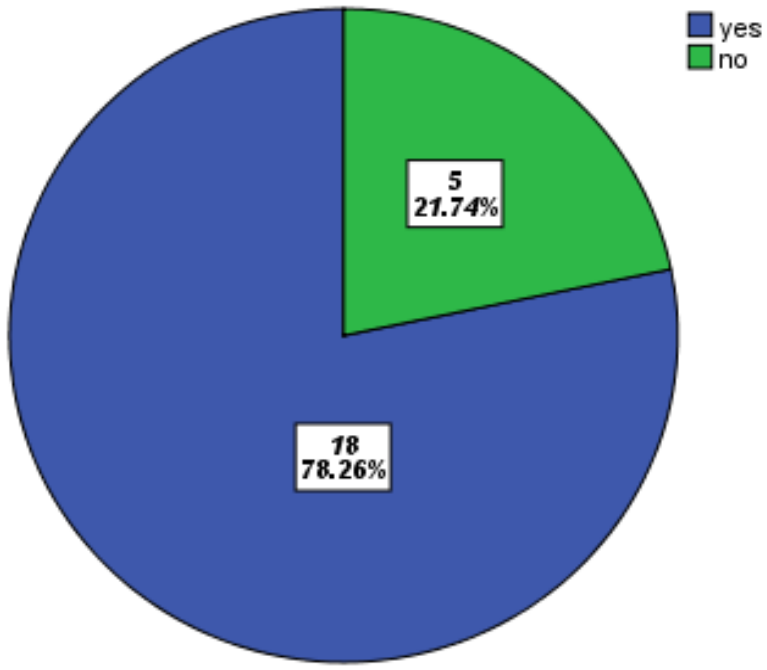


Figure 2: **proportion of respondents in health facilities with expired and non-expired medicines and supplies**

The results in figure 2, reveals that 18(78.26%) of the respondents reported that their health facilities had expired medicines and supplies. Medicines that were found expired included essential medicines 13(56.5%), family planning products 2(8.7%), and donated medicines 15(65.2%) (See table 3).

Table 3: The Proportion of responses from respondents per health facility

Names of health facilities	**Number interviewed per health facility**	**Response from respondents per health facility**	
		Expired medicines (78.26%)	**Non-expired medicines (21.74%)**
Munuki PHCC	4	3 (13.8%)	1(3.6%)
Malakia PHCC	4	3 (13.8%)	1(3.6%)
Kimu PHCC	4	3 (13.8%)	1(3.6%)
Usratuna PHCC	4	3 (13.8%)	1(3.6%)
Kator PHCC	4	3(13.8%)	1(3.6%)
Nyakuron PHCC	5	2(9.2%)	1(3.6%)
Total	**25**	**23**	

The proportion of responses from respondents per healthy facility with high expiry of medicines and supplies include; Munuki (13.8%), Malakia (13.8%), Kimu (13.8%), Usratuna (13.8%), Kator (13.8%) and Nyakuron (9.2%). A total of 17 respondents in those health facilities reported high expiry of medicines and supplies as compared to the remaining 6 respondents. see table 3 above.

Table 4: The proportion of available medicines and supplies with high expiry in the health facilities

Variables	Categories	Frequency N=23	Percentage (100%)
All medicines in stock	Yes	18	78.3
Expire	No	5	21.7
	Total	**23**	**100.0**
Essential Medicines	No	10	43.5
	Yes	13	56.5
	Total	**23**	**100.0**
Family Planning Products	No	21	91.3
	Yes	2	8.7
	Total	**23**	**100.0**
Donated Medicine	No	8	34.8
	Yes	15	65.2
	Total	**23**	**100.0**

Source primary field data 2019

Table 5: Bivariate Analysis of Available Medicines and supplies Associated With high Expiry

Variables	categories	expired	Non-expired	Total	χ^2	P-value
Medicines in stock	Yes	18(100.0%)	0(0.0%)	18(78.3%)	**23**	**0.00*0**
expire	No	0(0.0%)	5(100.0%)	5(21.7%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Essential medicines	No	5(27.8%)	5(100.0%)	10(43.5%)	**8.306**	**0.004***
	Yes	13(72.2%)	0(0.0%)	13(56.5%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Family planning	No	16(88.9%)	5(100.0%)	21(91.3%)	0.608	0.435
products	Yes	2(11.1%)	0(0.0%)	2(8.7%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Donated medicine	No	3(16.7%)	5(100.0%)	8(34.8%)	**11.979**	**0.001***
	Yes	15(83.3%)	0(0.0%)	15(65.2%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		

Source primary field data 2019

As shown in table 5, in this study, health facilities that had essential and donated medicines have a significant association with its high expiry (P<0.000 and p-0.001) respectively.

The high expiry of the donated medicines in the health facilities were likely due to, most of the donated medicines and supplies are not aligned to the needs of the population, excessive supplies of a similar product and failure to comply with guidelines and for the donated medical devices or supplies due to lack of prior trainings.

4.2 Section B: Socio-demographic characteristics of the respondents

Table 6: Descriptive statistics of respondents according to age

Variable	N	Range	Minimum	Maximum	Mean	Std. Error	Std. Deviation	Variance
Age	23	44	25	69	41.39	2.414	11.579	134.067
Total	23							

Source primary field data 2019

The result presented in Table 6 shows that the mean age of respondents is 41.39 years with minimum age 25 years and maximum age 69 years. The age of the respondents had 11.6 years of deviation from the mean age.

Table 7: The relationship between age and expiry of medicines and supplies

Variable	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	t	p-value	df
Age	41.6	2.5	11.8	36.4 - 46.9	0.2532	0.8026	22

Where df is degrees of freedom, t is the test statistics for the continuous variable (age

For continuous variables like age, student t-test distribution was used to establish the level of association between age and high expiry of medicines and supplies.

The result presented in Table 7 shows that there is no statistically significant association between age and expiry of medicines and supplies in the health facilities.

Table 8: demographic features of respondents

Variables	Categories	Frequency (N=23)	Percentage (100%)
Sex	Male	11	47.8
	Female	12	52.2
	Total	**23**	**100.0**
Marital Status	Single	3	13.0
	Married	16	69.6
	Divorced	1	4.3
	Widow/Widower	3	13.0
	Total	**23**	**100.0**
Level Of Education	Secondary	1	4.3
	Tertiary	21	91.3
	Not Completed Secondary	1	4.3
	Total	**23**	**100.0**
Professional Cadre	Nurse/Midwife	2	8.7
	Clinical Officer	5	21.7
	Medical Officer	1	4.3
	Cold Chain Officer	2	8.7
	Dispenser	2	8.7
	Pharmacist	10	43.5
	Cold Chain Manager	1	4.3
	Total	**23**	**100.0**
Religion	Catholic	13	56.5
	Protestants	9	39.1
	SDA	1	4.3
	Total	**23**	**100.0**

Source primary field data 2019

The demographic characteristics displayed in table 8 show that more than half 12 (52.2%) of them were female, the majority 16 (69.6%) were married as compared to the only one (4.3%) who was divorced. Also, the majority 21 (91.3%) of the respondents had had a

tertiary level of education while 1 (4.3%) had not completed secondary education unlike 1 (4.3%) that completed. However, the distribution of respondents according to professional qualification indicates that 10 (43.5%) were pharmacist, 1 (4.3%) medical officer and cold chain manager and the rest fall within the range of 10 and 1. Also, the result indicates that more than half 13(56.5%) of the respondents were Catholics, 9(39.1%) Anglicans and 1(4.3%) were Seventh - day Adventist.

Table 9: Bivariate analysis of demographic characteristics associated with medicines and supplies expiry

		Have expired medicines				
Variables	**Categories**	**Yes**	**No**	**Total**	χ^2	**P-Value**
Level of Education	Secondary	1(5.6%)	0(0.0%)	1(4.3%)	0.608	0.738
	Tertiary	16(88.9%)	5(100.0%)	21(91.3%)		
	Not completed secondary	1(5.6%)	0(0.0%)	1(4.3%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Professional Qualification	Nurse/Midwife	1(5.6%)	1(20.0%)	2(8.7%)	3.603	0.73
	Clinical Officer	3(16.7%)	2(40.0%)	5(21.7%)		
	Medical Officer	1(5.6%)	0(0.0%)	1(4.3%)		
	Cold Chain Officer	2(11.1%)	0(0.0%)	2(8.7%)		
	Dispenser	2(11.1%)	0(0.0%)	2(8.7%)		
	Pharmacist	8(44.4%)	2(40.0%)	10(43.5%)		
	Cold Chain manager	1(5.6%)	0(0.0%)	1(4.3%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		

Source primary field data 2019

The associated result between demographic characteristics and high expiry of medicines and supplies presented in table 9, shows that there is no significant association between demographic and expiry drugs.

Section C: Health Worker Factors Associated With Medicines and Supplies Expiry

Table 10: Univariate analysis of health workers associated with medicines and supplies expiry

Variables	Categories	Frequency N=23	Percentage 100%)
Working Period	< 6 Months	3	13.0
	6-1 Year	2	8.7
	1-2 Years	1	4.3
	> 2 Years	17	73.9
	Total	**23**	**100.0**
Level Of Knowledge	Fair	2	8.7
	Good	2	8.7
	Very Good	11	47.8
	Excellent	8	34.8
	Total	**23**	**100.0**
Health Workers Attitude	Fairly Good	7	30.4
	Am Not A Supervisor	2	8.7
	Good	13	56.5
	Do Not Know	1	4.3
	Total	**23**	**100.0**
Participate In Decision	Yes	19	82.6
Making	No	4	17.4
	Total	**23**	**100.0**
If no, who makes decision for you			
My supervisor	Yes	4	17.4
	Not applicable	19	82.6
	Total	**23**	**100.0**
The rationale for the use of medicines and supplies	Clinical needs for an adequate period	5	21.7
	Every patient who comes to	16	69.6

the facility		
Giving Medicines according to the burden of disease	1	4.3
Missing	1	4.3
Total	**23**	**100.0**

Source primary field data 2019

The frequency distribution of health worker-related factors displayed in table 10, indicates that the most 17(73.9%) of the respondents had worked for more than two years in their facility while only 1(4.3%) had worked for 1-2 years. Besides, 11(47.8%) of the respondents rated them having very good knowledge on medicines and supplies management for daily operations as compared to 2(8.7%) to those with fair, and good knowledge. However, only 13(56.5%) of the respondents agreed that their staffs had a good attitude towards timely reporting on medicines and supplies availability while one (4.3%) does not know and 2(8.7%) were not supervisors. In this study, the majority 19(82.6%) of the respondents indicated that they participate in decision making regarding the management of medicines and supplies at their service centers and only 4(17.4%) do not. Meanwhile, those who do not participate in the decision reported their supervisors who do so. Also, 16(69.6%) of the respondents indicated giving medicine to every patient who comes to the facility as the rational use of medicine and only 1(4.3%) that reported medications appropriate for clinical needs.

Table 11: Bivariate analysis of health workers associated with high expiry of medicines and supplies

		Have expired medicines				
Variables	**Categories**	Yes	No	**Total**	χ^2	**P-value**
Working period	< 6 months	3(16.7%)	0(0.0%)	3(13.0%)	2.255	0.521
	6-1 year	2(11.1%)	0(0.0%)	2(8.7%)		
	1-2 years	1(5.6%)	0(0.0%)	1(4.3%)		
	> 2 years	12(66.7%)	5(100.0%)	17(73.9%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Level of	Fair	2(11.1%)	0(0.0%)	2(8.7%)	2.361	0.501

knowledge	Good	2(11.1%)	0(0.0%)	2(8.7%)		
	Very good	9(50.0%)	2(40.0%)	11(47.8%)		
	Excellent	5(27.8%)	3(60.0%)	8(34.8%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Health workers attitude	Fairly good	7(38.9%)	0(0.0%)	7(30.4%)	3.784	0.286
	Not a supervisor	1(5.6%)	1(20.0%)	2(8.7%)		
	Good	9(50.0%)	4(80.0%)	13(56.5%)		
	Do not know	1(5.6%)	0(0.0%)	1(4.3%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Participate in decision making	Yes	15(83.3%)	4(80.0%)	19(82.6%)	0.03	0.862
	No	3(16.7%)	1(20.0%)	4(17.4%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
My supervisor	No	15(83.3%)	4(80.0%)	19(82.6%)	0.03	0.862
	Yes	3(16.7%)	1(20.0%)	4(17.4%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Rationale for the use of medicines and supplies	Patients receive medications appropriate	4(22.2%)	1(20.0%)	5(21.7%)	0.664	0.882
	Giving medicine according to burden of disease	12(66.7%)	4(80.0%)	16(69.6%)		
	Giving medicines to patients	1(5.65)	0(0.0%)	1(4.3%)		
	Missing	1(5.6%)	0(0.0%)	1(4.3%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		

Source primary field data 2019

The results presented in Table 11 indicate no statistically significant association between health workers and the expiry of medicines and supplies.

Section E. Cold-Chain and Logistic Factors Associated With high expiry of Medicines and Supplies

Table 12: Uni-variate analysis of cold-chain and logistic factors associated with high expiry of medicines and supplies

Variables	Categories	Frequency N=23	Percentage (%)
Adequate Storage Facility	Yes	21	91.3
	No	2	8.7
	Total	**23**	**100.0**
Alternative Storage Facilities	Keep them in Office	2	8.7
	Not Applicable	21	91.3
	Total	**23**	**100.0**
Opinion Of State	Acceptable Standards	14	60.9
	Unacceptable Standards	9	39.1
	Total	**23**	**100.0**
Experience Medicines And Supplies Expiry	Yes	19	82.6
	No	4	17.4
	Total	**23**	**100.0**
How often Does It Occur	Weekly	1	4.3
	Monthly	7	30.4
	Every three months	8	34.8
	Every Six Months	3	13.0
	Missing	4	17.4
	Total	**23**	**100.0**
Poor Storage Facility	No	15	65.2
	Yes	8	34.8
	Total	**23**	**100.0**
No Qualified Personnel's	No	20	87.0
	Yes	3	13.0
	Total	**23**	**100.0**

Over Stocking Of Medicines And Supplies	No	8	34.8
	Yes	15	65.2
	Total	**23**	**100.0**
Do Not Know the actual number People	No	15	65.2
	Yes	8	34.8
	Total	**23**	**100.0**
Partners Procure Medicines	No	20	87.0
	Yes	3	13.0
	Total	**23**	**100.0**

Source primary field data 2019

The frequency distribution of cold-chain and logistic factors associated with medicines and supplies indicates that the majority 21(91.3%) of the health facilities have adequate storage facilities. However, 2(8.7%) of the health facility whose storage facilities were not adequate indicated that they keep them in the office. Regarding respondent's opinion on the state of storage facility for medicines and supplies in terms of room temperature, contact with water and moisture reveals that more than half 14(60.9%) had acceptable standards as compared to 9(39.1%) unacceptable. besides, 19 (82.6%) of the respondents agreed that they sometimes experience medicines and supplies expiry while only 4(17.4%) never experienced. Meanwhile, among respondents who experienced medicines expiry reported weekly 1(4.3%), monthly 7(30.5%), every three months 8(34.8%) and 3(13.0%) every six months. The major reasons for high expiry of medicines and supplies includes poor storage 8(34.8%), non-qualified personnel's 3(13.0%), overstocking of medicines and supplies 15(65.2%) and 8(34.8%) revealed that they do not know the actual number of people who access the facility every 3-6 months.

Table 13: Bivariate analysis of cold-chain and logistic factors associated with high expiry of medicines and supplies

		Have expired medicines				
Variables	**Categories**	**Yes**	**No**	**Total**	χ^2	**P-value**
Adequate storage facility	Yes	16(88.9%)	5(100.0%)	21(91.3%)	0.608	0.435
	No	2(11.1%)	0(0.0%)	2(8.7%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
alternative storage facilities	keep them in office	2(11.1%)	0(0.0%)	2(8.7%)	0.608	0.435
	Not applicable	16(88.9%)	5(100.0%)	21(91.3%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
opinion of state	Acceptable standards	10(55.6%)	4(80.0%)	14(60.9%)	0.982	0.322
	Unacceptable standards	8(44.4%)	1(20.0%)	9(39.1%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Experience medicines and supplies expiry	Yes	16(88.9%)	3(60.0%)	19(82.6%)	2.273	0.194
	No	2(11.1%)	2(40.0%)	4(17.4%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
How often does it occur	Weekly	1(5.6%)	0(0.0%)	1(4.3%)	8.061	0.089
	Monthly	7(38.9%)	0(0.0%)	7(30.4%)		
	Every three months	7(38.9%)	1(20.0%)	8(34.8%)		
	Every six months	1(5.6%)	2(40.0%)	3(13.0%)		
	Missing	2(11.1%)	2(40.0%)	4(17.4%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
poor storage facility	No	11(61.1%)	4(80.0%)	15(65.2%)	0.615	0.621
	Yes	7(38.9%)	1(20.0%)	8(34.8%)		
No qualified personnel's	No	15(83.3%)	5(100.0%)	20(87.0%)		
	Yes	3(16.7%)	0(0.0%)	3(13.0%)	0.958	0.328
Overstocking of	No	4(22.2%)	4(80.0%)	8(34.8%)	**5.759**	**0.033***

medicines and supplies	Yes	14(77.8%)	1(20.0%)	15(65.2%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Actual number of people unknown	No	10(55.6%)	5(100.0%)	15(65.2%)	3.407	0.122
	Yes	8(44.4%)	0(0.0%)	8(34.8%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Partners procure medicines	No	15(83.3%)	5(100.0%)	20(87.0%)	0.958	1
	Yes	3(16.7%)	0(0.0%)	3(13.0%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		

Source primary field data 2019

According to the result presented in table 13, there is no statistically significant association between cold-chain and logistic factor and high expiry of medicines and supplies except overstocking of medicines and supplies ($p<0.033$). This is because when there is overstocking and low consumption rate by patients, chances are high that medicines and supplies will expire.

Section F: Regulatory Factors Associated With high expiry of Medicines and Supplies

Table 14: Univariate analysis of regulatory factors associated with high expiry of medicines and supplies

Variables	**Categories**	**Frequency N=23**	**Percentage (100%)**
Standard operating procedure	Yes	20	87.0
	No	3	13.0
	Total	**23**	**100.0**
Regular checks	No	20	87.0
	Yes	3	13.0
	Total	**23**	**100.0**
Understand disease burden	No	21	91.3
	Yes	2	8.7
	Total	**23**	**100.0**
Ordering what health facility	No	21	91.3

consume	Yes	2	8.7
	Total	**23**	**100.0**
Accurate projection	No	21	91.3
	Yes	2	8.7
	Total	**23**	**100.0**
Why normally add buffer stock	To avoid stock-outs	18	78.3
	Unpredictable lead time	3	13.0
	Long-distance	2	8.7
	Total	**23**	**100.0**
Received restricted medicines	Yes	3	13.0
	No	20	87.0
	Total	**23**	**100.0**
Cases medicines expire	Yes	2	8.7
	No	21	91.3
	Total	**23**	**100.0**
If no why did they expire	The physician to administer not there	2	8.7
	No adequate patients to consume	3	13.0
	Dates of expiry were too close	16	69.6
	Not applicable	2	8.7
	Total	**23**	**100.0**

Source primary field data 2019

The study finding indicates that the most 20(87.0%) of the respondents indicates that their facilities have standard operating procedures while 3(13.0%) do not. Among those, whose facility does not have standard operating procedures, 3(13.0%) do regular checks to prevent expiry,2(8.7%) understand disease burden and order based on that,2(8.7%) order what the facility can consume, and 2(8.7%) accurate projection of the population in the catchment area. Also, 18(78.3%) of the respondent add a buffer to stock to avoid

stock-outs, 3(13.0%) due to unpredicted lead-time and 2(8.7%) reported long-distance ministry of health and the suppliers.

Table 15: Bivariate analysis of regulatory factors associated with high expiry of medicines and supplies

		Have expired medicines				
Variables	**Categories**	**Yes**	**No**	**Total**	χ^2	**P-value**
Have a standard operating procedure	Yes	15(83.3%)	5(100.0%)	20(87.0%)	0.958	1
	No	3(16.7%)	0(0.0%)	3(13.0%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Regular checks	No	15(83.3%)	5(100.0%)	20(87.0%)	0.958	1
	Yes	3(16.7%)	0(0.0%)	3(13.0%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Understand disease burden	No	16(88.9%)	5(100.0%)	21(91.3%)	0.608	1
	Yes	2(11.1%)	0(0.0%)	2(8.7%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Ordering what health facility consume	No	16(88.9%)	5(100.0%)	21(91.3%)	0.608	1
	Yes	2(11.1%)	0(0.0%)	2(8.7%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Accurate projection	No	16(88.9%)	5(100.0%)	21(91.2%)	0.608	1
	Yes	2(11.1%)	0(0.0%)	2(8.7%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Why normally add buffer stock	To avoid stock-outs	15(83.3%)	3(60.0%)	18(78.3%)	4.387	0.112
	Unpredictable lead time	1(5.6%)	2(40.0%)	3(13.0%)		
	Long distance	2(11.1%)	0(0.0%)	2(8.7%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Received restricted	Yes	2(11.1%)	1(20.0%)	3(13.0%)	0.273	0.539
	No	16(88.9%)	4(80.0%)	20(87.0%)		

medicines						
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
Cases medicines expire	Yes	1(5.6%)	1(20.0%)	2(8.7%)	1.028	0.395
	No	17(94.4%)	4(80.0%)	21(91.3%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		
If no why did they expire	Physician to administer is not there	1(5.6%)	0(0.0%)	1(4.3%)	0.836	0.841
	No adequate patients to consume	2(11.1%)	1(20.0%)	3(13.0%)		
	Dates of expiry were too close	13(72.2%)	3(60.0%)	16(69.6%)		
	Not applicable	2(11.1%)	1(20.0%)	3(13.0%)		
Total		**18(100.0%)**	**5(100.0%)**	**23(100.0%)**		

Source primary field data 2019

Regarding regulatory factors, the results indicate that there is no statistically significant relationship between them and the expiry of drugs in this study.

PRESENTATION OF KEY INFORMANT INTERVIEW GUIDE RESULT

According to results presented key informant result, the majority of the respondents reported that they had essential, family planning products and donated medicines that expired in their health facilities. The respondents concluded that most medicines expire due to low turn up for them especially family planning products.

The interviewees also indicated that the health workers were experienced and had good attitude, good understanding of the usage of medicines. However, three out of ten respondents agreed that health workers were knowledgeable about irrational use of medicine and were qualified professional health workers.

With respect to cold-chain factors associated with high expiry of medicines and supplies at health facilities, two out of ten respondents stated poor storage facility, low consumption of drugs by patients, supply of medicines close to expiry date. In addition, one out of seven respondents stated inadequate storage facilities, late delivery close to expiry date, over congestion of drugs. Also, low turn up by consumers for some products like family planning, and unacceptably storage facilities were found cold-chain factors associated with high expiry.

The logistic specific factors associated with high expiry of medicines and supplies at health facilities that were mentioned by interviewees include congestion in the store, delivery of medicines and supplies close to expiry date, and late supply close to expiry. Furthermore, overstocking of similar drugs all the time coupled with poor storage facilities, stocking drugs without consumption and unpredictable lead-time contributes to high expiry of medicines and supplies at the health facilities.

According to the key informant guide result, regulatory factors were found to be associated with high expiry of medicines and supplies at the health facilities. However, two out of ten respondents indicated that low supervision, and one stated poor supervision as strong significant factors associated with high expiry. In addition, delayed monitoring of medicines, inadequate supervision, low supervision by ministry of health, low supervision in the health facilities also contribute to high expiry of medicines and

supplies. Poor disposal, poor stocktaking, coupled with supervision challenges and supply of medicines had a close association to the high expiry of medications and supplies.

According to the interviewees, the specific roles of Ministry of Health (State and National) on the management of medicines and supplies include; supervision and supply of all medicines, bring partners to support health facilities, bringing medicines in the facilities, delivery of medicines to facilities, disposal of expired medicines, ensure no stock out of medicines and management of medicine and supplies. In addition, the ministry does provision of guidelines on certain drugs and medicines, provision of standard guidelines on use of medicine, regulate, and manage medicines. Also, they regulate use of medicines and its disposal, and supervision of all the health facilities in terms of medicine use as well as its supply.

Two out of the twenty-one respondents indicated proper supervision of health facilities including lead-time for medicines, consumption of medicines and its storage facilities in each facility. Provision of good and adequate storage facilities, and encourage patients to access health facilities for treatment. In addition, good and frequent supervision, motivation of health workers, improve supervision in the health facilities, improve service delivery, supervision and disposal systems of expired medicines and supplies can minimize high expiry of medicines and supplies. More so, the study found that bringing medicines with longer shelf life, constant supervision, set up of a proper disposal system for expired medicines, timely delivery of medicines to health facilities could minimize high expiry at the health facilities. Also, good supervision in terms of close monitoring and evaluation, encourage capacity building for health workers, set up proper storage facilities in the primary health care centres (PHCCs) minimizes high expiry at the health facilities.

CHAPTER FIVE: DISCUSSION OF STUDY FINDING

5.1 proportion of respondents who reported high expiry of medications and supplies in health facilities

Twenty-three respondents partook in the study and out of those, 78 % said they had expired medications and supplies in their health facilities. The level of expiry reported was the similar across the different PHCCs included in this study. This is in line with findings from the key informant interviews, which found that essential medicines, family planning products and donated medicines were found, expired at the health facilities. Relatedly, Nakyanzi*et al.*, (2009) reported in their study in Uganda that majority of medicines supplied to the public health facilities and stores were found to be expired particularly medicines for vertical health programs. Similarly, Kraiselburd et al, (2013), reported that access to essential medicines is dependent upon well-established and functioning supply chain systems. The above findings could be attributed to low consumption of medicines and supplies by the patients, poor storage facilities at the health facilities could have contributed to the high expiry of medicines and supplies. In addition, supply of medicines and supplies close to the expiry date leads to high expiry at the health facilities. This means that there should be a system put in place that can enable movement of medicines from the manufacturer through the end users at the lower health facilities.

In addition the high expiry of donated medicines and supplies could also be attributed to donations received irrespective of needs of the general population and always given in excess of a similar product, and some medicines are dumped by manufacturers, and failure to comply with the guidelines in forecasts.

5.2 Health workers factors associated with high expiry of medicines and supplies at health facilities

The study found that 73.9% of the respondents had worked for more than two years in their health facilities while only 4.3% worked for one to two years. However, no statistical significance exits between working period and high expiry of medications and supplies at the health facilities. In addition, 47.8% of the respondents were

knowledgeable on medicines and supplies management. While qualitative data obtained indicates three out of ten of the health workers were knowledgeable, and qualified as compared to one out of eight who were experienced, had good attitude and professional in their line of duty in the different health facilities.

The evidence in this study is line with report by the Ministry of Health Government of Malaysia recommended that all personnel must read the High Alert Medication labels carefully before storing to ensure medications are kept at the correct place. Otherwise, if healthcare workers and dispensers use abbreviations when prescribing High Alert Medications, it may lead to missing out the medicines and they could end lying on the shelves without being dispensed (MoH, 2011). Also, another study conducted by Celeste Sauls (2016) in South Africa, which found out that whilst the majority of the participants claimed that they knew what the acronym means, their knowledge itself was incorrect although the end result may be the same. The Republic of South Africa has a higher Gross Domestic Product (GDP) compared to the Republic of South Sudan where this study was conducted from. However, the above comparison clearly demonstrates that the challenge of medicine expiry is not just experienced by developing and fragile countries like South Sudan, but it also affects middle-income countries like South Africa.

This suggests that the behavior and attitude of the individual healthcare workers handling medicines is very important in ensuring robust strategies are put in place to ensure that no medicines expire. Furthermore, the majority 82.6% of the respondents in the questionnaire agreed that they participated in decision making concerning management of medicines and supplies. Despite this fact, there was no statistical significance exists between decision-making and high medicines expiry. However, there is limited research that established the relationship between decision-making and high expiry of medicine and supplies at the health facilities.

5.3 Cold-chain and logistic factors associated with high expiry of medicines & supplies at health facilities

The study established out that the majority 91.3% of the respondents said that their health facility had adequate storage facilities. However, 8.7% of respondents said that health facilities whose storage facilities were not adequate indicated that they keep medicine in

the office. Similarly, 60.9% said that they had acceptable standards as compared to 39.1% had unacceptable storage facilities. However, this is evidenced in results obtained from the qualitative data, which found poor storage facilities, inadequate storage facilities and unacceptable storage facilities contributes to high expiry of medicines and supplies. Correspondingly, Celeste Sauls (2016) reported the pharmaceutical storage area must be under the control of the responsible pharmacist because non-pharmaceutical staff received and stored medicines elsewhere and this led to over-stocking and high expiry of medicines and supplies in the health facilities. The results obtained from qualitative data indicate specific logistics factors significantly contribute to high expiry of medicines and supplies. The most cited were congestion in the stores, delivery of medicines and supplies close to the expiry date, over stocking of similar medicines all the time and unpredictable lead-time.

5.4 Regulatory factors associated with high expiry of medicines & supplies expiry at health facilities

According to this study finding, 87.0% of the respondents reported availability of standard operating procedures at their respective health facilities as compared to the 13.0% who do not. In addition, 78.3% of the respondent indicated that they add a buffer stock to avoid stock-outs. Despite this fact, none of the regulatory factors showed a statistically significant association with high expiry of medicines and supplies. The study finding is contrary with an assessment report in South Sudan in 2010, where implementing "pull system" had medicine stock out lacked pharmaceutical management capacities especially at the State and County levels (*Building Pharmaceutical Management Capacity in South Sudan*, 2017). Similarly, poor management of a change in treatment policy was responsible for the expiry of huge stock of chloroquine sulfadoxine/pyrimethamine and isoniazid in some health facilities in Uganda (MoH, 2006).

Therefore, the differences in findings from this study and those from the two studies referenced here could be because of poor coordination resulting into expiry of medicines in the health facilities. For example, expiry due to treatment policy change and duplicate procurement can be prevented by sound coordination between key stakeholders.

Furthermore, among the regulatory factors, the major reasons stated for the high expiry of medicines and supplies were supply of medicines to expiry date. Besides, no adequate patients to consume and lack of health workers to administer the medicines and supplies. This is line with qualitative results, which stated that supply of medicines close to expiry date, poor stocktaking, low supervision and poor supervision by the ministry of health. However, delayed monitoring of medicines and supplies, poor disposal of medicines and supplies as well as supervision challenges contribute to high expiry of medicines and supplies. In line, (Perspectives, 2004) reported in their study that there should be system of medicine usage based on expiry date to ensure appropriate stock rotation for example FEFO. In addition, expired stocks should be separated from the usable ones to avoid mixing the two categories, which might end up being picked unknowingly. Finally, expired medicines should be disposed-off frequently in line with disposal policies to free up space as a preventive measure of avoiding dispensing expired medicines.

The limitations of this study based on the quantitative and qualitative findings include the following;

Lack of financial resources limited the study only to Jubek State. The findings of this study were not generalized to other states because the study was only conducted in Juba, Jubek state.

Since the study setting was health facility based, there was limited number of health workforces working in those selected health facilities thus, very small sample size.

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1 Conclusions

This study established that; knowledge on management of medicines and supplies; health worker's attitude; and participation in decision making; and role of the supervisor and rational use of medicine were not associated with expiry of medicines at the study site.

Proportion of respondents in health facilities with expired and non-expired Medicines and Supplies

The findings of the study stated that there were 78.26% of the respondents in the health facilities who said that there were high expiry of medicines and supplies. However, the qualitative data specified essential medicines, family planning products and donated medicines that had high expiry in the health facilities. The reason for the high expiry of the donated medicines was likely due to donations received irrespective of needs.

Health workers factors associated with high expiry of medicines and supplies at health facilities

The health worker factors associated with high expiry of medicines and supplies at the health facilities are as follows; Knowledge, qualification of the health workers, good attitude, good understanding of usage of medicines, professionalism and experience of the health workers. This implies that as much as the health workers were knowledgeable, experienced, qualified and professional, it does not prevent high expiry of medicines and supplies in their health facilities.

Cold-chain and logistic factors associated with high expiry of medicines & supplies at health facilities

The study findings indicated that poor storage facilities; low consumption of medicines by the patients; and supply of medicines close to the expiry date contributed to high expiry at the health facilities. The analysis indicated that overstocking of medicines and supplies was associated with reported expiry of medicines.

The interviewees said that the logistic factors associated with high expiry of medicines and supplies were unpredictable lead-time delivery of medicines and supplies close to the expiry date and late delivery. This suggests that cold-chain and logistic factors have contributed to high expiry of medicines and supplies.

Regulatory factors associated with high expiry of medicines & supplies expiry at health facilities

The study found that supervision role of ministry of health (state and national); disposal of expired medicines and supplies; and poor supervision contributed to high expiry of medicines and supplies. However, the findings established that regulatory factors have significantly contributed to high expiry at the health facilities.

6.2 Recommendations

The study recommends establishment or implementation of a policy that governs stock management at health facility level like over stocking, supply of medicines close to expiry date and low consumption by patients. This should incorporate aspect of FEFO and FIFO.

There is need for proper supervision of health facilities at both state and national level, by the regulatory body.

There is need to set up adequate and improved storage facilities for medicines and supplies at the health facilities to prevent high expiry

There is need for proper set up of disposable systems for expired medicines and supplies at the health facilities to prevent high expiry of medicines and supplies.

There is need for capacity building in the management of medicines and supplies usage in terms of trainings, continuous medical education and strengthening standard operating guidelines.

There is need for set up of a technical team or body at state and national Ministry of Health to strengthen standard operating guidelines on medicines and supplies chain management.

National and state Ministry of Health and regulatory authorities should enforce existing international guidelines to prevent dumping of donated medicines.

Sound coordination is needed between Ministry of Health, Central Medical Stores and existing health partners to harmonise procurement and consumption as well as with vertical programmes to prevent duplicate procurement.

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APPENDIX 1: CONSENT FORM FOR STUDY PARTICIPANTS

My name is **Lokosang Emmanuel Alex;** I am conducting a study on **"Factors Associated with high rate of expiry of Medicines in Public Health facilities in Juba City, South Sudan"** in partial fulfillment for the Award of the Degree of Master of Health Supply Chain Management of University of Rwanda.

Study Procedures: You are requested to participate in this study, as frontline healthcare worker who handles, dispenses and manages medicines and supplies at your health facility. I anticipate that you will be in position to help us to better understand medicines and supplies expiry issues at this health facility.

Benefits: There may be no direct benefits associated with your participation in the study, but the information you provide will be useful in improving management of medicines and supplies at your health facility and also at the level of State Ministry of Health and GoSS.

Risks or Discomfort: This research is considered to have minimal risk. That means that the risks associated with this study are the same as what you face every day. There are no known additional risks to those who take part in this study.

Compensation: No research participants will be compensated, however refreshment can be provided during the interview time when it is available.

Privacy and Confidentiality: We will keep your study records private and confidential. Certain people may need to see your study records. By law, anyone who looks at your records must keep them completely confidential. The only people who will be allowed to see these records are:

The research team, including the Principal Investigator and those involved with the study**.** I may publish what I have learned from this study. If I do so, I will not include your name.

Voluntary Participation / Withdrawal: You should kindly participate in this study if you want to volunteer. This research does not put any participant under pressure in any way. In addition, you are absolutely free to participate in this study or withdraw at any

time you wish. Your withdrawal in this study has no penalty or loss of benefits you are entitled to receive.

You can get the answers to your questions, concerns, or complaints

If you have any questions, concerns or complaints about this study, contact the researcher on…….

Assessment of understanding

Please check which box best describes your assessment of understanding of the above informed consent document:

- I have read the above informed consent document and understand the information provided to me regarding participation in the study and benefits and risks. I give consent to take part in the study and will sign the following page.
- I have read the above informed consent document, but still have questions about the study; therefore I do not give yet give my full consent to take part in the study.

_____

_____

Signature of Person Taking Part in Study Date

_____

Printed Name of Person Taking Part in Study

_____

_____

Signature of Person Obtaining Informed Consent / Research Authorization Date

_____

Printed Name of Person Obtaining Informed Consent / Research Authorization

APPENDIX 2: QUESTIONNAIRE:

	SECTION A:	**Details of the Health Facility**			
	Name		**Level of health facility**		
	Location				
	SECTION B: Demographic Characteristics				
1	Age (Complete years)		Sex	☐ (1) Male ☐ (2) Female	
2	Marital Status	☐ (1) Single	☐ (2) Married	☐ (4) Divorced	☐ (5) Widow/Widower
3	Level of Education	☐ Primary		☐ Secondary	☐ Tertiary/Clinical Training School
		☐ completed Primary		☐ Not completed secondary	☐ completed secondary
4.	Professional qualification	☐ Nurse / Midwife ☐ Laboratory Technician ☐ Clinical Officer ☐ Health Assistant		☐ Medical Officer ☐ Cold chain officer ☐ Dispenser ☐ Pharmacist	☐ Cold chain manager
5	What is your religious Affiliation?	☐ Catholic	☐ Protestant/Anglican	☐ SDA	
		☐ Muslim	☐ Non-believer	☐ Other (*Specify)*	
	SECTION C: Proportion of medicines and supplies that Expired				

6	(i) Do you have medicines in your health facility/store that are expired? ☐ Yes ☐ No (ii) Do you have medicines in your stock/store that are expired? (iii) If *yes* to 6 (i) and (ii) above, which particular medicines are expired? (*Multiple responses possible)* Essential medicines ☐ Family planning products ☐ Donated medicines ☐ All medicines in the cold chain ☐ Other (*Specify*.).....		
	SECTION D: Health workers factors associated with medicines & supplies expiry		
7	For how long have you worked in this facility?	☐ 6 Months ☐ 6 months – 1 year	☐ 1 -2 years ☐ More than 2 year
8	Using a scale of (1-5), what is your level of knowledge on medicines & supplies management for daily operations at the care point or department where you work?	☐ 1 Poor ☐ 2 Fair ☐ 3 Good	☐ 4 Very Good ☐ 5 Excellent
9	What would you say is the attitude of staff you supervise towards timely reporting on medicines and supplies availability?	☐ Poor ☐Fairly good ☐ Am not a supervisor	☐Good ☐I do not know
10	Do you participate in decision making regarding management of medicines and supplies at your service centre or department?	☐ Yes	☐ Yes

11	If *No*, who makes decisions/orders for medicines and supplies on your behalf at your centre or department (*Multiple responses allowed*)	☐ My supervisor ☐ We receive directly from the MoH ☐ Until there is a stock out then the team decides
12	What is your understanding of rational use of medicines and supplies (*Tick one responses only)* ☐ Patients receive medications appropriate to their clinical needs for adequate period of time. ☐ Giving medicine to every patient who comes to the facility ☐ Giving medicine according to the burden of disease ☐ Giving medicines to patients according to what is available in the stores and or shelves in the pharmacy	
	SECTION E: Cold-chain and logistics factors associated with medicines and supplies expiry at health facilities in Juba City South Sudan	
13	Do you have adequate storage facility for medicines and supplies at your service point or department?	☐ Yes ☐ No
14	If *No* what alternatives do you have for storing medicines and supplies	☐ We keep them in the office ☐ Transport them home at the end of every day ☐ We keep them in the general store with other commodities ☐ We look them at the care centre ☐

15	In your opinion what is the state of your storage facility for medicines and supplies in terms of; room temperature, contact with water, moisture etc.	☐ Acceptable standards (temperature, water & moisture) ☐ An acceptable standard (temperature, water & moisture) ☐ I do not know (temperature, water & moisture)	
16	For the time you have been here, do you sometimes experience medicine and supplies expiring?	☐ Yes	☐ No
17	If *Yes* how often does this occur?	☐ Weekly ☐ Monthly ☐ Every three months ☐ Every six months	

18	What could be some of the major causes of medicines and supplies expiration at your health facility? (*Multiple responses allowed*)	☐ Poor storage facilities, therefore waste ☐ We do not have the qualified personnel/specialists to prescribe some of the drugs sent to this health facility ☐ Over stocking medicines and supplies through the "push" system from MoH ☐ We do not know the actual number of people who access the facility every 3-6 months ☐ Our partners sometimes procure medicines directly without following the MoH supply chain management ☐ Other (*Specify*)----------	
	SECTION F: Regulatory factors associated with medicines and supplies expiry at health facilities in Juba City South Sudan		
19	Do you have any standard operating procedures that guide you in the use of medicines and supplies?	☐ Yes	☐ No

20	If *No* what do you do to ensure that medicines do not expire in the store or shelves? (*Multiple responses allowed*)	☐ Doing regular checks (every morning) ☐ Understand the disease burden and order based on that ☐ Ordering only what the health facility will consume and complete before the expiry date ☐ Do accurate projection of the population in the catchment area ☐ We do not do anything, we just work normally
21	Why do you normally add a buffer stock	☐ To avoid stock outs ☐ We have an unpredictable Lead Time ☐ Long distance between MoH and or the suppliers
22	Do you also receive restricted medicine/drugs that must be administered by certain cadre of specialists / physicians as per the national clinical guidelines?	☐ Yes ☐ No
23	If *Yes,* are there cases where some of these medicines have expired because they were not administered?	☐ Yes ☐No

24	If *Yes* why did they expire	☐ The cadre/physician/specialist to administer is not there ☐ We do not have adequate patients to consume those medicines ☐ Dates of expiry were too close by the time the medicines were brought to the health facility

APPENDIX 3: KEY INFORMANT INTERVIEW GUIDE

Introduce yourself fully and explain the study and its purpose in details

Questions

1. In your opinion do you think medicines & supplies expire at health facilities in Juba where you work at or supervise? If *yes*, can you elaborate more on the type of medicines?
2. What is your view on the fact that medicines and supplies expire in health facilities in Juba City as a result of health workers' related factors such; their knowledge, attitude and irrational use of medicine among others?
3. Given your experience in this field, what could be some of the cold-chain factors associated with medicines & supplies expiry at health facilities in Juba City?
4. What are some of the logistic specific factors associated with expiry of medicines and supplies at health facilities in Juba City?
5. Can you explain to me some of the regulatory factors associated with medicines & supplies expiry at health facilities in Juba?
6. What are some of the Ministry of Health State and GoSS specific roles when it comes to management of medicines and supplies?
7. What should be done to minimize expiry medicines and supplies?
    a. By MoH, GoSS, partners, health workers, other stakeholders?

APPENDIX 4 : BUDGET

S/No.	Particulars	Unit	Unit Cost (USD.)	Unit quantity	Quantity	Amount (USD)
1	Research Assistants	Days	10	3	5	150
2	Research assistant	Lunch	2	3	5	30
3	Data Entry	Questionnaire	2	1	25	50
4	Researcher	Transport	20	2	1	40
5	Researcher	Accom (Day)	15	5	1	75
6	Researcher	Feeding	3	5	1	15
7	Questionnaires	Printing	1	3	25	75
	Total Research budget					**435**

The Republic of South Sudan

Ministry of Health

MOH/ERB 26/2019
To: Lokosang Emmanuel Alex
University of Rwanda

Date: 7th Aug. 2019

RESEARCH APPROVAL LETTER

Dear **Lokosang**

Subject: Factors Associated with the high Expiry Rate of Medicine In Public Health Facilities

I am writing in response to the request for authorization for the study on **'Factors Associated with the high Expiry Rate of Medicine in Public Health Facilities'** in Jubek State.

After a close review of the proposal, I am glad to inform you that the ethical committee at the ministry of Health - RSS has approved the study. The Ministry acknowledges the importance of the study to enable the decision makers to come up with appropriate plans on the purchase and use of medicines at the health facilities in South Sudan.

Please, keep the Ministry of Health- RSS and the State Ministries of health informed in case of any changes regarding the study and on its progress. I look forward to the result, especially the recommendations that will be generated from the study. Note that any information generated from the study should not be published without the consent of the Ministry of Health RSS.

Good luck don't hesitate to get in touch should there be any queries.

MINISTRY OF HEALTH 07 AUG 2019 REPUBLIC OF SOUTH SUDAN

Dr. Richard Lako Lino Loro
Director General for Policy, Planning, Budgeting and Research
Ministry of Health, Republic of South Sudan

CC: Undersecretary- MOH- RSS
CC: Director General, Pharmaceutical - RSS
CC: Director Generals, State Ministry of Health

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