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

FEASIBILTY OF INTEGRATING OXYTOCIN INTO VACCINES SUPPLY CHAIN IN SIERRA LEONE

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

By

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DECLARATION

I declare that this dissertation is the result of my own work except where specifically acknowledged, has been through the anti-plagiarism system and found to be compliant and has not been submitted for any other degree at the University of Rwanda or any other institution.

This is the approved final version of the dissertation.

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ABSTRACT

Introduction

Postpartum haemorrhage is still leading the cause of maternal mortality globally. Oxytocin is the drug of choice for the treatment and prevent of postpartum haemorrhage. Oxytocin must be maintained at temperature similar to vaccines that is +2to +8 degree Celsius. Most women in low income countries are still deprived to access quality oxytocin at service delivery point during childbirth as a result of lack of the infrastructure and poor knowledge of health workers to properly store the product.

EPI program with a huge infrastructural investment on cold chain that is available even at remote settings will contribute greatly to it proper storage and hence maintained potency.

Supply chain integration is the merging of both oxytocin and vaccines in the cold chain to achieve effectiveness and efficiency.

Objectives

The aim of this research was to access the feasibility of integrating oxytocin into vaccines cold chain in Sierra Leone.

1. Assess the current status of vaccine supply chain in Sierra Leone.
2. Evaluate the present status of oxytocin supply chain in Sierra Leone.
3. Assess the feasible to integrate oxytocin storage into the vaccine cold chain of the EPI in Sierra Leone.

Study targeted 120 health facilities participants nationwide, the design of the questionnaire took a dual approach of both Quantitative and Qualitative face to face data collection. The study covers four regions Western Area, Southern, Northern and Eastern regions and 14 health districts of Sierra Leone. The study sample size was determined using 10% of 1200 health facilities nationwide that conduct immunization and maternal services. The data tool used was SPSS version 20.

Results

99% of all health facilities visited stored oxytocin and vaccines in their facilities.

Only 104(86.7%) health facilities (n=120) respondents stored both vaccines and oxytocin in the same refrigerator while 31.3% used other means of storage.

Of the 104 respondents that stores both oxytocin and vaccines together in the same refrigerator only 29.8% label their oxytocin from vaccines and 70.2% respondents' stores without labelling. 82.5% respondents (n=120) believed that storing oxytocin and vaccines together is a good practice, 12.5% respondents believes is a bad practice and 5.0% say they don't know if is a good or bad practice. 83.3% of health facilities (n=120) had enough

storage space for both oxytocin and vaccines. 100 (83.40%) respondents supported integration at Health facility, 13(10.80%) respondents supported integration at district level and 7(5.80%) support integration at central level.

From a total of 120 facilities assessed, respondents revealed that 100(83.30%) stated that the available space in the refrigerators is enough to store both oxytocin and vaccines together while 20(16.70%) said their available capacity is not enough to store both together in the refrigerator (Figure 4.8).

Discussion and Conclusions

The present study found that 86.7% of the HFs respondents stores vaccines and oxytocin together in the same refrigerator which is in support to the WHO/UNICEF joint statement on integration of temperature- sensitive health products particularly oxytocin into the EPI cold chain where safe and feasible(WHO/UNICEF, 2014).

The findings of this study shows that integration of oxytocin into vaccines supply chain in Sierra Leone will leverage opportunities for economies of scales and scope and promote Million Development Goals, which is in consistent with the study done by PATH Placing Oxytocin in the Immunization Cold Chain, which highlighted Global Alliance on Vaccines Immunization's interest on integrated approach to health will advance efforts to achieve the Million Development Goals(New, n.d.).

Table of contents

Contents

LIST OF FIGURES

TABLES

ACRONYMS:

PPH	**Postpartum Haemorrhage**
MoHS	**Ministry of Health and Sanitation**
DDMS	**Directorate of Drugs and Medical Supply**
EPI	**Expanded programme on Immunization**
ICC	**International co-ordination committees**
BCG	**Bacillus Calmette Guerin**
LMIS	**Logistics Management Information System**
FP	**Family planning**

CHAPTER ONE

1.0 INTRODUCTION

1.1 Defnitions of key concepts

According to USAID, 'supply chain entails all activities involving planning and management and also encompasses sourcing and procurement of all logistics management activities. It create a health environment for collaboration and coordination with channel partners which can be suppliers, third party service provider's intermediaries and customers. In essence supply chain management integrates demand and supply across the companies and within management.(USAID Deliver, 2011)

USAID defines supply chain integration as a performance -improving procedure that develops strong linkages between actors, levels and function within the supply chain to optimize customer's service. The objectives of supply chain integration are to improve efficiency and minimize failure while also enhancing product availability. Supply chain integration works to better connect supply with demand, which can both enhance customer service and lower cost.(Usaid/Deliver, 2011).

Immunization supply chain encompasses all systems, personnel's and equipment, and activities implemented to ensure the effective delivery of vaccines from the place of production to the beneficiaries who needs them. An ideal supply chain is one that ensures that the limits of science are not constrained by the limits of systems. ("IMMUNIZATION SUPPLY CHAIN," 2014)

Integrated health service delivery concentrate on providing health care services to clients by satisfying the six right of consumer. Integration is an organisation and management of health services at a time they demand the care which is commensurate to their desired outcome and provide value for money. Integration must be seen as a continuous process that involves technical engagement which describes the organization different tasks to execute in order to make available efficient and effective health care services to the general population, integration is a system not an event. (Brief & Goals, 2008).

In a study done by USAID Title Supply Chain Integration: case study from Nicaragua, Ethiopia and Tanzania shows that many countries have been involved in integration studies and that has help to solve their chronic supply chain problems promoting streamline supply

chain processes making it very simple by removing all the bureaucracy in the process, leading to effective supply chain process and provide quality health service to the general population.(Usaid/Deliver, 2011).

In Sierra Leone the Directorate of Drugs and Medical Supply has been in collaboration with many programs in the process of integration, so far progress have been made in this area in terms of integration. Storage, distribution and information management system are under the domain of the directorate of drugs and medical supplies. This has led to tremendous improvement, by removing duplication of effort, allows visibility of data to all responsible parties and health workers of different program has formed a cohesive team network that better understands supply chain management. (Usaid/Deliver, 2011).

EPI is one of the frontline public health programme under the Directorate of Reproductive Maternal Neonatal and Child Health (RMNCH) within the Ministry of Health and Sanitation. EPI Programme also Integrate and implementation activities with other public health programs such as the Malaria Control Programme, Leprosy/Tuberculosis Control Programme, Integrated Management of New born and Childhood Illness (IMNCI), Nutrition Programme, Health Education Division, and the Directorate of Disease Prevention and Control this is as a result to reduce infant and under five- mortality rates. EPI is implemented nationwide and is found in all remote settings in the country this integration helps other programs to achieved coverage during campaigns or routine activities.

Even though there has been so much improvement in integration in the supply chain system in Sierra Leone the Expanded Programme on Immunization (EPI) still runs vertical supply chain since its inception in 1978 to target six childhood Killer Diseases; Tuberculosis, Diphtheria, Pertussis, Tetanus, Poliomyelitis and Measles.

The vaccines supply chain of EPI-Sierra Leone is well established and its cold chain system is available even in remote communities to render immunization services. Vaccines are kept at +2 to+8 degree Celsius that is similar to temperature in which oxytocin must be kept. The rising need for pharmaceutical to be kept at controlled temperatures is on the increase. Pharmaceuticals like oxytocin must be transported and stored at controlled temperatures. Challenges to maintain this sensitive temperature will damage the product or reduce access to availability of life saving medicines. To ensure high quality care of health is implemented, there must be a way to managed temperature sensitive drugs in a temperature controlled supply chain.

‘WHO and UNICEF confirmed that it is permissible to transport and store drugs in the vaccines cold chain, provided the best storage and labelling practices are adhered to at all times to clearly distinguish non- vaccine products from vaccines and diluents’ (Temperature Sensitive Health Products in the Expanded Programme on Immunization). Even though WHO and UNICEF joint statement to integrate temperature sensitive products especially oxytocin in vaccines supply chain but there has been no study in Sierra Leone to guide the process. This study Feasibility of Integrating Oxytocin in Vaccines Supply Chain attempt to provide a decision framework and provide a generic result for decision makers nationally and EPI program managers on how to integrate.(WHO/UNICEF, 2014).

1.2 Problem statement and significance of study

Infant and maternal mortalities in Sierra Leone are on the high side. In Sierra Leone the Government and its partners are determined to reduce both maternal death and infant mortality using vaccines for under-fives and oxytocin to prevent postpartum haemorrhage. Oxytocin is very effective in preventing postpartum haemorrhage which is a common cause for maternal death but it requires a cold chain to maintain its potency, which in most cases not readily available in the current supply chain system for health commodities in Sierra Leone. Vaccines on the other hand are well established and operate a well maintained cold chain system. Since vaccines and oxytocin serve a common goal of reducing child and maternal mortalities (and usually administered by the same service providers), it is logically and cost effective to integrate the supply chain systems of these products. However, integrating oxytocin into the vaccine supply chain requires a great deal of coordination effort given that the two products (Oxytocin and Vaccines) are delivered by two distinct programmes in Sierra Leone. The supply chain for vaccine is seemingly under intense pressure to effectively and efficiently deliver result. Therefore, bottlenecks that may arise as a result of logistical arrangement in merging two supply chains networks might not lead to progression or yield the desired result.

1. 3 AIM OF THE STUDY

This study aims to assess the feasibility of integrating Oxytocin into vaccine supply chain in Sierra Leone.

1.4 RESEARCH OBJECTIVES

The main objectives of this study are:

1. To assess the present status of vaccines supply chain in Sierra Leone.

2. To evaluate the current status of oxytocin supply chain in Sierra Leone.
3. To assess the feasibility of integrating oxytocin distribution into the vaccine cold chain in Sierra Leone.

1.5 RESEARCH QUESTIONS

This study will answer the following questions:

3. What is the present status of vaccines supply chain in Sierra Leone?
4. What is the current state of oxytocin supply chain in Sierra Leone?
5. Is it feasible to integrate oxytocin distribution into the vaccine cold chain of the E.P.I in Sierra Leone?

1.6 JUSTIFICATION

Supply chains in the health sector is the process of delivering public health product to diverse delivery points, including hospitals, health centres, health posts and other private out lets.

Given that most of the temperature control drugs in the primary health care supply chain are not stored under similar temperature requirement as vaccines, EPI in Sierra Leone as else were operate a vertical supply chain in reaching out beneficiaries in the public. These programme specific supply chain makes provision for the programme to draw out its own policies and procedures to achieve its target.

The primary objective of vaccine supply chain is to ensure efficiency, effectiveness and sustainability. Project optimise recognised that integrating vaccine with other drugs such as oxytocin should only be done if the process aim at achieving its primary objective. Given the similarity in the storage and distribution between vaccine and oxytocin it suggests that their integration could pay off.

Integrating the supply chain of vaccines with oxytocin that require temperature control suggest a positive path way to address those challenges. Considering the urgency in the need for both oxytocin and vaccine and the level of investment in those drugs, there is an increase pressure on the service delivery side for increase efficiency in the supply chain. This study therefore shed light on the state of the integration in supply chain, the key challenges and success so far.

This study seeks to enhance a clear understanding on the emerging issues on integrating vaccines with oxytocin in the supply chain. The outcome will inform Directorate of Drugs and Medical Supplies, EPI and other global agencies on the feasibility of integration.

1.7 Study limitation

Supply chain systems in the public health system of Sierra Leone seek to enhance an uninterrupted supply of health products to the general public. The study on the integration of oxytocin into the vaccine supply chain in Sierra Leone was supposed to capture data from all the facilities in the 14 health districts. However, due to the lack of funding and constraints including time study demand was restricted to data drawn from samples from the 14 health districts and study done in 120 health facilities. Study on integrating oxytocin and vaccine cold chain possesses a big challenge to achieve desired outcomes without compromise so the findings are limited to the available data. However, this researcher and team focus their energy on feasibility of integrating oxytocin in vaccines supply chain.

This study was limited due to the assumption that the response given by participants to the study are true and can be verified in the future by other researchers in the same study.

The target for this study was health facility respondents with refrigerator therefore generalizing this study nationwide is not possible. Further studies assessing the feasibility of integration in other health facilities that conduct immunization without cold chain is important.

CHAPTER TWO

2.0 Literature review

2.1 Supply chain management

Medical supply chain management is defined as "a tool that manages inventory for gaining competitive advantage". It is observed that Medical supply chain links organisation, people, processes, procedures and systems that are involved in getting products and services to consumers. As a result, it is concluded that supply chain management is the management of the entire set of business processes that produce and deliver products/services to the final consumer (João & Ribeiro, n.d.).

Supply chain management is an integrated co-ordination planning and control of all business processes and procedures and activities in the supply chain to render higher quality consumer value at an optimal cost to the supply chain and at the same time satisfies requirements of other stakeholders in the supply chain(Indicators, Metrics, & Lee, 2005).

To achieve benefits of supply chain management and to excel in this digital economy, organisations must be well knowledgeable in order to manage the integration of business, people, technology and process not only within organization and enterprise but also across extended organisations and enterprises. Collaboration of and coordination amoung suppliers, customers and other business partners are the primary goal of Supply Chain Management System (SCMS), this system leverage opportunities, benefits and competitive advantages to organizations, but its management and implementation comes with its undue challenges to the organizations. Integration and remodelling or redesigning is a vital component in the SCMS implementations. Supply chain management implementation does not only involve Enterprise Resource Planning (ERP) systems but also the enhancement of their communication with legacy systems. ERP systems must well integrate or merge with SCM systems with Customer Relationship Management (CRM), Product Life cycle Management (PLM), e-markets and e- procurement as well as encourage collaboration and cooperation at all levels in the value chain. In the current electronic world and dynamic business environment, many companies are merging, expanding, contracting, outsourcing and remodelling or designing their SCM systems, as a result of rapid technology advancement, the basic supply chain that has operated for years has now evolved into Supply Chain Network. This interactive Supply Chain Network and integrated systems in which organizations and firms integrate to improve on every value chain. The process of redesigning or redefining and making connection between organization parts to form a whole, in order to make a new one is called integration. Integration also emphasizes on connecting organizations with logistics, information and communication sharing and management.

In this 21st century, there has been a few adjustments in business conditions or environment that has led to positive contribution to improvement of supply chain networks: firstly, as a result of globalization and enlargement of multi-national companies, strategic alliances, joint ventures and business partnerships, that produce significant success factors, following the earlier "Just-In-Time", "Lean Management" and "Agile Manufacturing" practices. Secondly, improvement in technology, that has particularly led to a dramatic fall in information communication costs, which are the utmost components

of transaction costs and has led to changes in collaboration and coordination among the members of the Supply Chain Network (Awad & Nassar, 2010).

2.2 Supply chain integration

Looking at several public health definitions globally, the supply chain definition for the term "integration", is so far the most appropriate, as it is used by the supply chain community. In so many occasions, supply chain integration is define as the integration of information flow between the different levels and functions within a supply chain. It is significant to capture integration as a source of significant performance improvement. For the purposes of this study, we define integration as: the merging of more than one vertical supply chain for specified programmes or products.

Supply chain integration is an approach to improve performance that develops uninterrupted and coherent linkages between the players, functions and levels within a supply chain to improve customer service. The objectives of supply chain integration hinges on the satisfaction of the following: improvement of effectiveness, efficiency and decrement of redundancies while enhancing product availability. Integrating supply chain further strives and better connects demand with supply on one hand, and on the other hand, add value to both customer, and service at a very low cost.

Integrated supply chains that are well functioning has a feature that clearly defines the responsibilities and roles of the actor's, simplify processes, visibility of information, agility collaboration, alignment of objectives and build trust. Sharing all these opportunities and experiences helps to overcome challenges and improve supply chain performance ("Integration of Vaccine Supply Chains with Other Health Commodity Supply Chains A framework for decision-making," n.d.).

2.3 Global declaration towards integration

Merging services is supported by several global declarations to back integration of services. According to United Nations Secretary General, Ban-Ki-Moon, in his forward to the 2010 Global Strategy for Women's and Children's Health, the strategy "sets out the key areas where action is urgently required to enhance financing, strengthen policy, and improve service delivery" and that one of these areas is "integrated delivery of health services and life-saving interventions, so women and their children can access prevention, treatment, and care when and where they need it." In a similar fashion, the Global Vaccine Action Plan 2011–2020 has brought into play full integration of national EPI plans into national health plans, most especially at primary levels of health care system, as one of its major aims. This major plan is in line with the spirit of the 1984 WHO cold chain design

named, “Logistics and Cold Chain for Primary Health care. Integration is not only aiming at pulling resources for greater efficiency, it also uses it as an opportunity for greater social mobilization for all programmes concerned. The 2005 Paris Declaration on Aid Effectiveness stated that there is need for donors to strategically align objectives of host countries and to make use of existing systems to “eliminate duplication of efforts and rationalize donor activities to make them as cost-effective as possible’’.

On the other hand to maintain potency, there is need for the health systems to develop ways that will ensure oxytocin to be kept in the cold chain at all levels in the supply chain until it reaches the final consumers. A programme that offers immunization services have one of the most promising opportunities with regards cold chain equipment, and always ensures products are maintained at their required temperatures. Expanded Program on Immunization in many countries has developed a well-structure system that functions effectively, and many other organizations can use this system to ride upon to achieve a very good intervention, to guarantee entrance to quality-assured essential health commodities consumption at service delivery point. A temperature sensitive commodity like oxytocin requires a special handling process to benefit from this integration with immunization systems(New, n.d.)

2.4 Global action towards integration safety

Also, undertaking integration as a cost saving intervention is not the only concern, safety concerns have been tabled by immunization partners and stakeholders, including bloggers in a recent discussion on the TechNet blog (TechNet-21) . For example, some Immunization experts have expressed worries about a possible error as a result of integrating oxytocin into vaccine cold chain, which may result in health workers making errors, while using oxytocin as diluent instead of Bacillus Calmette Guerin (BCG) diluent to reconstitution (Bacillus Calmette Guerin BCG) vaccine.

Published evidence has proved the use of oxytocin accidentally, has only one reported incident of a premature infant who accidentally received oxytocin instead of vitamin (K) intra-muscularly, shortly after delivery. The patient remained hemodynamically stable but developed transient hyponatremia as the sole biochemical abnormality(New, n.d.).

2.5 Countries experiences in integration

Family Planning (FP) programs in many countries were integrated into other health commodities in the last 20 years. These are the different learning experiences in integration which can be valuable to provide vital opportunities for integration of vaccine supply chain with other health commodities.

In Bangladesh, integration process was well developed, unfortunately it was distorted by issues around politics and extreme hatred arising between health workers and Family Planning staff over some concerns of integration. Health workers believed integration was an opportunity for pooling additional resources and responsibilities, while their FP staff believed it is an end to the Family Planning program.

In Bolivia, integration inception led to data worsening quality in the logistics management information system (LMIS), this has been gradually overcome by changes in reporting forms.

In Mali, integration of Family Planning into essential medicines resulted into poor availability and system disturbance due to inadequate planning.

In Nepal, the intended outcome of integration took several years to reach its successful peak. Ministry of Health logistics integrated all activities that are undertaken by logistics in a single entity. Procurement, logistics Management Information System, forecasting, storage, requisition and distribution was integrated among different programs.

In Nicaragua, integration led to improved performance and availability of essential medicines and contraceptives and also led to cost savings for national program.

In Tanzania, integrating Family Planning with essential drugs, resulted in 40% lowering of distribution costs for the Family Planning program, but also deteriorated data quality.

In Zambia, primary transport facility was better coordinated by integrating eight different health programs to Medical Stores. Significant challenges were seen in LMIS across individual programs ("Integration of Vaccine Supply Chains with Other Health Commodity Supply Chains A framework for decision-making," n.d.).

Taking into consideration all these experiences there is a need to carefully analyse which function in the supply chain to integrate or which to keep separate. This experience exhibit decrease in data quality when integrating Logistics Management Information System, it is also an evidence that storage and distribution are technically feasible and yield significant benefits but needs sufficient political buy-in and concept towards collaboration between and among programs that are integrated for it to be institutionalized.

Integration of other health commodities during campaigns or routine immunization into vaccine systems, of which WHO and UNICEF have been taking the lead in this integration intervention, is crucial. These organizations have been in the forefront to advanced efforts to integrate vitamin (A) supplementation into immunization routine

programs in several countries. This effort has shown the synergies that can be mounted by integrating different products at service delivery point.

To understand policy and programme impacts on integration, WHO's Global Program for Vaccines and Immunization convened a meeting of international agencies involved in immunization and micronutrients, a meeting that was hosted by UNICEF in New York. Participants in the meeting noted that vitamin A supplements provided by health, nutrition, or immunization health workers are the most important means of getting vitamin A to mothers immediately after giving birth. Routine Immunization services always provide the opportunity and channels for mothers and young infants to contract routine health services through integrated efforts, by using the same infrastructure to transport vaccines and vitamin A to remote areas, and increase vitamin A uptake without decreasing immunization coverage. Health workers might also use the same opportunity by transporting oxytocin and vaccines using the same cold chain. Another effort of integration is accomplished during mass distribution of insecticide-treated bed nets (ITNs) in close collaboration with immunization programmes. In 2004, Togo was the first country to implement integrated distribution of ITNs to prevent malaria into a nationwide immunization mass campaign.

This approach of integration, together with other interventions, has increased the proportion of ITNs ownership in many households from 8% to 62%. A similarly, pilot project in Ghana, conducted together with UNICEF and Red Cross, found that mass campaign for measles integrated with distribution of ITNs led to high and equitable coverage(New, n.d.) .

WHO list of modern essential products included oxytocin as the drug of choice in their standard treatment guidelines in most countries .This choice of Oxytocin will help facilitate integration of procurement and delivery of oxytocin with vaccines and other drugs on cold supply chain. This will create a "one-stop shop" for deliveries of health services through EPI programmes and this may help stimulate health-seeking behaviours by women and therefore may tend to decrease inequalities in service delivery.(February, 2016)

2.6 Post-partum haemorrhage

Post-partum haemorrhage (PPH) is the major cause of death during and after delivery. It accounts for approximately 35% of all maternal deaths (February, 2016).

Recommendation documents from the World Health Organization says that oxytocin is the most effective uterogenic medicine for the prevention and treatment of PPH especially at

health facilities. This recommendation has led many countries including Sierra Leone to list it as the drug of choice for the treatment and prevention of postpartum haemorrhage.

WHO and UNICEF confirmed that it is allowable for storage and transportation of temperature sensitive drugs in the vaccines supply cold chain, only if good storage and labelling skills are considered at all times to clearly separate vaccines from non- vaccines and diluent. Although WHO and UNICEF joint statement support integration of temperature sensitive products especially oxytocin in vaccines supply chain but there has been no study in Sierra Leone to guide the process. This study Feasibility of Integrating Oxytocin in Vaccines Supply Chain, attempts to provide a decision framework and provides a generic result for decision makers nationally and EPI program managers on how to integrate (WHO/UNICEF, 2014).

Oxytocin is a synthetic cyclic nonapeptide hormone similar to that released by the posterior lobe of the pituitary gland of the hypothalamus. Oxytocin must be stored at +2 to +8 degrees Celsius and is very unstable when exposed to high temperatures, with possible excursion to room temperature for brief periods(Pharmacopoeia, 2010).

Oxytocin on the other hand has got a very positive policy for its use as an essential medicine of choice, but despite this good policy framework, it still faces challenges that limits its accessibility in many countries. In a multi- country study done in 2012 shows that stock out is still a problem at service delivery point. In many countries the system of distribution in place does not have the necessary infrastructure to house essential drugs that require cold chain, especially oxytocin, this is another challenge to its quality. Conversely oxytocin requires similar storage temperature like vaccines that is between 2 and +8 degrees Celsius.

In line with these supply chain challenges of oxytocin the Maternal Health Technical Resource Team (MHTRT) of the UN Commission on Life-Saving Commodities for Women and Children has been looking for opportunities for large volume availability of quality oxytocin, including advocacy and emphasis on the need to integrate oxytocin in a strong existing cold chain supply(WHO/UNICEF, 2014). Some countries like Ghana and Mali, to name a few, have attempted to integrate at some levels, their experience will help to answer some questions on oxytocin integration into vaccine supply chain in Sierra Leone.

2.7 Frame work for identifying opportunities for integration

Currently integration in Serra Leone is partially implemented, not all aspects of the supply chain has been merged, the transportation and storage part has been implemented and is a

form of integration that is implemented slowly so that it does not lead to a disadvantageous activity. At the moment, not all disease specific programmes are integrated, there are still some activities in the pipeline that needs to be addressed on how well to integrate disease specific products to one big supply chain. For example, products like malaria, HIV, Leprosy and Tuberculosis, are integrated at storage and transportation levels at the Directorate of drugs and medical supplies (DDMS) but all other activities in the supply chain are still handle by the individual programmes. Sierra Leone has launched its own national quantification committee which has at least two members from each disease specific programme and other stakeholders in the supply chain. The committee will work as a team during quantification activities. The activities of this committee will be managed by the Directorate of Drugs and Medical Supplies to enhance proper collaboration and coordination amoung programmes. This will leverage its own opportunities and best practices across multiple disease specific programme quantification processes.

In most countries supply chain activities includes several processes that take various forms and usually includes forecasting and quantification, procurement, receiving, storage and warehousing, information sharing from upstream to downstream and downstream in each level in the supply chain. Most supply chain have either two or three levels in their storage system: the central, regional and districts, before it reaches the service delivery point. Even though each country may vary in their structure, but integration of supply chain will leverage several opportunities and result in many direct benefits. But in some instances may even have indirect benefits, if for instance vaccines are part of the integrated package it will limit other product leakages because of the strict stock management in vaccines, but can be disadvantageous to vaccines supply chain if not properly planned, therefore integration with any products in the vaccine supply chain has to be slowly taken to make the right decisions, but if its disadvantages outweighs its advantages then the process must be terminated. The advantages of these benefits hinge on specific functions that are integrated. Storage and transport incurred relatively high fixed expenditure but if integrated, the cost will be spread amoung the different programmes and this will lessen the burden.

Quantification on the other hand is a supply chain activity that requires estimation of products' quantities before an order is placed, these quantities as estimated will go through the supply pipeline over a definite period of time. For example, the consumption data used in quantification cannot be used across each programme because one size does not fit all, this implies that not all data points for quantification are the same, therefore data collection

can be coordinated but not fully integrated. Vaccines and other medicine quantification can be cumbersome processes and therefore need the expertise of individuals with excellent knowledge on program history, activities and plan in the field. In-depth knowledge about products category and its demand drivers must be well understood. Immunization programs follow a specific pattern of schedule that is predictable, that is, population data, and epidemiology of a country while other products look at treatment regimen, disease burden, and consumption and disease patterns. Due to this uncertainty and complexity in quantification and demand of programme specific products that are relatively compared to well-structured activities in quantification of vaccines, there is possibility that it is not the best practice, and thus needs to be considered before integration. Furthermore funding sources are different and staff experiences are different across each program that makes vaccines and other products' quantification relatively very difficult.

Integration of vaccines and other health procurement may be very difficult to implement even though tender preparations can be generic with regards the questioning and screening process but also tender evaluation can be done by different stakeholders, different funding source, date scheduled for arrivals may be different and also the third party agency are different, leading to additional complexity in coordination and collaboration of these operations. In order to achieve leverage on prices, many countries have decided to pool their vaccine procurement with others in their regions or income levels.

Requisition and ordering are terms used by health workers to place an order for different health products. Vaccines follow strict routine order operations like immunization schedules, and birth cohort which have a predefined time and quantities of order. On the other hand other products like oxytocin need a pull system that identify needs of different health facilities. This process when integrated requires a huge intervention and investment to make the process easy.

Storage and Warehousing makes the most sense when integrated, substantial evidence in savings in these two functions if well managed can be efficient, as it reduces on management, inventory holding costs and warehousing. On the other hand this is a capital investment that requires a huge sum of money before other health products can be integrated. In most cases the existing warehousing may need refurbishment or replacement and expansion to support increased requirements in number, volume, and storage temperature of products. Introduction of new vaccines and other health products such as TB test kit, oxytocin and HIV test kits requires cold chain warehousing, and there is rapid increment for new and emerging products that requires cold chain warehousing. The need

for Vaccines and other new emerging products that requires cold chain warehousing space may leverage opportunities for them to share fixed and operational cost of additional warehousing capacity through a more integrated warehousing system. Training warehouse staff on how to handle additional products with different temperature requirements and how to handle additional complexity of their task is very crucial in integration, otherwise it will lead to an adverse outcome and confusion in the whole process.

Transportation of vaccines and other products can be a good opportunity to leverage on, the examples from Senegal and Tunisia have clearly demonstrated that transport at the last leg of the supply chain can be efficiently and effectively integrated for vaccines and other health products but there is need to look at their temperature requirements, resupply intervals, and service delivery points and see if they are well matched. Transportation as a major infrastructure in integration will help improve performance. Coordination of transportation activities is usually not an easy process and needs to be properly looked at in integration. There must be an effective coordination and collaboration in communication channels, amoung or between programmes that they may want to integrate. Lacking communication between or amoung different supply chain programmes may lead to unnecessary delays. In some circumstance there is need to upgrade the existing vehicle fleet in order to promote integration delivery volumes and its temperature challenges.

Information management system is typically a programme specific activity and since the inception of most programmes, their information management system has been working vertically. Health workers working in their specific programme activity will amass knowledge and experience on their specific programme related information system and how it works. Programme specific staff may be well trained on how they manage information related to their products for several years. Integrating programme specific information system will now lead to a confusion as to which information system to use and that will make the process complex. Also, the funding partners are different and the indicator each may want to capture may be different. In order to get the process right, staff have to be trained on one (1) information management reporting system that will be universal and works for every programme. In many countries that have integrated, for example Bolivia, where integration of logistic management information failed but later improved after some engagement.

2.8 Country specific factors for applying the frame work for integration

The level of integration and the willingness of the total political engagement and economy in the country will determined the extent and benefit of integration. Integration is always regarded as a continuous process, where each element of the supply chain finds its correct place within the continuum, hinging on different context-specific factors. The interconnection that exists between the supply chain for medicines, health products, and vaccines has the possibility of influencing the benefits and preparedness for further integration. The top most levels of leadership in the health sector, must have a political buy-in to support integration, nationally, attention must be on efficiency in the supply chain, and advocacy of global organisations collectively will create the right environment for initiating integration activities. The absence of any of these criteria will lead to significant constraints for integration, and this will lead to crumble of the integration process. Having the political buy-in is not the only criteria for integration, the economy of the country will also influence the preparedness of a country for integration. Countries with a well-established transport systems and a third party logistics agent to which the Ministry of Health can outsource distribution and transport of vaccines and other health commodities have a much easier case to build for integrated transport and distribution(Anvar, 2013).

2.9 Stimulating factor for supply chain integration

As immunization Supply chain systems of EPI programmes, are always on point to overcome current barriers and arising challenges, but the lines are not clear between supply chains of vaccines and those of other health products. Over the years vaccines were the only set of health products which required cold chain systems and runs a vertical supply chain system, but the current supply chain system pushes toward improvement of access to a well institutionalized immunization cold chain supply that is not only designed to merge oxytocin but also for an upcoming number of a wide range of variety of pharmaceutical products, such as some antibiotics, antiretroviral and insulin that must be stored at controlled-temperatures. The present requirements of emerging pharmaceutical commodities have led to new and favourable opportunities for supply chain integration between vaccines and other health products of public needs (Anvar, 2013).

Many schools of thought had presented documents to describe the need for service integration as a critical step toward achieving Million Development Goals (MDGs), the GAVI Alliance has stated that “the high coverage of routine immunization services provides an important entry point for women to access an integrated package of maternal and child health services.” In 2013 this new and underused vaccines support application

guidelines prompted, the Global Alliance for Vaccines Immunization (GAVI) statement, "The ICC or equivalent national coordinating body, including any technical EPI advisory groups, should be closely involved in the process of deciding whether to introduce a new vaccine to ensure that all information and options have been taken into account, or to guide effective integration of immunization initiatives." These statements are clear manifestations supporting GAVI's wish to ensure that any new additions to the existing systems of immunization are carefully judged. Evaluating the process necessitates opportunities for the National Immunization Technical Advisory Group to expand analysis to include other health products in the supply chain system(New, n.d.).

Vaccine supply chain includes all the people, activities, resources, infrastructure, and planning. All these activities are the integral parts necessary to address vaccine safety and effectiveness until it reaches the final consumers. A well-structured supply chain is a very strong criteria used to increase equity, coverage and contribute to reduce under-five mortality rate. Immunization supply chain has been designed since the inception of EPI, which is about 40 years ago. These strong immunization supply chains have enhanced over 85% global coverage and have allowed children to receive at least three doses of basic package of routine immunization(Flynn, Huo, & Zhao, 2010).

The vaccine supply chain of EPI-Sierra Leone is well established and its cold chain system is available even in remote communities to render immunization services. Vaccines are kept at +2 to+8 degree Celsius that is similar to temperature in which oxytocin must be kept. The rising need for pharmaceuticals to be kept at controlled temperatures is on the increase. Pharmaceuticals like oxytocin must be transported and stored at controlled temperatures. Challenges to maintain this sensitive temperature will damage the product or reduce access to available of life saving medicines. To ensure high quality care of health is implemented, there must be a way to manage temperature sensitive drugs in a temperature controlled supply chain. Immunization supply chain having this resilient nature on the other hand is an opportunity to ride on and integrate oxytocin in this well-established supply chain that is available even at the most remote communities or settings of the country because of their well- structure cold chain supply. This can be achieved if guidelines and policy are in place to guide the process.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study design

A cross-sectional study design was done and assess health facilities on the current status of oxytocin and vaccine supply chains in Sierra Leone and also assessed the knowledge and feasibilty of health workers on integration of oxytocin into vaccines supply chain at service delivery points.

3.2 Study methods

The study on integrating oxytocin into vaccine supply chain in Sierra Leone was designed to take a dual approach of both Quantitative and Qualitative frame work for the collection and analysis of data. The study was designed to cover health facilities in the four regions: Western Area, Southern, Northern and Eastern regions covering the 14 districts of Sierra Leone. The study was conducted on selected health facilities with a view to generalize finding for the entire Country. The study attracts 120 health facilities were questionnaires were administered at service delivery points to respondents that are engaged in immunization activities and maternal health care. Face to face interviewed was performed using a questionnaire. The questionnaire comprises four (4) sections the first section was health facility information, the second section looked at vaccines availability and storage facility the third section looked at availability and storage facilities of oxytocin was obtained. In the fourth section feasibility of integration of oxytocin into vaccines cold chain was obtained. The questionnaire was piloted in another clinic (not included in the main study) before been used in the main study. Data collection was done from the 1ST of July 2019 to the 30th of July, 2019. The researcher plus two data collectors were in the field to collect data in the field. The researcher went to southern and eastern regions and two data collectors targeted western area and the northern region of Sierra Leone. The data was validated to reduce errors in the study.

3.3 Study area

Sierra Leone is small country in the west coast of Africa, bordered by Guinea, Liberia and the Atlantic Ocean. The country is subdivided into four regions North, South, East and West and is partitioned into 14 districts, 152 Chiefdoms with land area of 71,620 square kilometres and a population of approximately over 7.5 million people and over 1,200 health facilities.

3.4. Study population

Study population includes healthcare personnel involved in routine immunization and maternal health care at service delivery points.

3.5 Sample size calculation

Study sample calculation was done using 10% of 1,200 health facilities nationwide. That is 10/100* 1200 gives the total of 120 facilities personnel's that took part in the study.

3.6 Selection of the subjects (sampling)

A total of 120 subjects were selected randomly and was interviewed nationwide for the purpose of this study. Which is 10% of the total 1200 health facilities nationwide.

3.7 Criteria of inclusion and exclusion

Inclusion criteria

Health facilities was included in this study based on the following:

- The facility must be providing immunization and maternal health care services;
- The facility with refrigerator.
- Respondents in the health facilities who approved to be part of the study by signing a written consent to participate in the study.

Exclusion criteria

Health facilities will be excluded in this study based on the following:

- Health facilities that provide maternal and child health care during the selection of the facilities but at the time of data collection was longer offering those services.
- Health facilities with refrigerator selected before the study but at the time of data collection the refrigerator was not functioning..
- Respondents who approved to be part of the study but in the course of data collection decided not to be part of the study.

3.8 Material

Questionnaire and SPSS version 20 data tool was used, the questionnaire captures information on facility, respondents personal information, number of deliveries conducted in the health facilities, assessment on vaccines storage and availability, assessment of oxytocin storage and availability and knowledge of respondents on integration of oxytocin and vaccines.

3.9 Data analysis

The data were captured on forms (questionnaires), and all forms were screened, cross-checked and packaged for further processing and safe keeping. The collected information was entered into the SPSS version 20, screened again before analyses were done. Both Excel and SPSS version 20 were used for data analyses. Demographic

characteristics of the study subjects that has to do with distribution of health facilities, deliveries in health facilities, functional temperature monitoring device and vaccines availability were tabulated and analysed. Descriptive statistics for continuous variables such as mean, standard deviation, and range, and for categorical variables the numbers and percentages were calculated. A total forty two questions were used to assess subjects that took part in the study. A score of 1(one) point was given for each correct response given by respondents, and 2(two) for each incorrect response. The total of the points gained by each respondent was obtained and converted into percentages that were displayed in tables and graphs in the results.

3.10 Ethical consideration

Approval of the study was sought from the University of Rwanda and ethical clearance obtained from Ethics Committee in Sierra Leone. Permission to perform the study in the selected health facilities was obtained from the authorities of these facilities. All respondents gave their consent by signing a written informed consents before participating in the study. All data obtained in this study was kept confidential and used only for the purpose of this study.

CHAPTER FOUR

4.0 Results

4.1 Health facility information

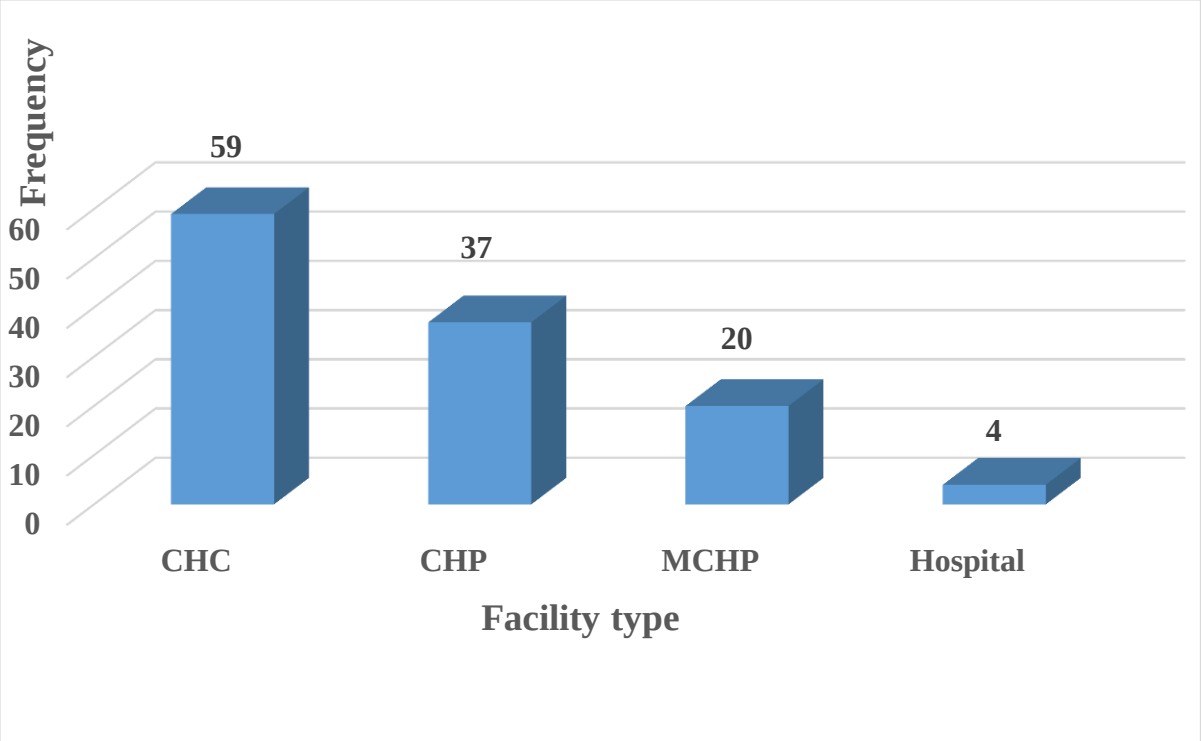
List of Tables

Table 4. 2 Distribution of health facilities selected for study by Districts

No.	Districts	Frequency	Percentage
1	Bo	10	8.3
2	Bombali	10	8.3
3	Bonthe	6	5.0
4	Kailahun	8	6.7
5	Kambia	6	5.0
6	Kenema	10	8.3
7	Koinadugu	6	5.0
8	Kono	8	6.7
9	Moyamba	10	8.3
10	Port Loko	11	9.2
11	Pujehun	7	5.8
12	Tonkolili	8	6.7
13	Western Area Rural	10	8.3
14	Western Area Urban	10	8.3
	Total	120	100.0

A total of 120 health facilities were assessed in this study – 11(9.20%) from Port Loko district, 10(8.30%) from Bo district, 8(6.70%) from Tonkolili district, Pujehun 7(5.8) and 6(5.00%) from Koinadugu district (Table 4.1).

Figure 4.1 Distributions of Health Facilities by Types at district level



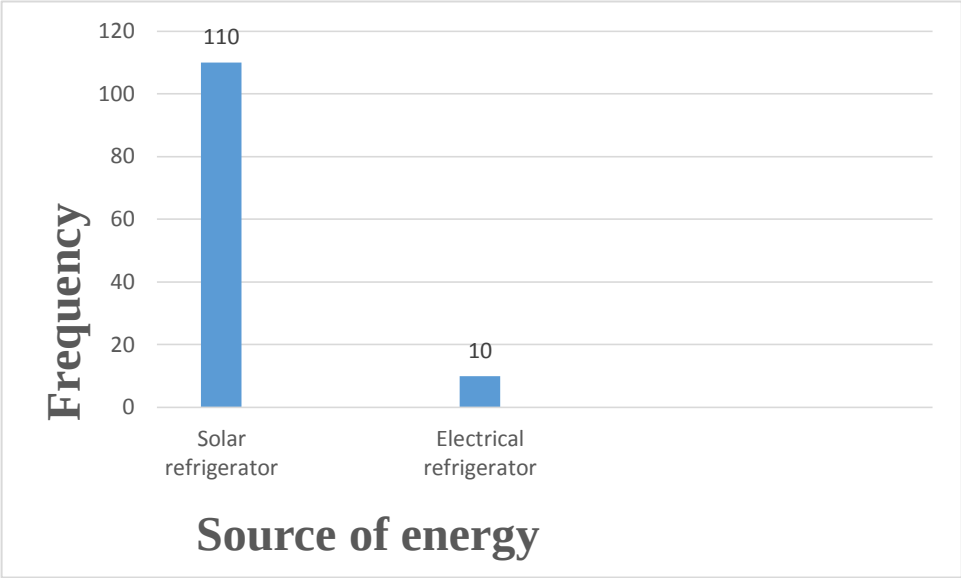
CHC=Community Health Centre; CHP=Community Health Post; and MCHP=Maternal & Child Health Post

With regards to the types of facilities assessed, results revealed that 59(49.20%) were Community Health Centres (CHC), 37(30.80%) were Community Health Posts (CHP), 20(16.70%) were Maternal and Child Health Posts (MCHP), while only 4(3.30%) were hospitals (Figure 4.1)

4.2 Assessment of vaccine storage facility

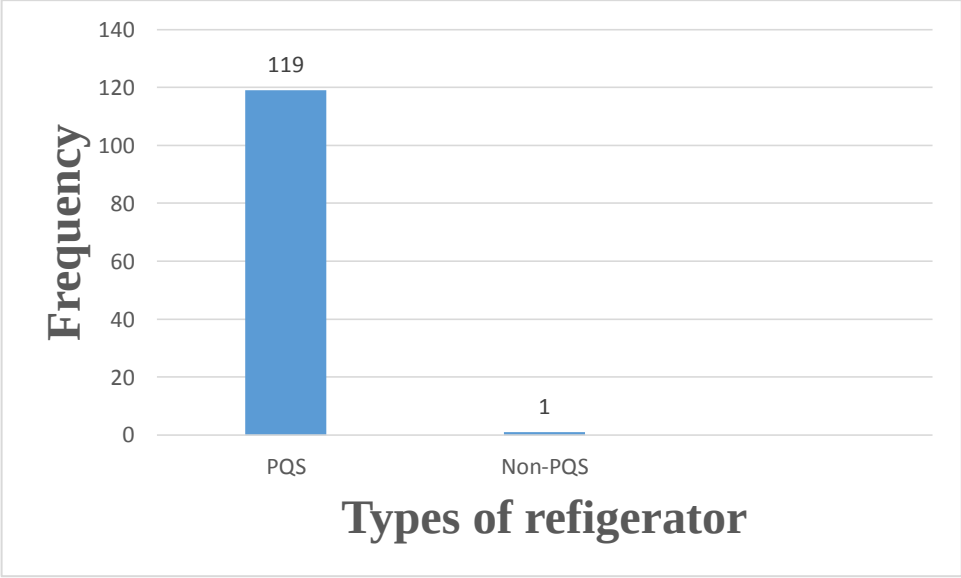
Out of a total of 120 respondents, results revealed 100.00% stores vaccines in their facilities at the time of assessment. Analysis shows that 100% respondents have ice packs in their refrigerators. With regards transportation, 100% of vaccines are transported using vaccine carriers or cold box lined with condition ice packs.

Figure 4.2 Source of energy for the different refrigerators in the health facilities



Analysis with regards source of energy revealed solar refrigerator to be 110 (91.70%) and electrical refrigerator10 (8.30%) (Figure 4.2).

Figure 4.3 Types of refrigerator in the different health facilities



PQS= Prequalify system, Non- Prequalify system

119(99.2%) respondents revealed that their refrigerators were World health Organisation Prequalify and 0.8% 0f respondents revealed that their refrigerators were non- World Health Organisation prequalify (Figure 4.3)

Table 4. 2 Quantities of vaccines available in health facilities

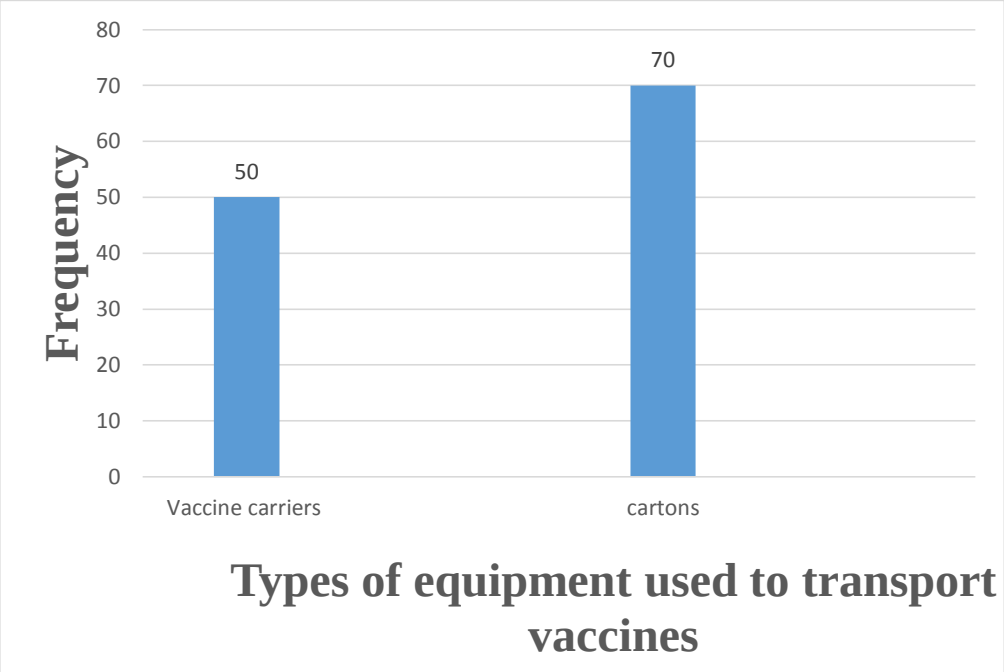
No.	Vaccine	Quantity				Quantity enough?	
		Minimum	Maximum	Mean	SD	Yes	No
1	BCG	0	5840	106.33	536.539	76(63.3%)	44(36.7%)
2	Penta	0	11090	285.58	1229.63	89(74.2%)	31(25.8%)
3	PCV-13	0	18956	357.63	2000.98	79(65.8%)	41(34.2%)
4	Rota	0	6000	151.43	697.23	60(50.0%)	60(50.0%)
5	IPV	0	7550	125.45	735.71	76(63.3%)	44(36.7%)
6	bOPV	0	6420	267.13	746.505	92(76.7%)	28(23.3%)
7	MR	0	23160	888.63	2439.71	105(87.5%)	15(12.5%)
8	Yellow Fever	0	3660	105.28	468.12	78(65.0%)	42(35.0%)
9	Td	0	7650	133.33	760.98	80(66.7%)	40(33.3%)

Analysis on vaccines availability at the different health facilities at the time assessment 76(63.3%) of the respondents revealed that BCG was enough for the month; 89(74.2%)) of the respondents revealed that Pentavalent vaccine was enough for the month; 79(65.8%) of respondents revealed that Pneumococcal conjugate-13 vaccines was enough for a month of stock. of the health facilities revealed that was enough for the month ; 60(50.0%) of the health facilities revealed that Rotarix vaccines was enough for the month ; 76(63.3%) of the health facilities revealed that Inactivated Polio vaccines was enough for the month ; 92(76.7%) of the health facilities revealed that bivalent Oral Polio vaccines was enough for the month ; 105(87.5%) of the health facilities revealed that Measles Rubella vaccines was enough for the; 78(65.0%) of the health facilities revealed that Yellow fever vaccines was enough for the month; 80(66.7%) of the health facilities revealed that Tetanus diphtheria vaccines was enough for the month and 42(35.0%) (Table 4.2)

4.3 Availability and storage of oxytocin

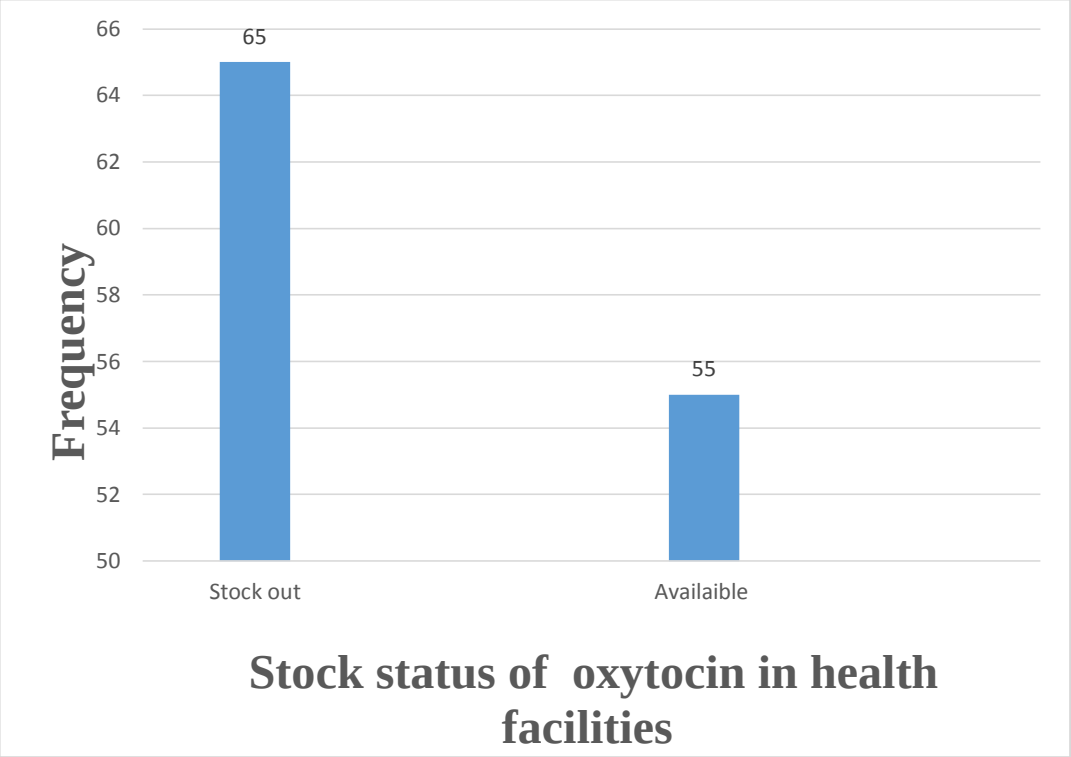
Regarding the availability and storage of oxytocin, 100.00% of respondents store oxytocin at the time of assessment.

Figure 4.4 Types of equipment used to transport oxytocin to the health facilities



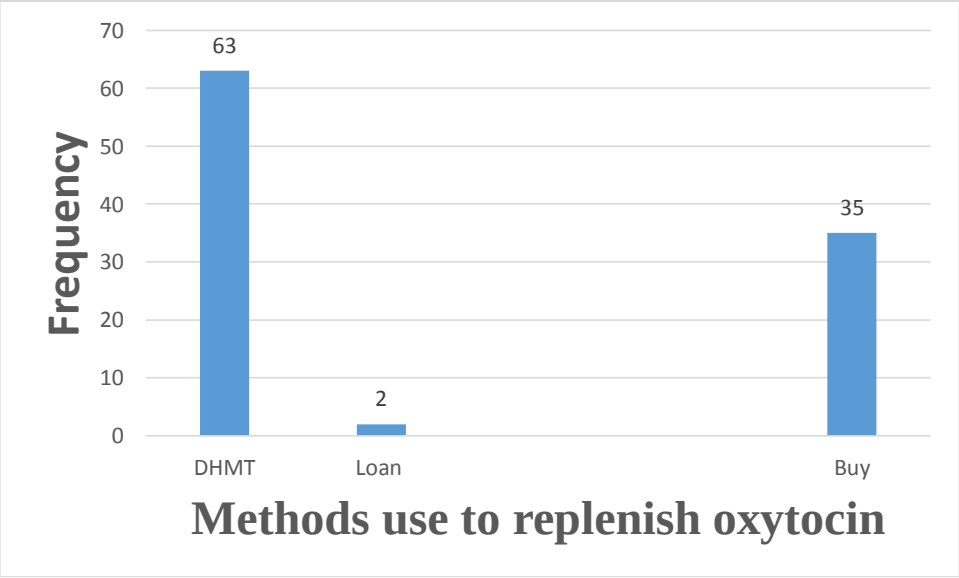
50(40.70%) of respondents revealed that they transport oxytocin using vaccine carriers and 70(58.3%) respondents revealed they transport oxytocin in cartons to their different health facilities (Figure 4.4).

Figure 4.5 Oxytocin distribution at health facility level



55(45.80%) respondents revealed that the quantity of oxytocin available is not enough for a month of stock and 65(54.20%) respondents revealed that they were stock out at the time of data collection. (Figure 4.5).

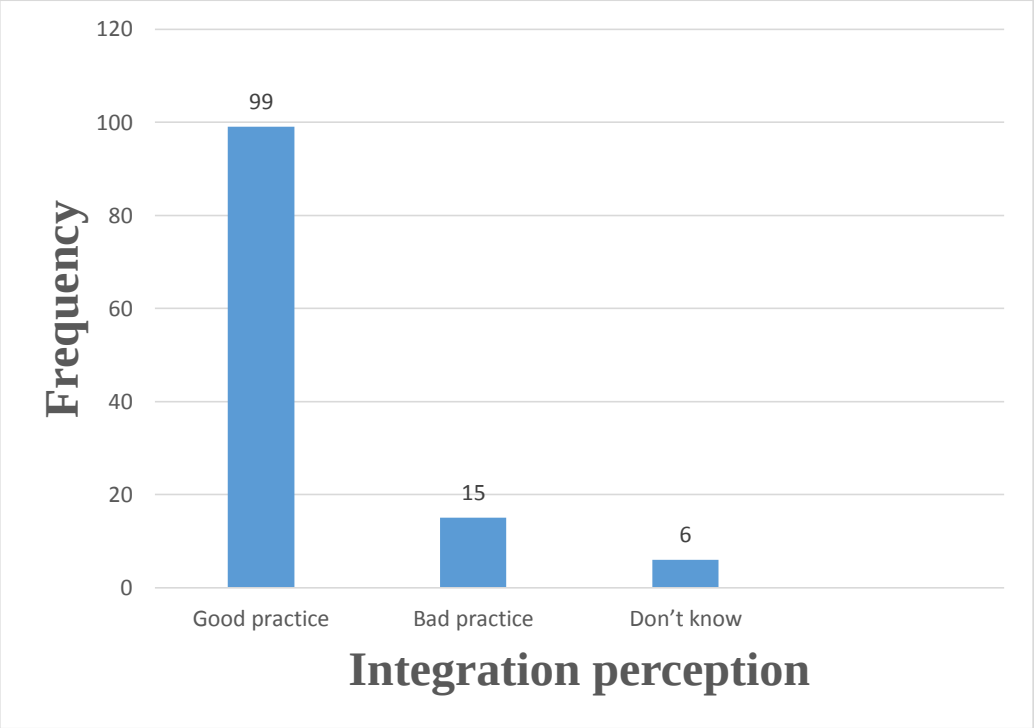
Figure 4.6 Replenishment of oxytocin at health facilities



63(52.50%) respondents revealed that requested from District Health Management Team and when they are stock out, 2(1.70%) loaned from other facilities when they are stock out and (35) 45.8% buy from pharmaceutical outlet when they are stock out (Figure 4.6).

4.4 Feasibility of integration

Figure 4.7 Respondents perception on integration of oxytocin and vaccines



Out of a total of 120 facilities assessed, respondents revealed that 99(82.50%) think storing oxytocin and vaccines together is a good practice, 15(12.50%) think storing both together is not a good practice, while 6(5.00%) said they don't known if it is a good practice (Figure 4.7).

With regards knowledge on integration results, respondents revealed that 31(25.80%) respondents have knowledge on integration and 89(74.20%) stated they lack knowledge on integration.

Data analysis on training revealed that 3(2.50%) of the respondents said they have been trained on integration and 117(97.50%) stated they have never received training on integration.

A total of 120 respondents revealed that there is no written guidelines or Standard Operating Procedure on oxytocin and vaccine integration available in their facilities.

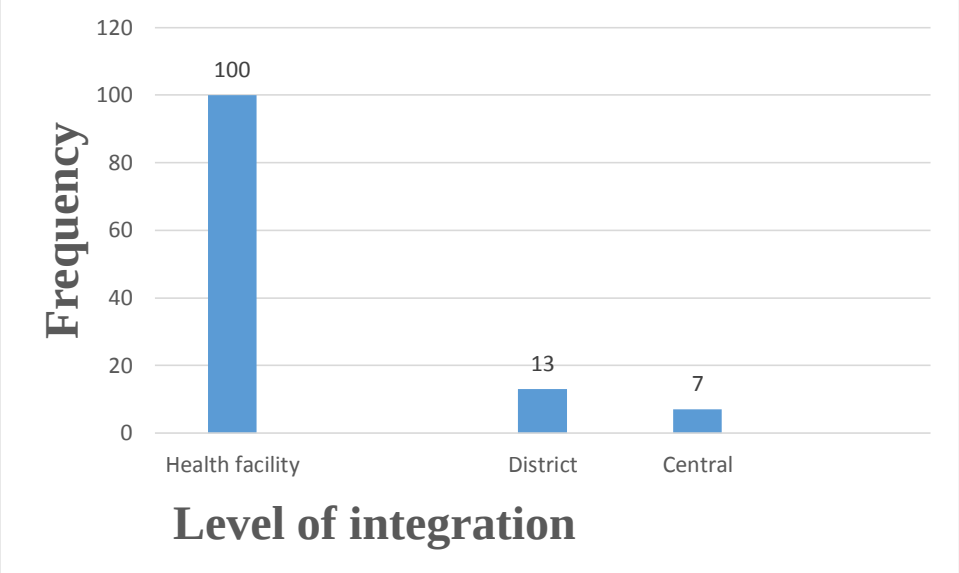
Results showed that out of 120 respondents, 104(86.70%) stores both oxytocin and vaccines together in the refrigerator and 16(13.30%) do not store oxytocin and vaccines together.

Results revealed that out of the 104(86.70%) respondents that stores vaccines and oxytocin in the refrigerator only (31)29.8% labelled their oxytocin and vaccines before storing while (73)70.2% does not label both products.

Results revealed that out of the 104(86.70%) who stores both vaccines and oxytocin together in the refrigerator only (30) 28.8% stacked them together while (74)71.2% stacked separately in the refrigerator.

Data analysis showed that out of the 16(13.30%) that do not store oxytocin in the refrigerator 2(1.70%) store oxytocin in cartons, 11(9.20%) store in cupboard and 3(2.50%) store on shelve.

Figure 4.8 Respondents perception at which level of integration



100 (83.40%) respondents supported integration at Health facility, 13(10.80%) respondents supported integration at district level and 7(5.80%) support integration at central level.

From a total of 120 facilities assessed, respondents revealed that 100(83.30%) stated that the available space in the refrigerators is enough to store both oxytocin and vaccines together while 20(16.70%) said their available capacity is not enough to store both together in the refrigerator (Figure 4.8).

CHAPTER: FIVE

5.0 Discussions

5.1 Summary of key finding

This study was designed to assess the feasibility of integrating oxytocin into vaccines supply chain in Sierra Leone. More than 59(49.20%) of these health facilities with refrigerators were Community Health Centres. Most of the facilities are catering for more than the required target population they are supposed to cover. It came out clear that most of the respondents at service delivery points are Maternal and Child Health Assistance. The study revealed more children are given birth to in remote communities and most died before they reached their one year birthday. Out of the 120 health facilities studied maximum of twenty (21) deaths were reported in the previous month and nine (9) of these deaths were due to postpartum haemorrhage. Report revealed that 100% of the facilities have functional refrigerator that are powered by solar and always transport vaccines using vaccines carriers, 99.20% of the health facilities reported stores vaccines and most of the facilities have enough quantity of vaccines that can last them for a month this showed that the supply pipeline is almost always full and does not allowed total stock out of these antigen. Reports showed that 119 (99.20%) stores oxytocin in their facilities but only 50 (41.70%) use cold boxes or vaccine carriers to transport oxytocin. 65(54.20%) reports showed stock out in most all of the health facilities visited. More than 99(82.50%) of respondents admitted that storing oxytocin and vaccines together is a good practice. Analysis of the knowledge on integration revealed 89(74.20%) respondents lack knowledge on integration. Report revealed that 104(86.70%) stored both products together but only 31(25.80%) label both products before storing in refrigerator. 95 (79.20%) respondent preferred integration at Health facility level. 100(83.30%) respondents admitted there is enough space in the refrigerators to store both oxytocin and vaccines together. Study revealed that only 30(25%) of respondents had special training in vaccines supply chain,117(97.50%) revealed they have never received any training on vaccines and oxytocin integration. 100% of the respondents admitted that there is no written guidelines or policy on integration and there is need for guidelines if integration is to be institutionalized.

5.2 Detailed discussions

The study shows 83.3% health facilities have enough capacity to store both vaccine and oxytocin using the same refrigerator. It can be deduced that the integration of both oxytocin and vaccine will not create any significant issues in storage facility, this is because there is an existing storage to store both products.

Also, the study shows that there was a positive perception among respondents 82.5% supported integration of oxytocin and vaccine in the supply chain system. This is similar to a study conducted in Tunisia and Senegal by project optimize on integrating the Supply chain of vaccines and other health commodities(Integrate & Chains, n.d.).

91.7% of the health facilities visited already had a well-established cold chain system that is powered by solar energy which will make the integration process smooth and cost effective since there is little or no cost on electricity.

The present study found that 86.7% of the HFs respondents stores vaccines and oxytocin together in the same refrigerator which is in support to the WHO/UNICEF joint statement on integration of temperature- sensitive health products particularly oxytocin into the EPI cold chain where safe and feasible(WHO/UNICEF, 2014).

The findings of this study shows that integration of oxytocin into vaccines supply chain in Sierra Leone will leverage opportunities for economies of scales and scope and promote Million Development Goals, which is in consistent with the study done by PATH Placing Oxytocin in the Immunization Cold Chain, which highlighted Global Alliance on Vaccines Immunization's interest on integrated approach to health will advance efforts to achieve the Million Development Goals(New, n.d.).

CHAPTER: SIX

6.0 Conclusion and recommendations

6.1 Conclusion

Regarding outcomes from the study, the following conclusions can be drawn;

The findings of this study shows that integration of oxytocin into vaccines supply chain in Sierra Leone will leverage opportunities for economies of scales and scope that is using the similar infrastructure like storage, transport, distribution and human resource to render both services

Efficiency enhancement will also fall in place due to the availability of potent oxytocin at service delivery points at a recommended temperature of +2 to +8 degree Celsius.

Training personnel's will removed knowledge gap or perception that oxytocin must not be stored in refrigerator at recommended temperature.

Despite all respondents knew that oxytocin must be store in the cold chain but significant quantities of oxytocin are transport outside the cold chain.

Despite most responds admitted that storing oxytocin and vaccines together is a good practice but most do not label before storing.

Stock out of oxytocin is still a problem faced by the health system.

There is no written policy or procedure on how to integrate Vaccines and oxytocin together.

6.2 Recommendations

With regards findings from the study conclusions, these are the following recommendations:

1. Make potent oxytocin available for use always in the health facility at +2 to +8 degree Celsius for the treatment and prevention of postpartum haemorrhage.
2. Always transport oxytocin in vaccine carriers or cold boxes to maintained temperature at +2 to +8 degree Celsius.
3. Always label both products before storing in the refrigerator to prevent medication error
4. Training of health workers on vaccines supply chain.
5. Trained health workers on oxytocin and vaccines integration.

6. Developed manuals or standard operating procedures for oxytocin and vaccines storage

Appendix

Appendix 1: Questionnaire

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE & HEALTH SCIENCES

EAC REGIONAL CENTRE OF EXCELLENCE FOR VACCINE, IMMUNIZATION & HEALTH SUPPLY CHAIN MANAGEMENT

MASTERS IN HEALTH SUPPLY CHAIN MANAGEMENT

FEASIBILITY OF INTEGRATING OXYTOCIN INTO VACCINE SUPPLY CHAIN IN SIERRA LEO

INVESTIGATOR:

Pharm. Joyce Mariama Kallon, a Masters Student at the University of Rwanda.

SUPERVISOR: Pharm. Joseph Sam Kanu, PhD, Lecturer, Department of Community Health

Questionnaire No…

SECTION A: Health Facility Information

District……. District Code …… Date ……

Facility Name …… Facility Code……. Facility Address._____

Facility Type: (1) CHC (2) CHP (3) MCHP (4) Hospital

SECTION A: Assessment of vaccine storage Status

1. Do you currently store vaccine in this facility? 1. Yes 2. No
2. Do you have a functional refrigerator in this facility?
   1. Yes 2. No
3. If yes, what type of refrigerator do you have in this facility?
   1. WHO prequalify 2.Non-WHO prequalify

4. What is the source of energy for the refrigerator?

1. Solar 2. Electricity 3. Kerosene 4. Others, specify……

5. How do you maintained the storage environment of vaccines from districts to health facility level?

1. Cold box 2. Vaccine carrier 3.Cartons

6. Quantity of vaccines available in the Health facility today

No.	**Vaccine**	**Quantity**	**Is this quantity enough for this month? 1. Yes 2. Yes**
1	BCG		
2	Penta		
3	PCV-13		
4	Rota		
5	IPV		
6	bOPV		
7	MR		
8	Yellow Fever		
9	Td		

SECTION E: Availability and Storage of oxytocin

1. Do you store oxytocin in this facility? 1. Yes 2. No

2. How do you maintained the storage environment of oxytocin from districts to health facility level?

1. Cold box 2. Vaccine carrier 3.Cartons

3. What can you say about the quantity of oxytocin available in the health facility level?

1. Adequate 2. Inadequate 3. Not available

SECTION F: Feasibility of Integration

1. Do you think storing oxytocin and vaccine stock together is a good practice?

1. Yes 2.No 3. I don't know

2. Have you been trained on how to store both together?

1. Pre-service 2. In-service 3. Others

3. Do you have any written procedure on how to integrate both oxytocin and vaccines?

1. SOP 2. Guidelines 3. Manuals

4. Do you store both vaccines and oxytocin together in the refrigerator?

1. Yes 2. No

5. Do you label both products before storing them?

1. Yes 2. No

6. At what point in the distribution system should oxytocin be integrated into the EPI cold chain?

1. Central 2. DHMT 3. Health facility 4. Others specify…… 5. I don't know

7. Do the existing storage facility have the capacity to store both vaccines and oxytocin together?

1. Adequate 2. Inadequate

Any other comment…….

Thank you very much for your timely responses!

Appendix 2: Informed consent form

INFORMED CONSENT

Title of Study: "FEASIBILITY OF INTEGRATING OXYTOCIN INTO VACCINES SUPPLY CHAIN IN SIERRA LEONE"

Supervisors: Dr Joseph Sam Kanu

Student Researcher: **Joyce Mariama Kallon**

I am asking for your voluntary participation in my research project. The study has been approved by the University of Rwanda College of Medicine and Health Sciences. Please read the following information about the project. If you would like to participate, please sign in the appropriate box below.

Purpose of the project:

This study aims to assess the feasibility of integrating vaccine supply chain with oxytocin supply chain in Sierra Leone.

If you participate:

The study will require you to answer to questions related to vaccines and oxytocin storage and knowledge of health workers on its storage.

Time required for participation:

The study will require about 15 to 30 minutes answering to the questions and observations.

Potential Risks of Study:

The study is purely observational and involves little or no direct health risk to participants involved.

Benefits:

There are no financial benefits to you by participating in this study. However, information obtained from this study could be used to make appropriate recommendations to the authority concerned.

How confidentiality will be maintained:

"Your identity in this study will be treated as confidential. The results of the study or any other data, may be published for scientific purposes but will not give your name or include any identifiable references to you."

"However, any records or data obtained as a result of your participation in this study may be inspected by the sponsor, by relevant Ministry of Health and Sanitation personnel in Sierra Leone, University of Rwanda or by the person conducting this study. These records will be kept private as best as possible."

If you have any questions about this study, feel free to contact:

Supervisor: Dr Joseph Sam Kanu: Phone: +23276656781; email: samjokanu@yahoomail.com and Joyce M. Kallon +23278186423; email: joycewonderansu@gmail.com

Voluntary Participation:

Participation in this study is completely voluntary. If you decide not to participate there will not be any negative consequences. Please be aware that if you decide to participate, you may stop participating at any time and you may decide not to answer any specific question.

By signing this form, I am attesting that I have read and understand the information above and I freely give my consent/assent to participate.

Name: **Sig**: **Date**: 2019/__/__

Appendix 3: Ethical approval clearance

Department of Community Health
Faculty of Clinical Sciences
College of Medicine and Allied Health Sciences
University of Sierra Leone
Fourah Bay College Campus
Freetown

26th June, 2019

The Chairman
Sierra Leone Ethics and Scientific Committee
Youyi Building
Freetown

Dear Sir,

SUPERVISION OF MASTERS STUDENTS (JATU JOSEPHINE ABDULAI JOYCE MARIAMA KALLON

With reference to the above, I write to inform you the **Jatu Josephine Abdulai And Joyce Mariama Kallon** are Masters students at the University of Rwanda studying **Health Supply Chain Management.** They are using a blended learning approach: online and face to face lectures to do their Masters course. As requirement, they are required to have a Supervisor in Sierra Leone who is a Lecturer in a recognised related University in Sierra Leone. As an Associate Lecturer at the College of Medicine and Allied Health Sciences, University of Sierra Leone, I consented to supervise both students in order to improve the human resource capacity for health in the country. Recently, I was in Rwanda to attend a Research Workshop for Master Students, organised for both students and their Supervisors. The workshop clearly highlighted what is expected of both students and their Supervisors. In the workshop, both students successfully defended their research proposals. Their dissertation topics have been approved by the University of Rwanda, but they are required to obtain ethical approval of their studies in Sierra Leone before their dissertations can be accepted by the University.
Details of these students are summarized below:

NAME	STUDENT ID	TOPIC
Jatu Josephine Abdulai	**218014666**	**HEALTH SUPPLY CHAIN PERFORMANCE IN EMERGENCIES IN SIERRA LEONE.**
Joyce Mariama Kallon	**218014668**	**INTEGRATION OF VACCINE SUPPLY CHAIN WITH OTHER HEALTH SUPPLY CHAIN IN SIERRA LEONE (CASE STUDY WITH OXYTOCIN).**

Please contact me if you require further clarification on this issue.

I count on your usual cooperation.

Kind regards,

26/06/2019

Joseph Sam Kanu (Ph.D)
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