



UNIVERSITY of
RWANDA

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

***HEALTH SUPPLY CHAIN PERFORMANCE IN EMERGENCIES 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

Jatu Josephine Abdulai (B. Pharm.)

Reg Nr: 218014666

*Faculty of Public Health, School of EAC Regional Centre of Excellence for Vaccines ,
Immunization and Health Supply Chain Management, College of Medicine and Health
Sciences, National University of Rwanda.*

Supervisors:

Dr. Joseph Sam Kanu

Academic year 2018-2019

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.

.....

Student Name and Number

Signature

Date.....

.....

Main Supervisor's Name

Signature.....

Date.....

ACKNOWLEDGEMENTS

I would like to thank Dr. Joseph Sam Kanu, my supervisor for his contribution to this dissertation. I appreciate your time shared and guidance during this process. It was a long road but very educative filled with patience and attention to detail.

To the University of Rwanda team, Professor Claver Kayumba, Jean D'Amour Habagusenga , Joseph Lune Ngezi, and Regis Hitimana, many thanks for the unrelenting support throughout this process.

Many thanks and appreciation to Mr. Maurice Juma, Warehousing and logistics consultant for his extensive support, professional discussions, advice, assistance, and commitment to this process.

To my classmates for their motivation in all things: Pioneers of Health Supply Chain Management class and especially my Sierra Leonean colleague Joyce- for all the traveling, discussions and struggle to finish the race.

Dr Brima Kargbo, I would like to thank you for giving me this opportunity. Will ever remain grateful.

To Mr. Cyrus V.Sheriff, who stood by me and made this happen when I could so easily have given up. Thank you from the bottom of my heart.

Special thanks to my brother Mr. Jongoi Abdulai and My loving daughter Miss Melanie Davies for putting up with my late hours.

I wish to profoundly thank my mum and dad, Mr. and Mrs. Michael Abdulai for their unrelenting support during the entire course. You are truly an inspiration to me. Thank you for giving me the peace of mind I needed to finish the race.

Lastly and certainly not the least, Thank you God Almighty for making this dream achievable. I give YOU all the praise and thanks. It all belongs to YOU.

ABSTRACT

Background: Public Health emergencies are of serious concern to health systems globally. It is very important that preparedness ahead of time is adequate and capable of addressing urgent needs.

As health emergencies are unpredictable, they may occur at any time and with grave consequences. It is therefore of great importance that the supply chain is robust enough and logistically ready to manage commodity movement in an efficient and timely manner. Sierra Leone was affected by the ebola virus in 2014, it was a point of reflection at the health care system and several weak points were identified. Amongst these were weak supply chain management structures. Managing supply chains particularly sourcing, financing, planning and delivering products in a rapidly changing environment requires agile and flexible approaches and coordination.

Objectives: This study was designed to assess the status of the public health supply chain in Sierra Leone and to investigate the performance of the supply chain during the ebola crisis. Lastly to ascertain the level of preparedness of the supply chain in the eventuality of an emergency.

Methods: A cross-sectional study design was used to obtain participants' information with a structured questionnaire. The questionnaire was divided into four sub section collecting information on personal information of respondents, assessment of storage facilities, experience in supply chain and preparedness for future emergencies. Data collection was done for two months to all district level supply chain staff and selected central level staff. The data was analyzed and results generated. The presentation of results was done using charts, tables, and figures.

Results: The study included 55 respondents at the district and central level. Most respondents, 44 (80%) work at district level, whilst 11 (20%) work at central level operations. The study revealed that 11(20%) of the respondents were District Pharmacists, District Information officers, and District Storekeepers respectively were 8 (14.5%) each and District Hospital Pharmacists that responded had a total of 9(16.4%). Assessment of the current storage conditions showed that 42 (76.4%) of respondents stated that storage space was available but inadequate whilst 13 (23.6%) of respondents stated that that storage was available and adequate. The study revealed several limitations for the improvement of supply chain systems in Sierra Leone. They included: Inadequate number of staff: 32(58.2%) of respondents stated that this is a limitation whilst 23(41.8%) did not think this was a limiting factor in supply chain systems. Secondly, 45(81.8%) of respondents noted that lack of handling equipment is a limiting factor whilst, 10(18.2%) noted that this was not a limiting factor. Respondents were asked to indicate factors that represent

improvements to supply chain systems at their levels. The following were listed as opportunities: Availability of more qualified staff, 39(70.9%) stated that this was an opportunity whilst 16(29.1%) didn't hold this view for operations at their level. Forty-four -44 (80%) respondents revealed that the need for integration of supply chain management activities was an opportunity at their level whilst 11(20%) did not hold that view. Based on the data collected, it revealed that 22(40%) respondents had been actively involved in at least one emergency, 12(21.8%) had been actively involved in at least two emergencies whilst 11(20%) have not worked in any emergencies. This section investigated the level of preparedness of supply chain units at district and central levels. Forty eight-48(87.3%) respondents revealed that storage space was available but inadequate in the eventuality of an emergency, 4(7.3%) noted that space was available and adequate whilst 2(3.6%) noted that storage space is not available. To the question, do you currently have an emergency plan at your level: the following data was captured, 30(55.6%) respondents stated that an emergency plan was available at their level whilst 25(44.4%) stated that they were not in possession of an emergency plan.

Conclusion: The current supply chain is faced with numerous challenges including inadequate storage infrastructure, non-uniform inventory management systems across health facilities, inadequate staff and training capacity gaps, non-uniform distribution of Emergency protocol documents. However most respondents stated that the supply chain performance during the ebola crisis was good. The level of preparedness as informed by the research does not reveal a steady progression as expected after the ebola outbreak.

Warehouse improvement plans including staff capacity training, wider dissemination, and training on the Emergency protocols are recommended to improve preparedness plans.

Keywords: Emergency, Supply Chain, Preparedness, Performance

Table of Contents

DECLARATION	ii
ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
List of Tables	x
LIST OF SYMBOLS AND ACRONYMS	xi
Introduction	1
1.1.1. General Overview.....	1
1.1.2 Problem statement and significance of the study	2
1.2 Aim.....	3
1.3 Objectives.....	3
Literature Review.....	4
2.1 General Overview	4
2.1.1 Current State Assessment of Supply Chain.....	5
Methodology.....	7
3.3. Methodology	7
3.3.1 Study location and target population	7
3.3.2 Study design and data collection	7
3.3.3 Sample size determination.....	7
3.3.4 Sample procedure	8
3.3.5 Inclusion and exclusion criteria	8
3.3.6 Inclusion criteria	8
3.3.7 Exclusion criteria.....	8
3.3.8 Data collection.....	8
3.3.9 Ethical Approval.....	8
3.3.11 Statistical analysis.....	8
RESULTS	10
4.1 Personal information of respondent	10
4.2 SECTION B: Assessment of storage facility	15
4.3 Section C: Experience in Emergency.....	28
4.4 Section D: Preparedness for future emergency/outbreak.....	33
DISCUSSION	38
5.1 Summary of Key Findings	38
5.2 Detailed discussions	39
5.2.1 Current Supply chain Status.....	39

5.2.2 Performance of Supply chain during the ebola crisis	40
5.2.3 Emergency Preparedness	40
5.3 Limitations of the study.....	41
CONCLUSIONS AND RECOMMENDATIONS	42
6.1 Conclusions	42
6.2 Recommendations	43
APPENDIX.....	44
Appendix 1: Questionnaire.....	44
Appendix 2: Informed Consent Form	47
Appendix 3: Ethical Clearance Approval.....	49
References.....	50

List of Figures

Figure 1 : Distribution of respondents by Gender	Error! Bookmark not defined.
Figure 2: Age distribution of respondents	10
Figure 3: Educational level of respondents.....	11
Figure 4: Level of operations of respondents	12
Figure 5: Designation of Respondents	13
Figure 6: Respondents and special training in supply chain.....	14
Figure 7: Availability of storage space	15
Figure 8 : Availability of shelves.....	15
Figure 9 :Availability of pallets	16
Figure 10 : Availability of LMIS Tools	16
Figure 11 : Availability of Standby vehicle.....	17
Figure 12: Availability of paid staff.....	17
Figure 13: Availability of Auxiliary staff	18
Figure 14 : Availability of guidance document	18
Figure 15 : Availability of inventory management system in the warehouses	19
Figure 16 : Type of inventory control system used in the warehouses.....	19
Figure 17: Inadequate number of staff in supply chain management as a limitation to improvements on supply chain systems.....	21
Figure 18: Available equipment as a limitation to improvements in supply chain systems	21
Figure 19 : Lack of Management support as a limitation to improvements on supply chain systems	22
Figure 20 : Parallel systems of supply chain as a limitation to improvements on supply chain systems	22
Figure 21: Required qualifications in Supply chain as a limitation to improvements on supply chain systems	23
Figure 22: Push versus Pull system factor as a limitation to improvements on supply chain systems	23
Figure 23 : Availability of funds as a limitation to improvements on supply chain systems	24
Figure 24 : Large number of stakeholders in Supply chain as a limitation to improvements on supply chain systems.	24
Figure 25: Large number of stakeholders in Supply chain as a limitation to improvements on supply chain systems.	25
Figure 26: Need for integration of supply chain management activities as an opportunity for improvement of supply chain systems.	26
Figure 27: Introduction of short courses in supply chain management as an opportunity for improvement of supply chain systems.	26
Figure 28 : Large number of Stakeholders/partners involved in supply chain management as an opportunity for improvement of supply chain systems	27
Figure 29 : Supply chain officer in an emergency.	28
Figure 30: Number of Emergencies respondents have been active in.	29
Figure 31: Performance of Supply Chain in Emergencies	30
Figure 32 : Efficient movement of commodities in the Supply Chain.	30
Figure 33 : Efficiency of Information Flow	31
Figure 34 : Availability of an Emergency Plan	31
Figure 35 : Assessment of Storage Space	33

Figure 36 : Assessment of Buffer commodities	33
Figure 37 : Assessment of Staffing Capacity	34
Figure 38 : Assessment of Stand by Vehicle Availability	34
Figure 39: Assessment of Support from Higher Level	35
Figure 40 : Assessment of Support from Supervisors	35
Figure 41: Assessment on Information Sharing within the Supply Chain	36
Figure 42 : Assessment of Available Equipment	36
Figure 43 : Assessment of General Management Capacity	37
Figure 44 : Availability of an Emergency Plan at facility level.	37

LIST OF TABLES

Table 1 : Cadre of Respondents	11
Table 2 : Years of Employment of respondents	12
Table 3: Years of Experience of Respondents	13
Table 4 : Special Supply Chain Training taken by respondents	14
Table 5 : Partners supporting Supply Chain Activities in Various Districts	20

LIST OF SYMBOLS AND ACRONYMS

Acronyms	Meaning
DRC	Democratic Republic of Congo
ESC	Emergency Supply Chain
LMIS	Logistics Management Information System
MoHS	Ministry of Health and Sanitation
NGO	Non-governmental Organisation
SPSS	Statistical Package for the Social Sciences
UNICEF	United Nations Children's Fund
USAID	United States Agency For International Development
WHO	World Health Organization

CHAPTER :1

Introduction

1.1.1. General Overview

According to USAID, an Emergency supply chain preparedness is defined as ‘an established system developed ahead of an emergency that is able to manage all commodities necessary to respond to an outbreak and ensure that they get to the point of care as efficiently as possible’ (USAID, 2018). Since future public health emergencies are unpredictable but inevitable, it is crucial that we gather enough information on important lessons learned from previous emergencies in preparation for the next crises. (VanVactor, 2012) As Louis Pasteur put it, “chance or fortune favors the prepared”.

In the article titled “Supply Chain lessons for the next public Health Emergency”, details the most recent emergency in the Democratic Republic of Congo (DRC) where there is another Ebola outbreak, well documented. Since the DRC and WHO were well prepared and given the experience with Ebola in the DRC, responders were able to put in place response plans that were adequate. (Supply Chain Disaster Preparedness Manual). In their preparedness plan, Logistics was a key focus which also gives the due level of importance in the emergency processes.

The agility of supply chains and a harmonized way of responding to emergencies have to be planned across different levels and with different actors both in the private and public sectors if an efficient process has to be delivered. (Health, Chain, Assistance, & Task, 2018).

In almost all emergencies, the early periods get the most attention and as the situation stabilizes, attention is shifted elsewhere. It is important to acknowledge the changing needs of the community during this process and respond to these needs until the status of the emergency transitions into a recovery phase.

One big factor is ensuring there is always access to high – quality health supplies. In this light, how do we ensure that the private sector manufacturers are also stakeholders in the process but not just profit-seeking entities that drive up prices and sometimes compromise quality when demand is high? (D. Vanvactor, 2016).

The UNICEF’s Health supply chains in an Ebola context: Assessment and Risk Mitigation, though a working draft, details the importance of countries that haven’t been affected by the Ebola virus to put in contingency plans to ensure that there is a rapid response to emergencies (Jones, 2015).

Sierra Leone was ravaged by an Ebola outbreak in 2014 together with neighboring countries – Guinea and Liberia. The ebola virus was never thought to be endemic in Western Africa, but as with all emergencies, it was unpredictable and it hit the countries hard. Sierra Leone lost over 4,000

lives to this outbreak. While the outbreak is over five years down the line, the effects still ripple in the souls of the locals.

Albeit its negative effects, it painted a clear picture of the gaps within the health system and its poor efficiencies. The health system was not able to respond accurately to the community needs and this effect spiraled into the supply chain. With weak reporting and data collection systems that couldn't trigger stock shortages at various levels, poor distribution channels and low stock of needed commodities at the national level to ensure that reorder levels were addressed, the supply system was in dilemma.

Due to the lack of cohesiveness and coordination, donor partners took over the supply chain initially with a direct bypass of the central level to render support to the communities and health facilities. This presented a system that was not coordinated enough to know where the gaps were and which facilities had more than enough stock that could be used elsewhere. There was in short no visibility across levels. Procurements in the country were expensive due to the demand and sourcing internationally had long timelines.(Project & USAID Deliver Project, 2011)

Most recently, Sierra Leone experienced an unexpected natural disaster – flooding and Mudslide in August 2017 that claimed the lives of over 400 people. This time around, the overall response to this disaster was swifter than the ebola epidemic. This was due to the systems that had been put in place to anticipate such events.

Were lessons learned? Is there more we can do to ensure the supply chain activities are assessed, developed and improved for contingencies? Despite the importance of having an adequate supply chain system before and during emergencies, studies assessing health commodities supply chain systems in Sierra Leone have not been reported. Thus, we designed this study to assess health supply chain performance in emergencies in Sierra Leone. This study is therefore important to look at how effective was the supply chain during the Ebola epidemic and its contribution to the severity of the epidemic as against what measures have been taken after the Ebola epidemic to ensure that we have a robust supply chain system that is agile enough to meet the health care needs.

1.1.2 Problem statement and significance of the study

Emergencies are in most cases unpredictable but inevitable. Throughout the history of mankind, natural disasters and health emergencies continue to claim the precious lives of humans and cause serious morbidity. Preparedness before an emergency is very critical in minimizing the negatives consequences of an emergency. However, many developing countries cannot afford the huge cost

involved in emergency preparedness. Investment in supply chain management should be of top priority for every country.

The health supply chain system of Sierra Leone has been tested in several emergencies – the brutal civil war, the Ebola outbreak, and most recently the mudslide and flooding. In all these emergencies, the resilience of our supply chain for health commodities and lessons learned have not been assessed. These assessments are urgently needed so that Sierra Leone can better prepare for the inevitable next emergency. This study will assess the health supply chain performance in emergencies in Sierra Leone. Data from this study will better inform the country of our state of preparedness for any emergency.

1.2 Aim

The main aim of this study to assess the health supply chain performance in emergencies in Sierra Leone.

1.3 Objectives

The objectives of this study include the following:

- To assess the status of the health supply chain system in Sierra Leone
- To investigate the performance of the health supply chain system of Sierra Leone during the Ebola outbreak
- To investigate the level of preparedness of the health supply chain in Sierra Leone.
- To proffer solutions based on our findings

CHAPTER :2

Literature Review

2.1 General Overview

“Emergency Supply chain preparedness is defined as Developing a system prior to that of an emergency to ensure the efficient management of all health commodities, equipment that are required to respond to an outbreak and ensure that they are received at the point of care as efficiently as possible.” (Emergency supply chain and Medical countermeasure implementation in Sierra Leone, (2019).

Research has shown that the frequency and magnitude of disasters globally will increase, this by extension will require an efficient response system from supply chain actors (Shatzkin, 2018). This process is cumbersome requiring collaboration amongst different stakeholders. According to the USAID’s Best Practice in supply chain preparedness for Public Health emergencies, it highlighted the fact that being prepared and investing in the process prior to the anticipation of an emergency, may significantly improve the outcomes for vulnerable populations when an emergency does occur. However, it was noted that a good response to emergencies requires that the routine supply chain functions at an optimal level so that when challenged by emergencies, they can withstand the demands. It was also discussed in this report that some of the huge challenges in emergencies include lack of visibility and the multiple stakeholder involvement that needs a very high level of coordination.(Skryabina, Reedy, Amlôt, Jaye, & Riley, 2017)

This report recommends that a One Health approach (includes humans, animals and the environment) be used in disease preparedness and response. A model of important aspect to be considered during the preparedness phase included: touching on governance structures, mapping of stakeholders, stock management, finance, personnel, emergency guidance document. (Aronovich, Dana, MarieTien, Ethan Collins, Adriano Sommerlatte, 2010) Practical steps towards beefing up preparedness plans include: Stakeholder mapping ahead of time of all supply chain partners to understand clearly their roles and responsibilities, Different institutions within the government that might deal with the emergencies should be identified with roles and responsibilities note down- they might include local institutions, NGOs, international organisations, etc.(VanVactor, 2012) According to a case study conducted in the Philippines, the government was able to map out stakeholders and established a coordinating mechanism that brought all stakeholders together to give meaningful input in the preparedness process. This meant that as a country they were better able to identify existing opportunities and leverage on them to improve response of future emergencies.

2.1.1 Current State Assessment of Supply Chain

As defined by USAID (Best practices in supply chain preparedness for public health emergencies, January 2018), current state capability assessment of the supply chain will help the country understand their baseline of operations in terms of both routine supply chain capabilities and emergency supply chain capabilities. This will ensure that the weakened areas of the supply chain are prioritized and partner support/capacity can be leveraged to address these issues. Governance structures set up to understand the tiers within the health structure is also important to look at. Supply chain units must be guided on procedures and timeliness of activities. Financing was also discussed in the report as a key factor in supporting emergency supply chains. It should be clear where monies are sourced and what the procedures to access and disbursement are. Two funds should be established, the preparedness ESC budget and the response reserve fund.(Health et al., 2018)

Personnel training and readiness- Key component to the success of the ESC is the adequate staff knowledge on what to do and when training should help increase their understanding of ESC operations and help build capacity. Simulations were also recommended for weak points identification and areas for improvements. (“HPRT_final-e-clearance_Disaster-Preparedness-Manual-PCO-Cleared_April-27,” n.d.)

Emergency protocols- According to the report, there should be a document that states what triggers the activation of the ESC to ensure that the country moves from routine protocols to emergency protocols. (Session, 2019) It was highlighted that protocols of both routine and ESC procedures should be drawn up. This ensures that there is an understanding of how routine services will interface with emergency services.

The ESC protocols govern the readiness in the eventuality of an emergency and how to manage what would be done during an emergency.

Protocols should cater for the different levels of operations to endure that they are more detailed and practical.

Warehousing and storage are necessary to be in preparedness to manage commodities during an emergency. Storage infrastructure is key for sufficient warehousing to store the volumes and quantities of the expanded list during emergencies. With storage practices, the Logistics Management Information System (LMIS) should be running efficiently so that stock visibility is increased across all levels. However, these systems must be working during routine SC to be used during ESC. (Hale & Moberg, 2005)

According to Acurity Inc, 2018, the supply chain is essential in the provision of care. It is therefore of extreme importance that supply chain professionals are ready to address emergencies as and when they arise. The article helps to understand the relevance of the emergency preparedness plans and the contents of the plan. It states that the plan should look at past emergencies and incorporate training for those that would be involved in the next emergency. It ensures that all units are aware of what is to be done and how resources would be allocated.

According to the article Supply chain lessons for the next public health emergency, 2019 it stated the need for readiness of supply chain systems using the ebola outbreak in the Democratic Republic of Congo as an example.

It stated that due to the fact that the WHO and the country had been prepared in ensuring their emergency preparedness and response were efficient, it was easier to scale up when the need arose. Coordination was another strong point made referring to South Sudan. With collaboration with their partners, there was an arrangement to deliver Emergency Medicine Fund Kits that were distributed in all their states in a coordinated fashion. The article also discussed the need for continuous improvements in the supply chain so that routine systems are strengthened and robust enough for the extra strain that emergencies bring.

In the article, Emergency Management, there are four steps in managing an emergency, include Preparedness, response, recovery, mitigation. The planning phase of all emergencies start with Preparedness. This is the stage that all procedures and processes are made clear including the responsibility of persons.

CHAPTER :3

Methodology

3.3. Methodology

3.3.1 Study location and target population

The study was conducted in Sierra Leone, nationwide in all the sixteen districts. The study was carried out in the four regional levels of Sierra Leone: Western Area, Southern, Northern and Eastern regions.

The study targeted top management staff of health supply chain units at the Central level, district supply chain staff (District Pharmacists, Pharmacy Technicians, District Information Officers, and District Logistics Officers).

3.3.2 Study design and data collection

A mix methods study design was performed. Descriptive and review methods were used. This enabled the use of a structured questionnaire to collect data and a review of literature was conducted to get sufficient information for data analyses. A cross-sectional approach was also employed in this study.

The questionnaire comprises of four (4) sections: In the first section, personal information as related to supply chain experience and work were evaluated. In the second section, the assessment of storage facilities in relation to the effective management of commodities during emergencies was investigated. In the third section, experience in actual emergencies was looked at in relation to the performance of the supply chain. In the final section, preparedness for future emergencies was investigated. All supply chain staff at the District Medical Stores, Head of Units at the Central Medical Stores and Western Area Hospitals were given questionnaires. A week was given to them to fill out the questionnaires.

Data collection was done from July 26th to September 3rd, 2019.

3.3.3 Sample size determination

The sample size of the study was based on the number of key supply chain staff at the District level, central medical stores –selected staff dealing with warehousing and supplies activities and heads of supply chain units at public Western Area Hospitals. All respondents should be working in a government-owned facility. The questionnaire was thus distributed nationwide in all 16 districts in Sierra Leone.

Key supply chain staff at district level	16 districts x 4 = 64
Central Level , Western Area Hospitals	6
Central Level Personnel	3
Total number of Targeted respondents	73
Percentage response rate	75.3%

3.3.4 Sample procedure

A purposive sampling procedure was used targeting respondents that comprise supply chain units nationwide.

3.3.5 Inclusion and exclusion criteria

3.3.6 Inclusion criteria

Respondents/participants included in the study was based on the following criteria:

- Involvement in the health supply chain system
- Works in Public Health facilities
- Leadership roles in the health supply chain
- Gave written informed consent

3.3.7 Exclusion criteria

Respondents/participants will be excluded in the study based on the following criteria:

- Not working in the public sector health supply chain
- Failure to give written informed consent

3.3.8 Data collection

Data will be captured in this research using a structured questionnaire. The questionnaire will include sections on information about the health facility, knowledge on supply chain, and section on supply chain performance in emergencies.

Primary Source: Questionnaires, Interviews

Secondary Source: Articles, Books, Internet, journals

3.3.9 Ethical Approval

Approval of the study was sought from the University of Rwanda and ethical clearance obtained from the Ethics Committee in Sierra Leone. Permission to perform the study in the health facilities was obtained from the authorities of these facilities. All respondents signed a written informed consent form before participating in the study. All data obtained in this study was kept with confidentiality and used only for the purpose of this research.

3.3.11 Statistical analysis

All questionnaires were screened and arranged for further processing. Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) software version 20. Data from

the questionnaire were entered into the SPSS version 20 and screened before analyses were done. Tables, figures and graphs were used to present data. In all statistical analyses, *P*-values < 0.05 were considered statistically significant.

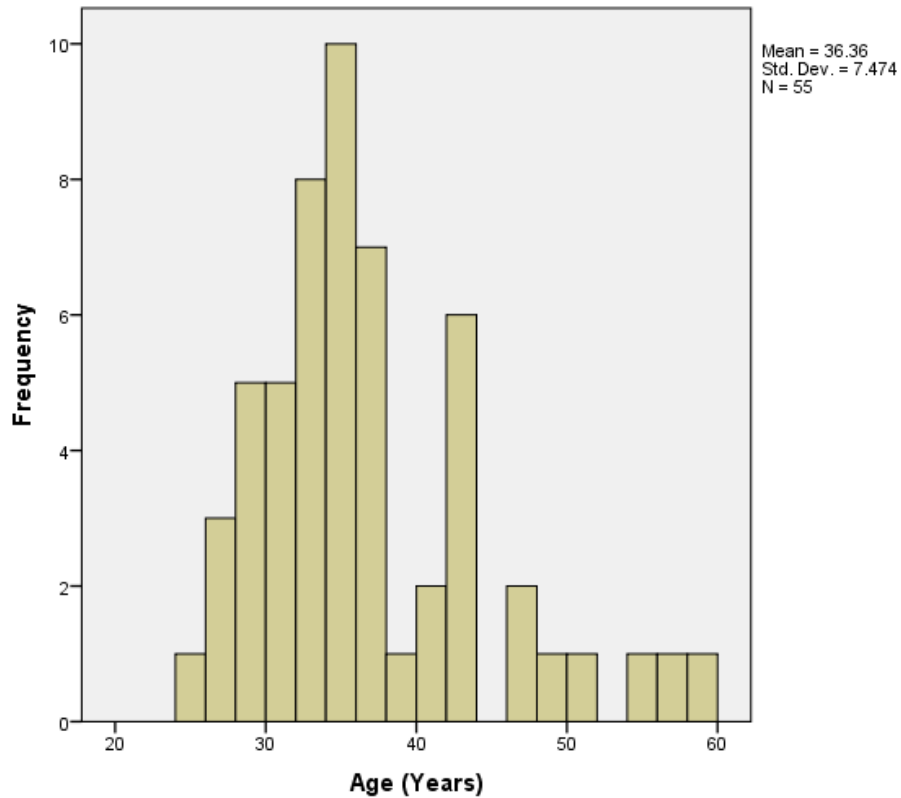
Microsoft Excel was also used to do analyses, Categorical variables are presented as frequencies and percentages. Continuous variables are presented as mean \pm standard deviation.

CHAPTER: 4

RESULTS

4.1 Personal information of respondent

The study included a total of 55 respondents – 51(92.7%) Males and 4(7.3%) Females.



Minimum age = 25 years, Maximum age = 58 years, Range = 33,
Median age = 35 years, Mean = 36.36 years and standard deviation = 7.47

Figure 1: Age distribution of respondents

Analysis of the age distribution of respondents revealed a minimum age of 25 years, maximum age of 58 years, range of 33, with a median age of 35 years, mean of 36.36 years and a standard deviation of 7.47 (Figure 4.2).

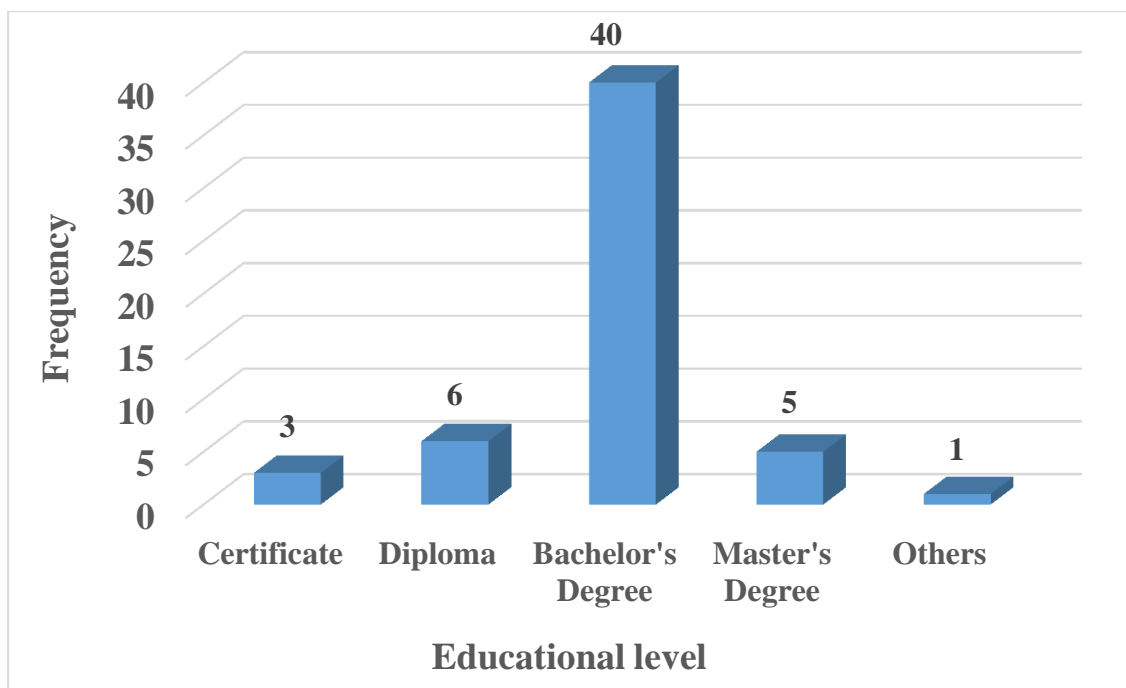


Figure 2: Educational level of respondents

Amongst the respondents, 40 (72.7%) had acquired a Bachelor's degree whilst 5 (9.1%) acquired a Master's degree (Figure 4.3). The study showed that 26 (47.3%) of the respondents were Pharmacists, 2(3.6%) were Pharmacy Technicians whilst 5 (9.1%) were Community Health Workers (Table 4.1).

Table 1: *Cadre of Respondents*

No.	Cadre of Respondents	Frequency	Percentage
1	Pharmacist	26	47.3
2	Pharmacy Technician	2	3.6
3	Community Health Officers	5	9.1
4	Others	22	40
5	Total	55	100.0

The study revealed that 11(20%) of the respondents were District Pharmacists, District Information officers, and District Storekeepers respectively were 8 (14.5%) each and District Hospital Pharmacists that responded had a total of 9(16.4%) (Figure 4.4)

Table 2: *Years of Employment of respondents*

No.	Years of Employment	Frequency	Percentage
1	1	7	12.7
2	2	3	5.5
3	3	3	5.5
4	4	5	9.1
5	5	8	14.5
6	6	8	14.5
7	7	3	5.5
8	8	9	16.4
9	9	2	3.6
11	11	1	1.8
12	12	3	5.5
13	18	1	1.8
14	20	1	1.8
15	35	1	1.8
16	Total	55	100.0

Investigation of years of employment revealed 14.5% each having worked for 5 years and 6 years respectively, 9 (16.4%) have worked for a total of 8 years. Minimum years of employment revealed 1 year with a maximum of 35 years, a mean of 6.56 years and a standard deviation of 5.50 (Table 4.2).

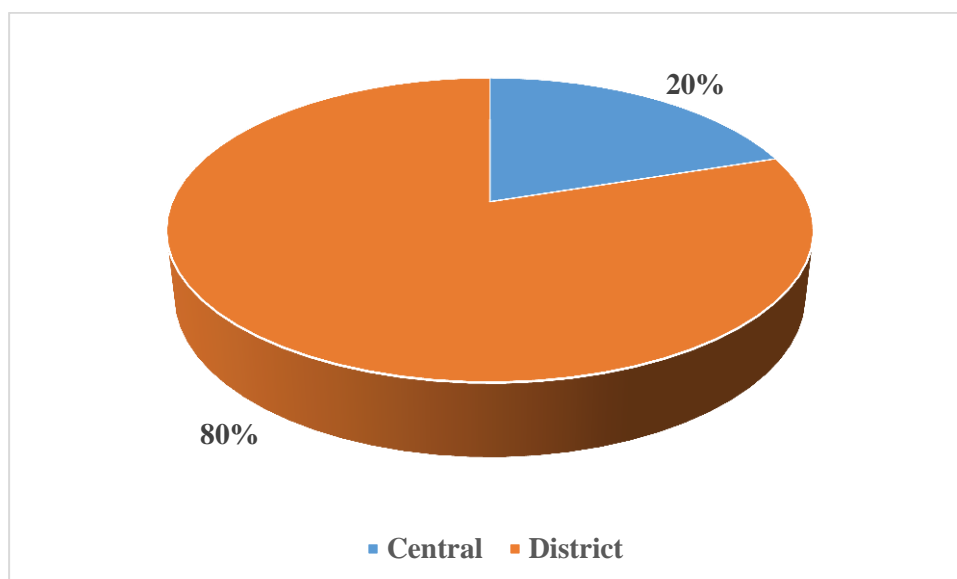


Figure 3: *Level of operations of respondents*

Most respondents, 44 (80%) work at the district level, whilst 11 (20%) work at central level operations (Figure 4.4).

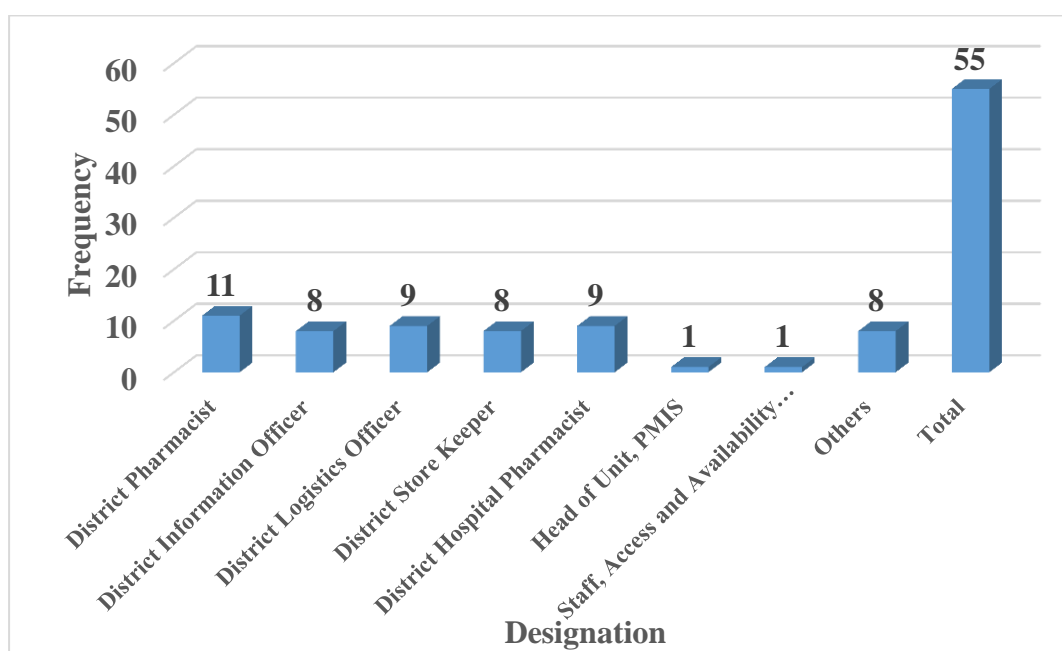


Figure 4: Designation of Respondent

Table 3: Years of Experience of Respondents

No.	No. of years of Experience	Frequency	Percentage
1	1	7	12.7%
2	2	3	5.5%
3	3	3	5.5%
4	4	5	9.1%
5	5	8	14.5%
6	6	8	14.5%
7	7	3	5.5%
8	8	9	16.4%
9	9	2	3.6%
11	11	1	1.8%
12	12	3	5.5%
13	18	1	1.8%
14	20	1	1.8%
15	35	1	1.8%
16	Total	55	100%

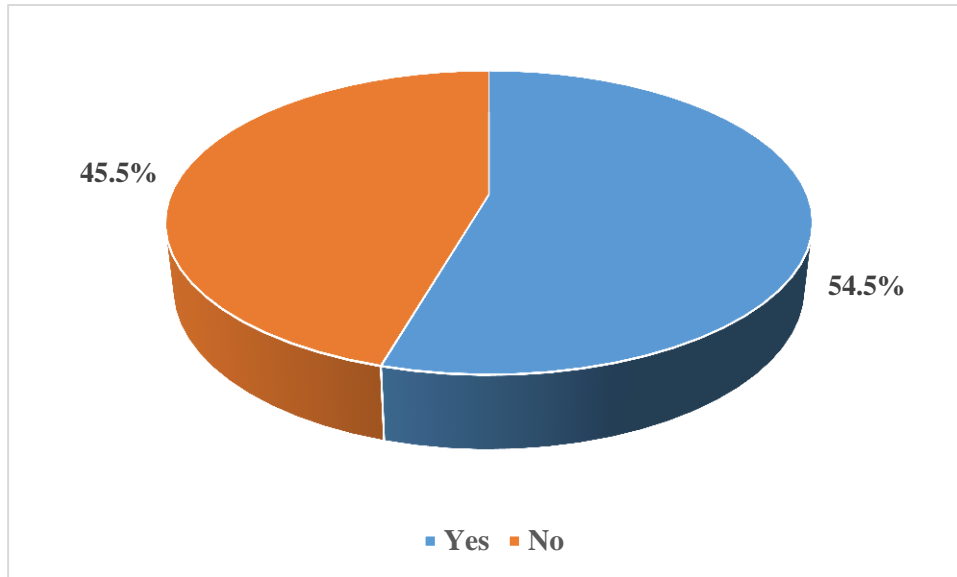


Figure 5: Respondents and special training in supply chain

Of the total number of respondents, 30 (54.50%) have had special training in Supply Chain whilst 25 (45.40%) haven't received any special training to Supply chain management (Figure 4.6).

Table 4: *Special Supply Chain Training taken by respondents*

No.	Special Training Components	Number Trained	Percentage
1	Logistics Management	24	36%
2	Information System	8	12%
3	mSupply Software	12	18%
4	Stores Management	12	18%
5	Logistics and Procurement Management	1	1%
6	Humanitarian Supply Chain Management	2	3%
7	Cold Chain Management	1	1%
8	Emergency Supply Chain	6	9%
9	Quantification	1	1%
10	DHIS-2 Software Training	67	100.0

Further investigation into the types of supply chain training attended revealed 24 (36%) having trained in Logistics Management Information System, whilst 12 (18 %) have been trained in Stores Management and Logistics and Procurement Management respectively (Table 4.4)

4.2 SECTION B: Assessment of storage facility

Assessment of the current storage conditions showed that:

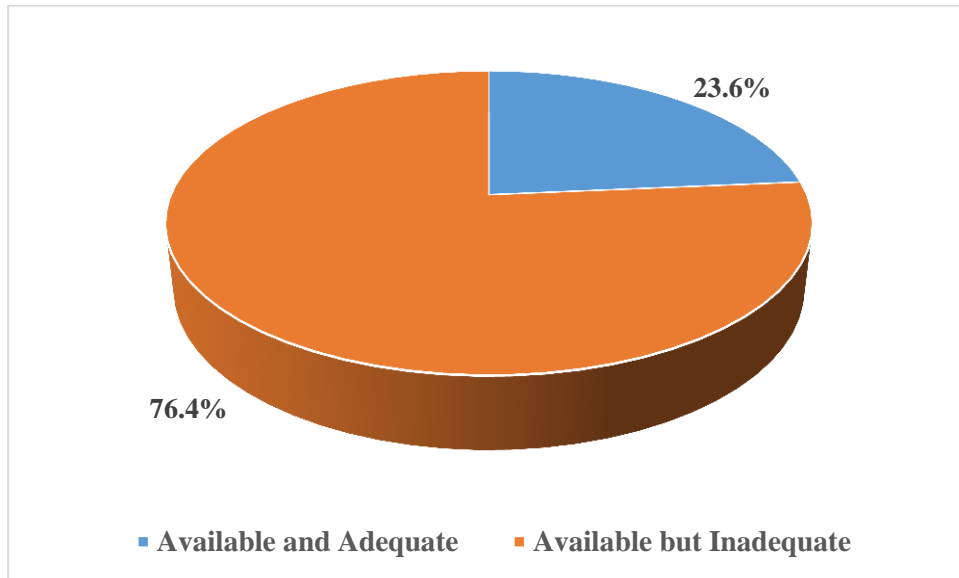


Figure 6: Availability of storage space

42 (76.4%) of respondents stated that storage space was available but inadequate whilst 13 (23.6%) of respondents stated that that storage was available and adequate (Figure 4.7).

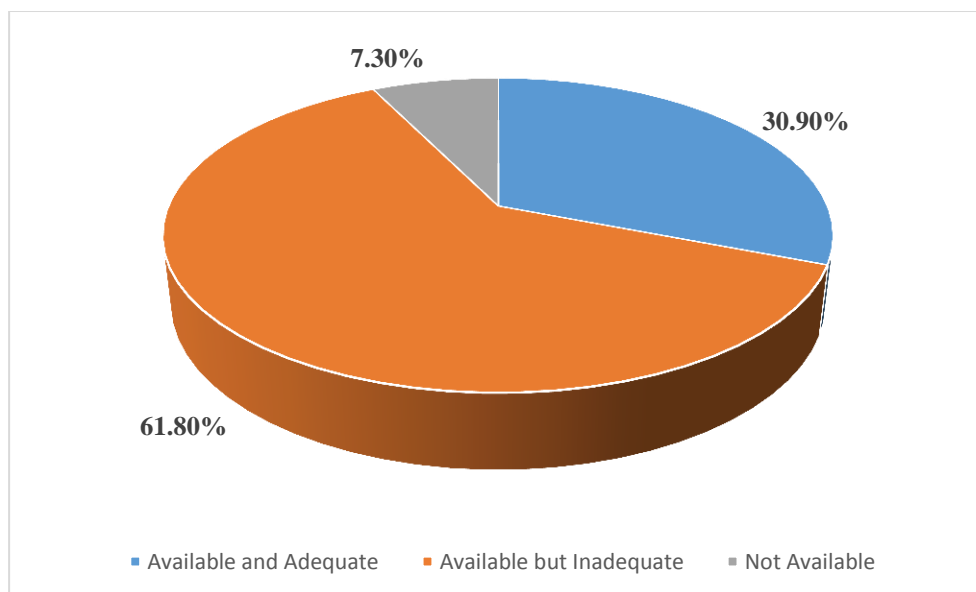


Figure 7: Availability of shelves

Investigation for available shelves revealed that 34 (61.8%) of respondents stated that shelves were available but inadequate, 17(30.9%) of respondents stated that

shelves were available and adequate whilst 4(7.3%) of respondents stated that shelves were not available in the stores (Figure 4.8).

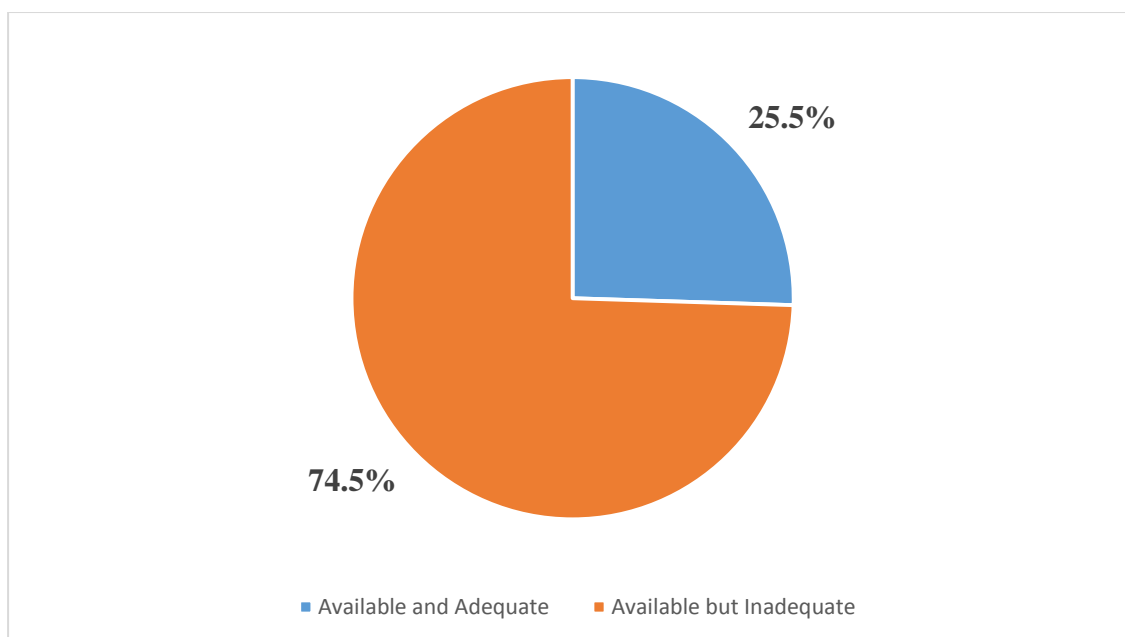


Figure 8: Availability of pallets

Out of 55 respondents, 41(74.5%) admitted having pallets but inadequate quantities for the stores whilst 14 (25.5%) admitted having enough pallets in the stores (Figure 4.9).

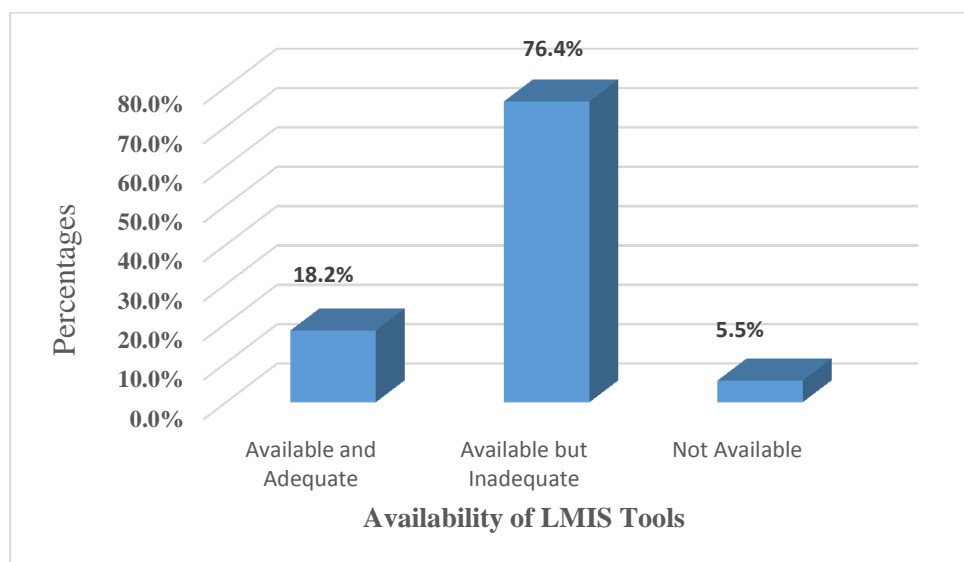


Figure 9: Availability of LMIS Tools

When asked on the availability of Logistics management information system (LMIS) tools, 42(76.4%) respondents noted that LMIS tools were available but inadequate, 10(18.2%) noted LMIS tools were available and adequate whilst 3(5.5%) noted that LMIS tools were not available currently at facility level (Figure 4.10).

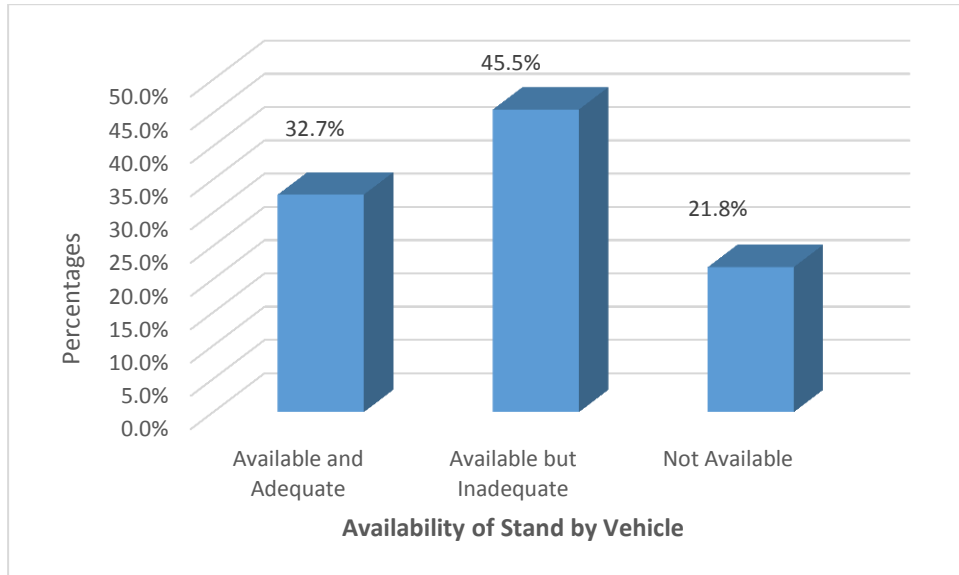


Figure 10: Availability of Standby vehicle

Twenty-five- 25(45.5%) respondents revealed that a Stand by vehicle for use was available frequently, 18(32.7%) respondents revealed that a stand by vehicle was always available and 12(21.8%) revealed that the stores had no stand by vehicle (Figure 4.11).

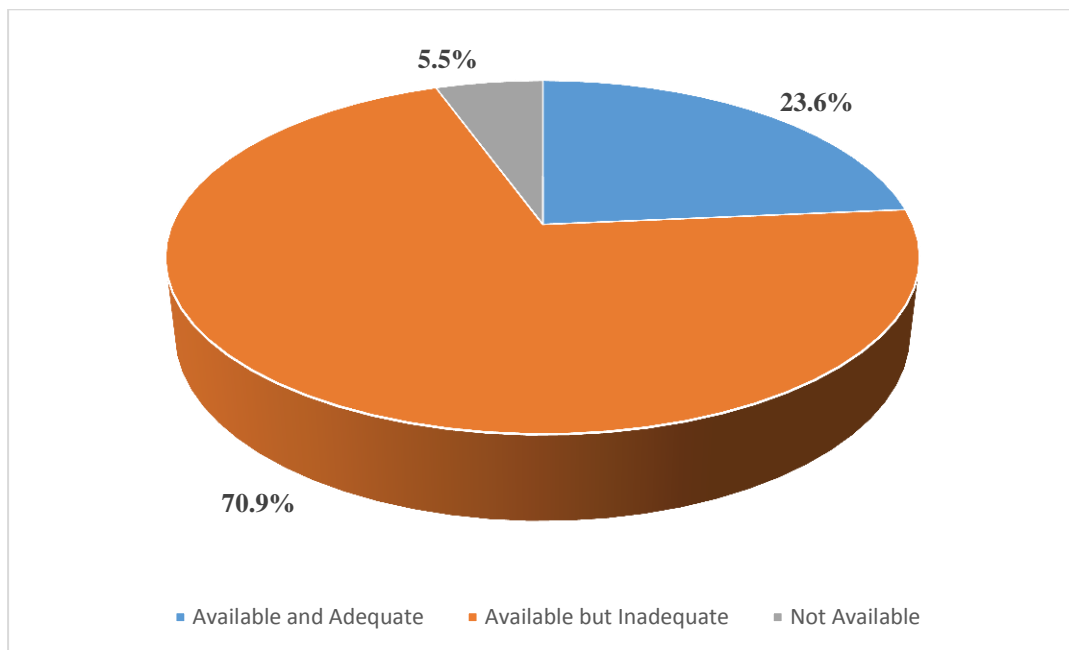


Figure 11: Availability of paid staff

The study revealed that in the stores, 39(70.9%) of respondents noted that paid staff were available but not enough, 12(23.6%) noted that paid staff were available and sufficient whilst 3(5.5%) respondents noted that no paid staff was available in the stores(Figure 4.12).

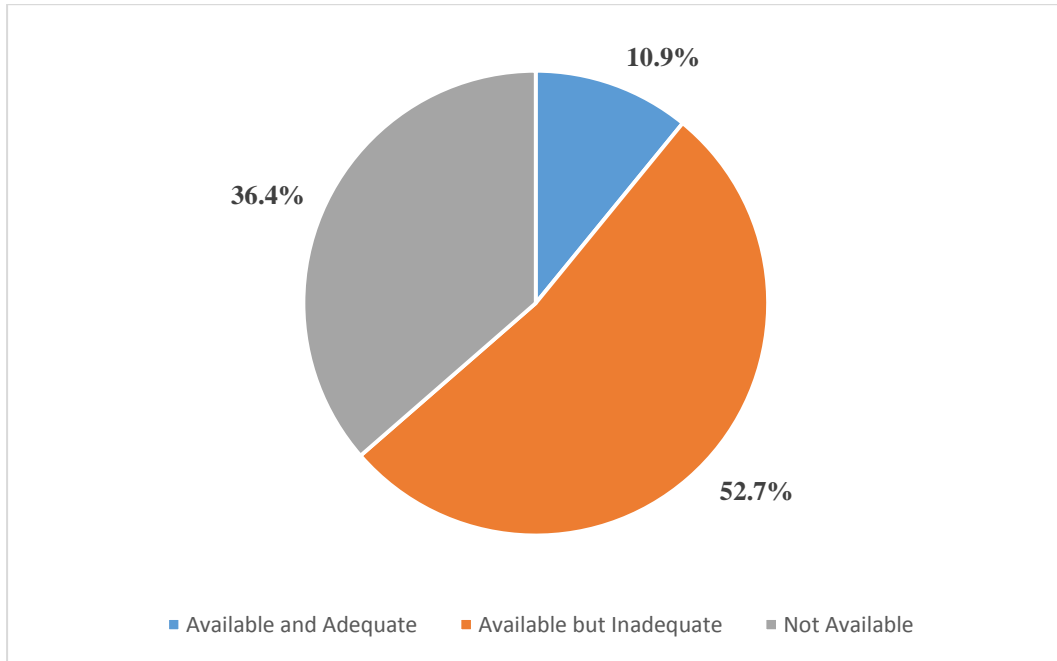


Figure 12: Availability of Auxiliary staff

With regards to the availability of auxiliary staff, 27(52.7%) respondents revealed that auxiliary staff were available but inadequate, 19(36.4%) revealed that auxiliary staff was not available in the stores whilst 6(10.9%) revealed that auxiliary staff were available and adequate (Figure 4.13)

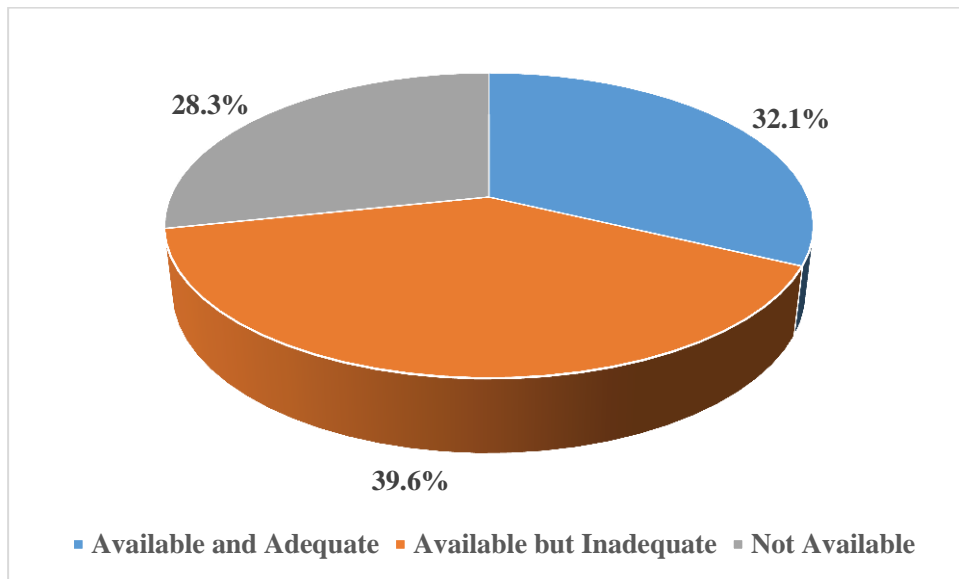


Figure 13: Availability of guidance document

Twenty-one -21 (39.6%) respondents revealed that guidance document was available but not enough in stores, 17(32.1%) revealed they were available and inadequate numbers whilst 15(28.3%) revealed there were no guidance documents in the stores (Figure 4.14).

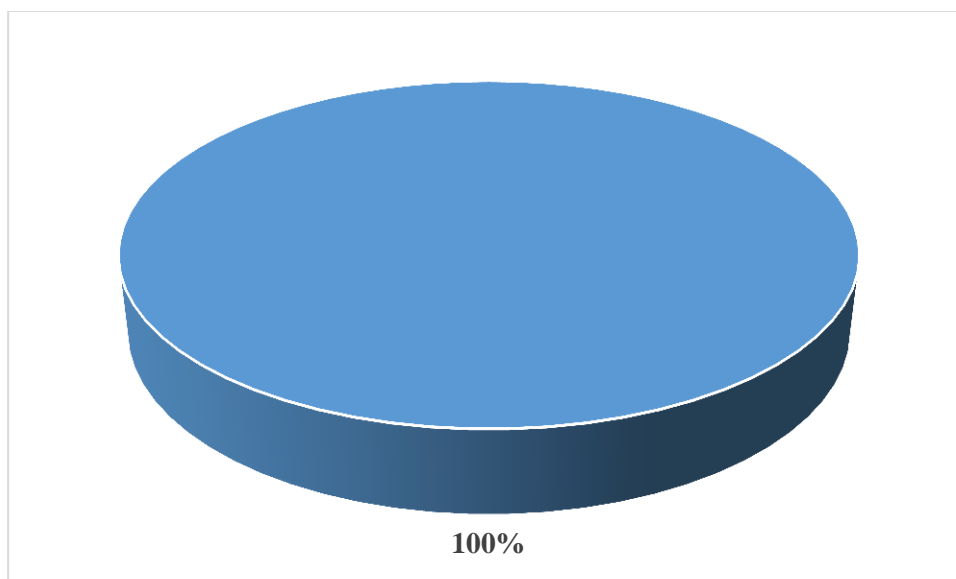


Figure 14: Availability of inventory management system in the warehouses

In relation to the availability of an inventory management system for the storage of pharmaceuticals, all respondents, 55(100%) revealed that the system was available (Figure 4.15).

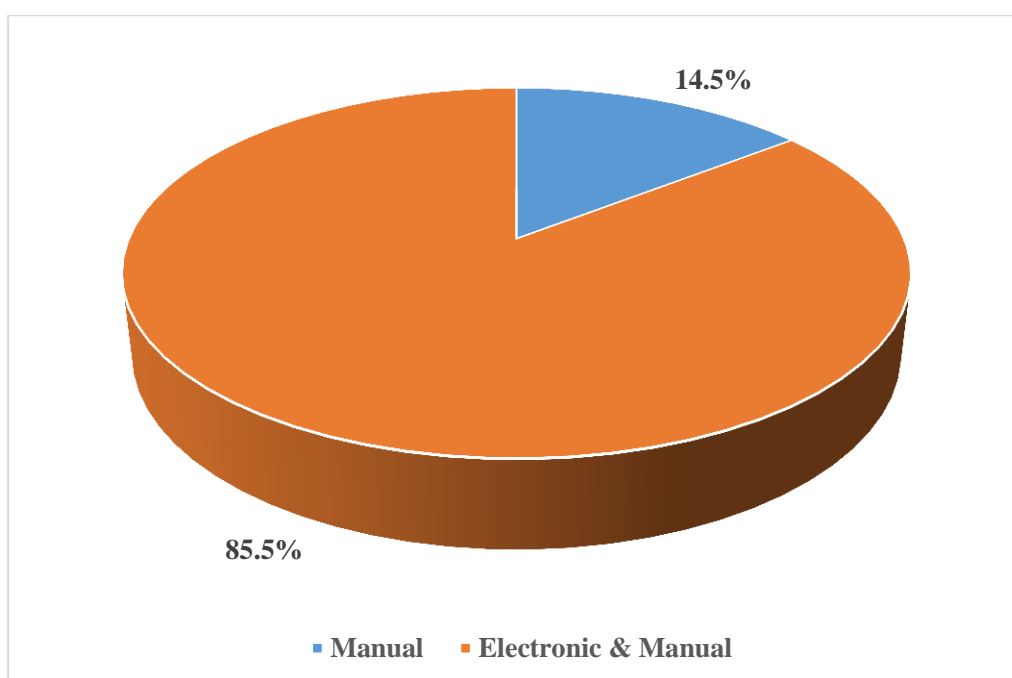


Figure 15: Type of inventory control system used in the warehouses

Investigation of type of inventory management used in warehouse revealed that 47 (85.5%) use both electronic and manual systems and 8 (14.5%) use only manual systems (Figure 4.16).

Table 5: Partners supporting Supply Chain Activities in Various Districts

No.	Partners supporting in Supply Chain Systems	Number of respondents
1	UNICEF	16
2	Crown Agents	3
3	Chemonics	2
4	UNFPA	10
5	CARE	13
6	CONCERN Worldwide	3
7	MSF	7
8	Marie Stopes	2
9	IRC-Saving Lives Project	3
10	World Vision	2
11	USAID	1
12	Global Fund	5
13	DFID	2
14	Civil Society Organisations	2
15	Presidential Malaria Initiative	1
16	Hellen Keller International	1
17	Clinton Health Access Initiative	1
18	CapAnamur	1
19	CUAMM	1

The study shows that different partners are working in the supply chain system and supporting Government of Sierra Leone efforts (Table 4.5).

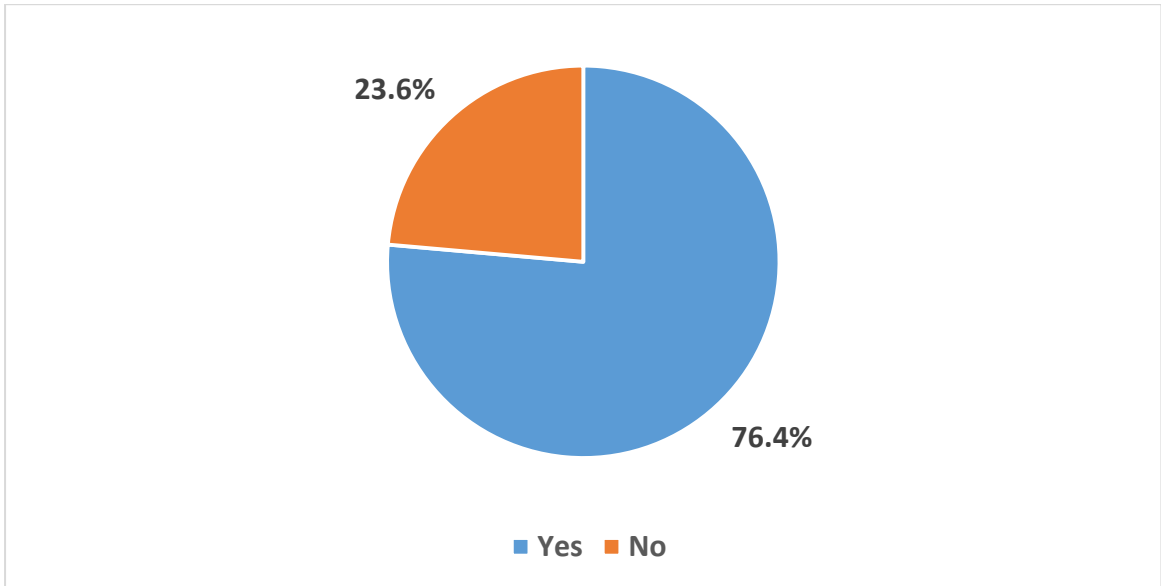


Figure 16: Inadequate number of staff in supply chain management as a limitation to improvements in supply chain systems.

The study revealed several limitations for the improvement of supply chain systems in Sierra Leone. They included: Inadequate number of staff: 32(58.2%) of respondents stated that this is a limitation whilst 23(41.8%) did not think this was a limiting factor in supply chain systems (Figure 4.17).

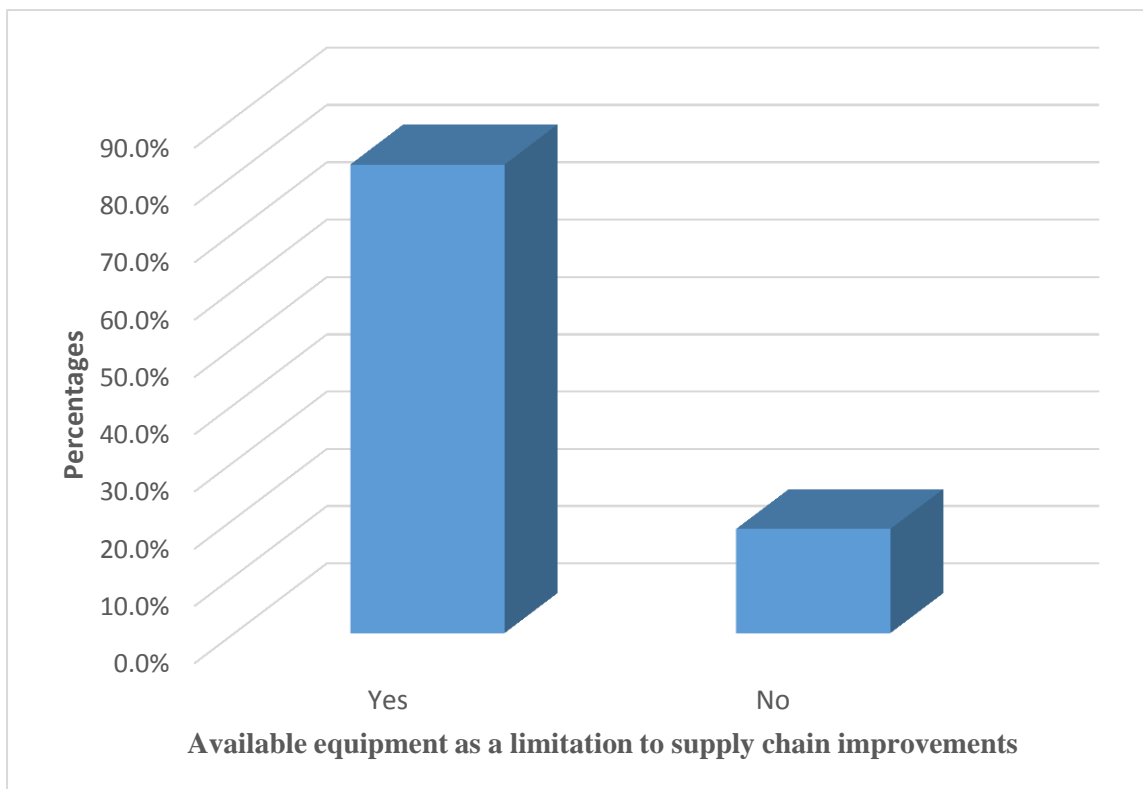


Figure 17: Available equipment as a limitation to improvements in supply chain systems

Secondly, 45(81.8%) of respondents noted that a lack of handling equipment is a limiting factor whilst, 10(18.2%) noted that this was not a limiting factor (Figure 4.18).

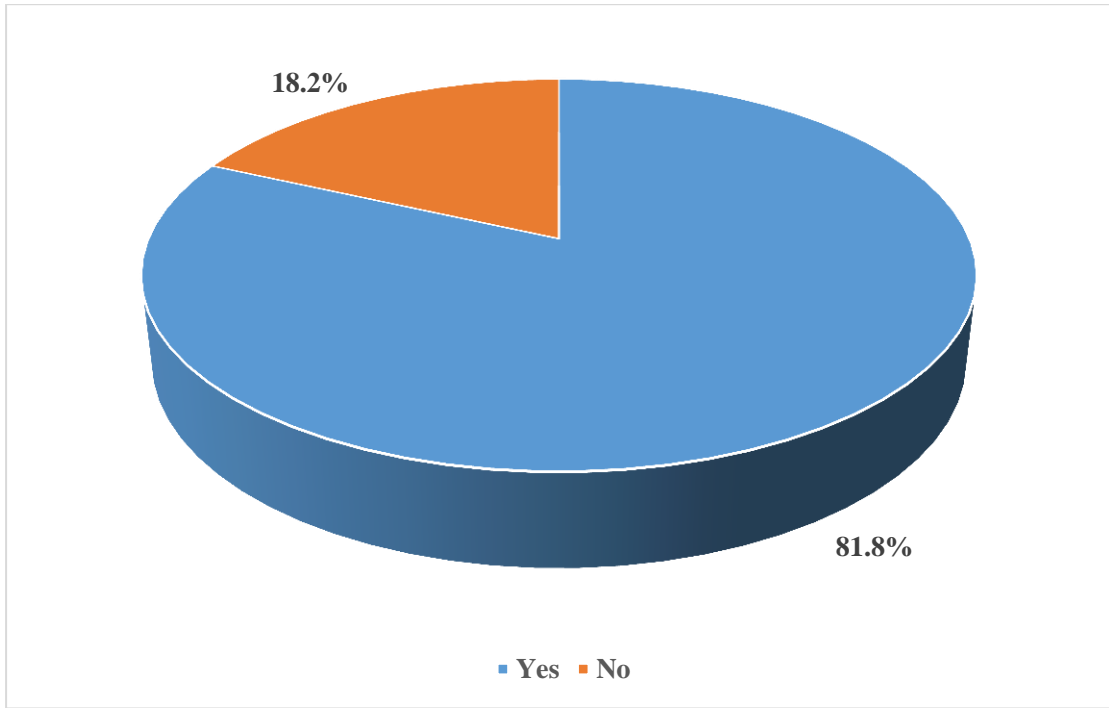


Figure 18: *Lack of Management support as a limitation to improvements in supply chain systems*

Forty-five, 45 (81.8%) of respondents noted that lack of management support was a limiting factor for supply chain systems whilst 10(18.2%) noted that this was not a challenge for their operations (Figure 4.19).

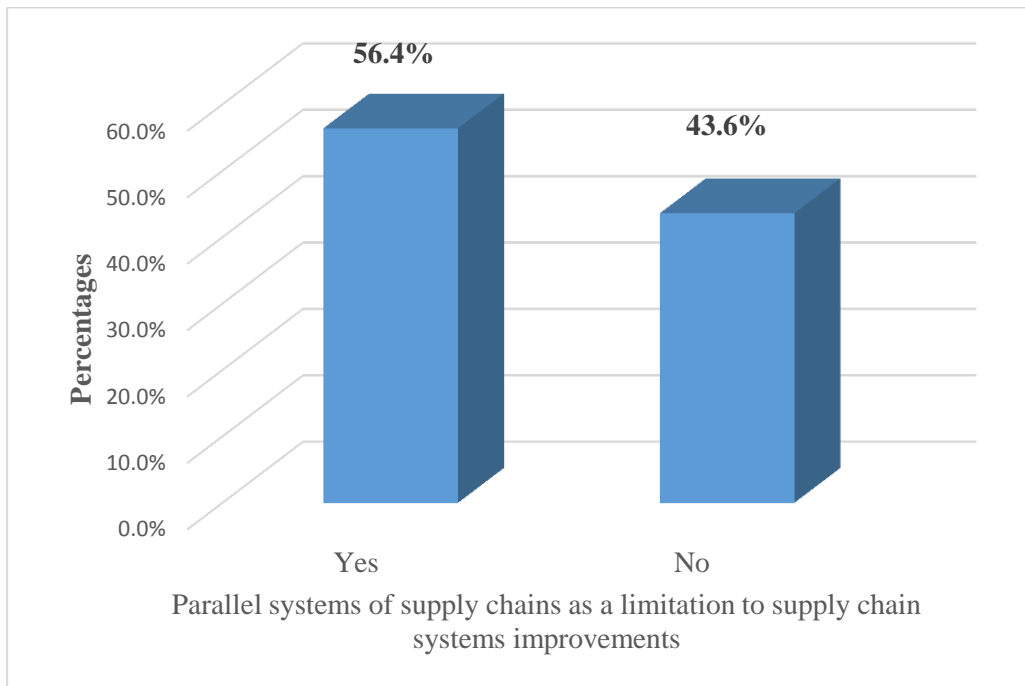


Figure 19: *Parallel systems of supply chain as a limitation to improvements in supply chain systems*

Parallel supply chain systems within the Ministry of Health and Sanitation structure was also highlighted by 31 (56.4%) respondents as a limiting factor in supply chain improvements whilst 24(43.6%) noted this was not a limiting factor in their operations (Figure 4.20).

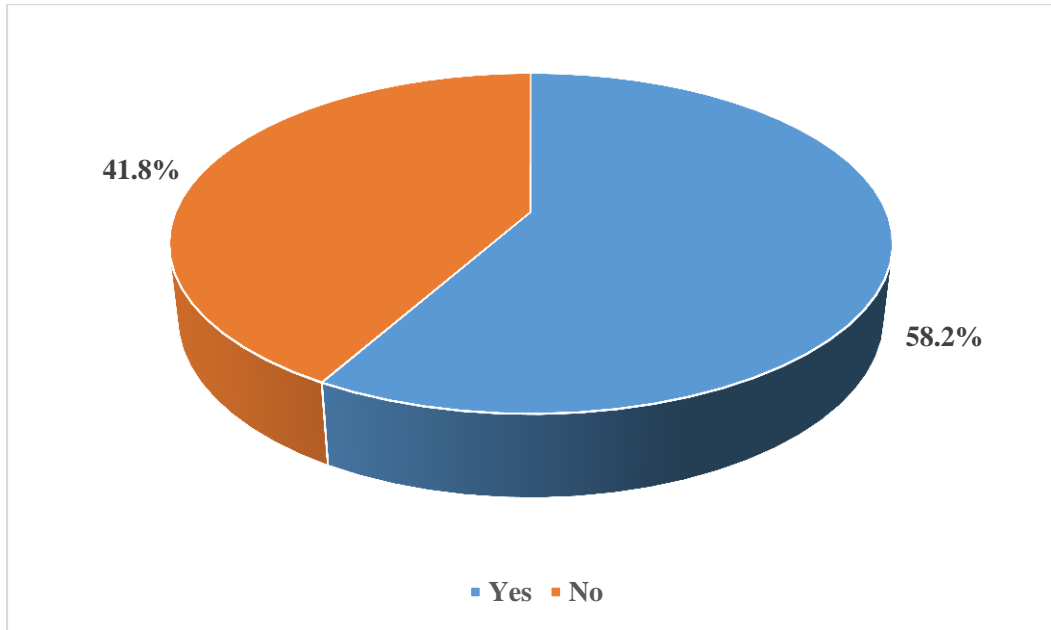


Figure 20: *Required qualifications in Supply chain as a limitation to improvements in supply chain systems*

Thirty-two -32(58.2%) respondents revealed that the lack of qualified staff is a limitation to their operations whilst 23(41.8%) revealed that this was not a limitation in their operations (Figure 4.21).

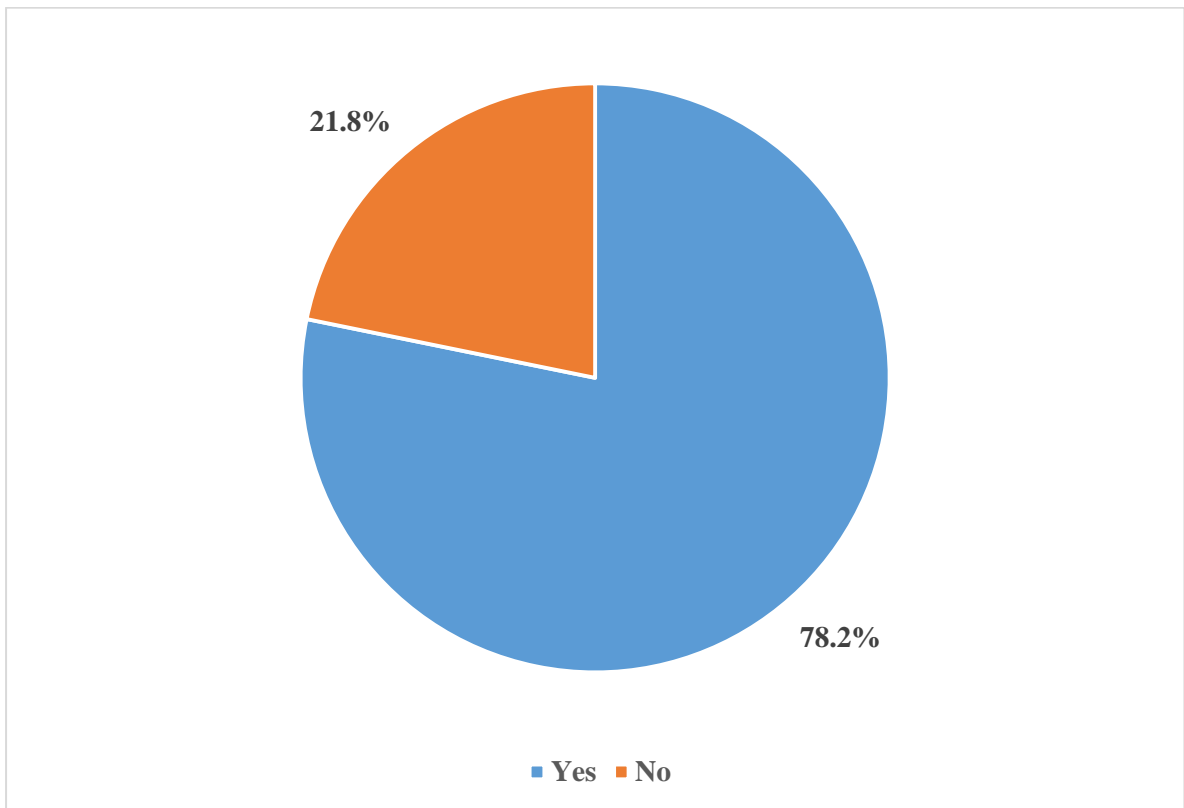


Figure 21: *Push versus Pull system factor as a limitation to improvements in supply chain systems*

Most respondents 43(78.2%) revealed that the push system was also a limiting factor to improvements in supply chain whilst 12(21.8%) respondents did not think this was a factor of limitation (Fig 4.22).

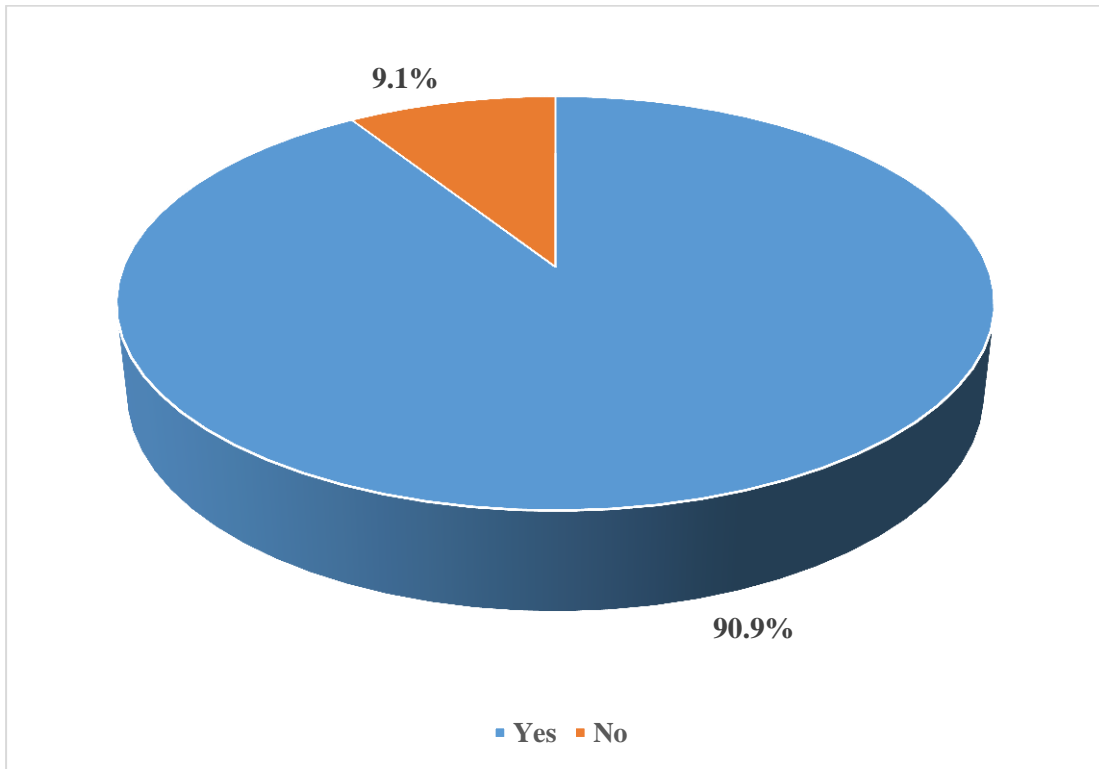


Figure 22: *Availability of funds as a limitation to improvements in supply chain systems*

Investigations also highlighted funds availability as a limitation as noted by 50(90.9%) respondents whilst 5(9.1%) respondents did not note this as a limiting factor (Figure 4.23).

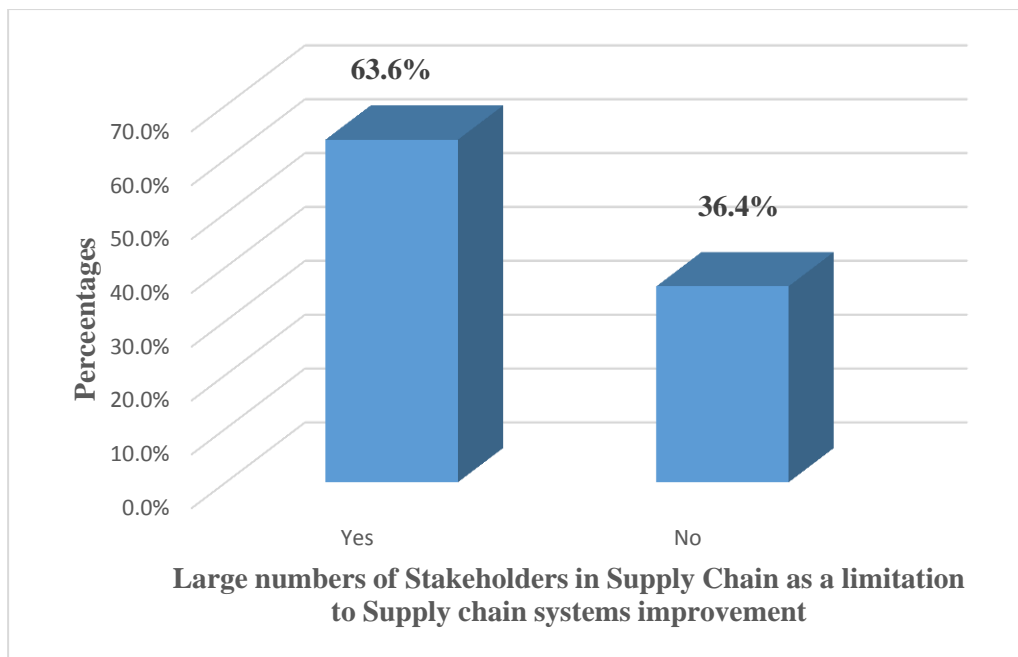


Figure 23: *Large number of stakeholders in Supply chain as a limitation to improvements in supply chain systems.*

Lastly, 35(63.6%) of respondents revealed that a large number of stakeholders in the supply chain was a limiting factor to supply chain improvements whilst 20 (36.4%) did not own the same view (Figure 4.24).

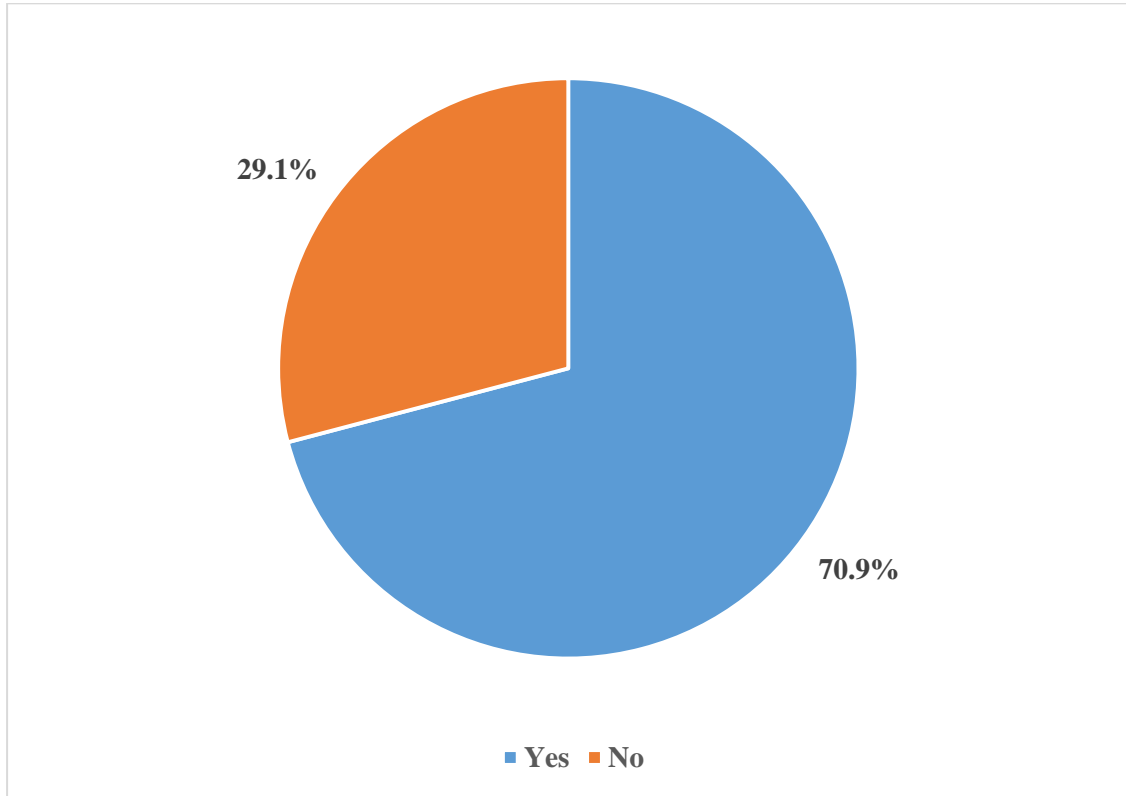


Figure 24: *Qualified staff in the Supply chain as an limitation to improvements in supply chain systems.*

Respondents were asked to indicate factors that represent improvements to supply chain systems at their levels. The following were listed as opportunities: Availability of more qualified staff, 39(70.9%) stated that this was an opportunity whilst 16(29.1%) didn't hold this view for operations at their level (Figure 4.25).

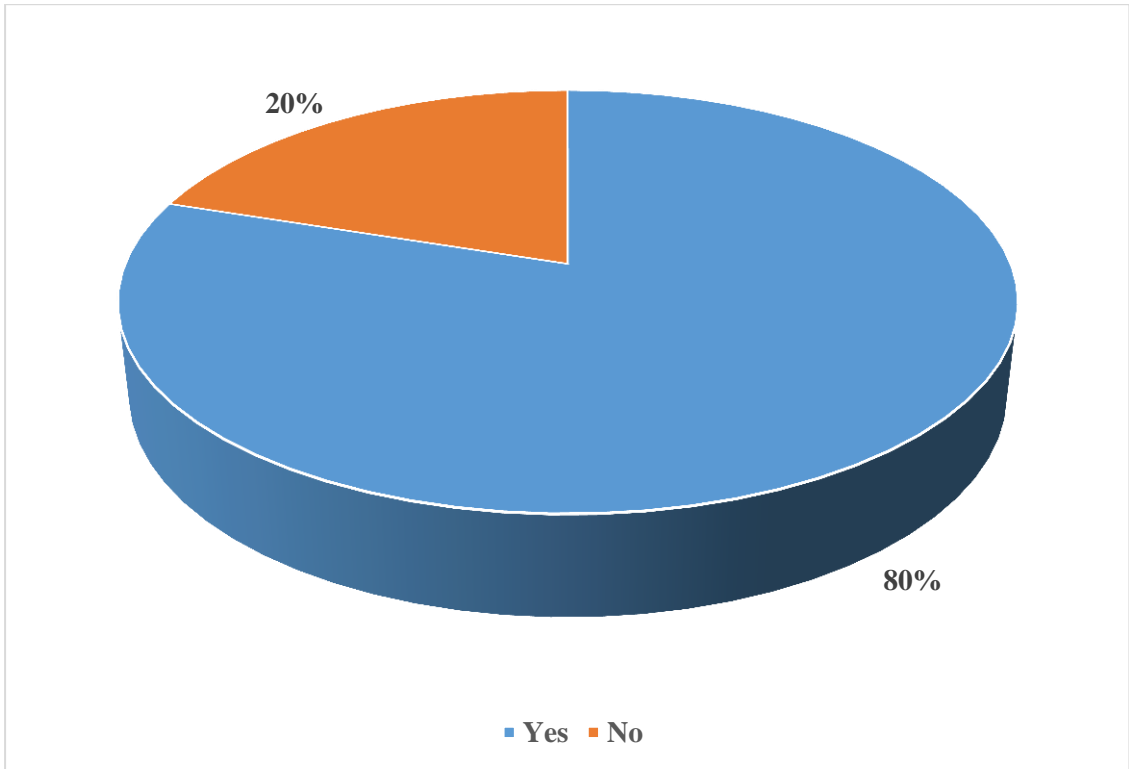


Figure 25: Need for integration of supply chain management activities as an opportunity for improvement of supply chain systems

Forty-four -44 (80%) respondents revealed that the need for integration of supply chain management activities was an opportunity at their level whilst 11(20%) did not hold that view (Figure 4.26).

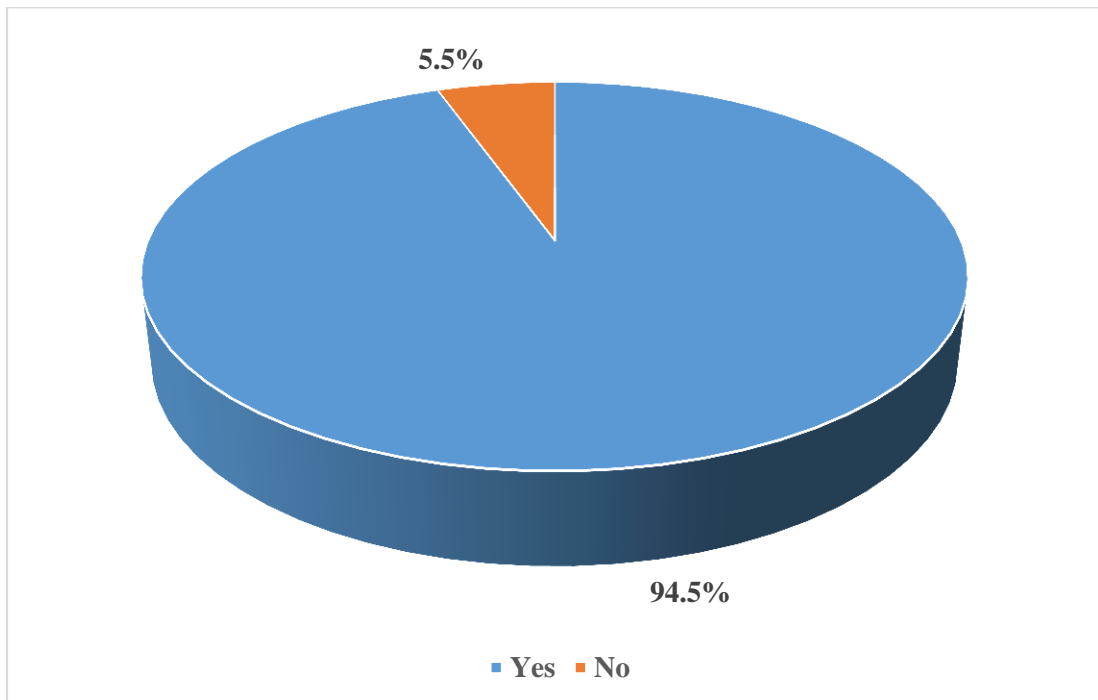


Figure 26: Introduction of short courses in supply chain management as an opportunity for improvement of supply chain systems

The introduction of short courses in supply chain was revealed by 52 (94.5%) respondents as an opportunity whilst 3(5.5%) did not see it as an opportunity to improve supply chain systems in their levels (Figure 4.27).

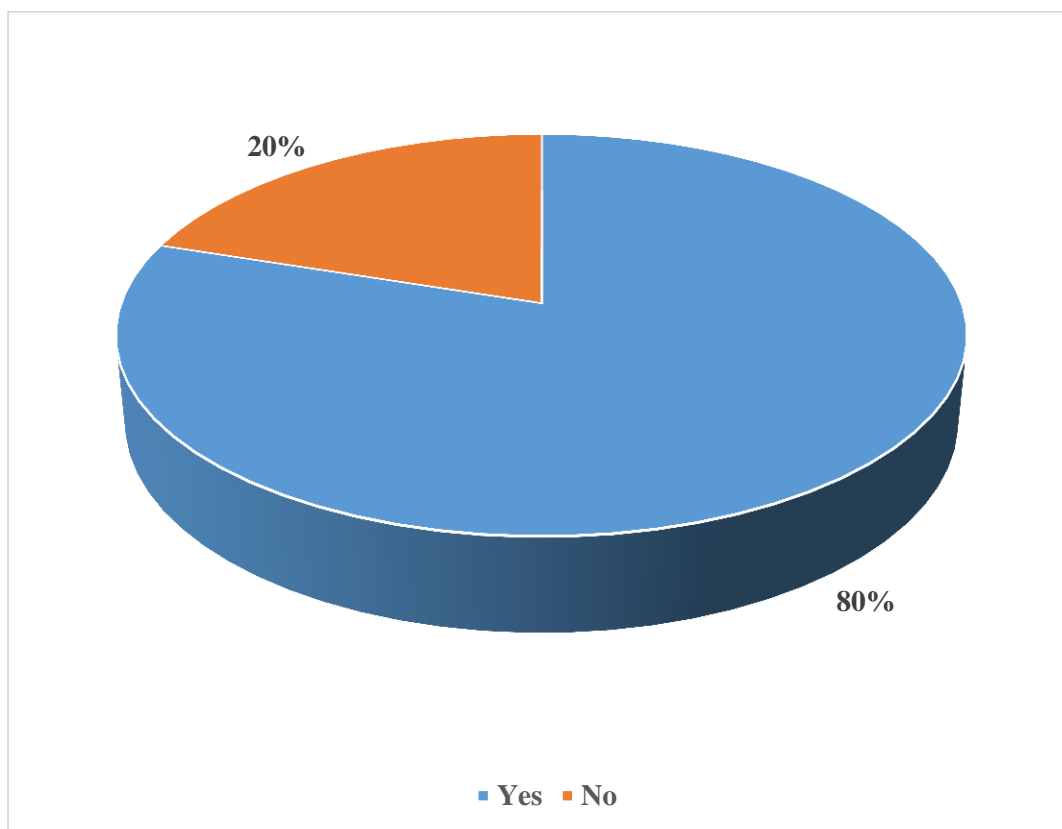


Figure 27: Large number of Stakeholders/partners involved in supply chain management as an opportunity for improvement of supply chain systems

Forty-four- 44(80%) respondents highlighted that large number of stakeholders or partners involved in the supply chain is an opportunity for improvements whilst 11(20%) did not hold that view for operations within their level (Figure 4.28).

4.3 Section C: Experience in Emergency

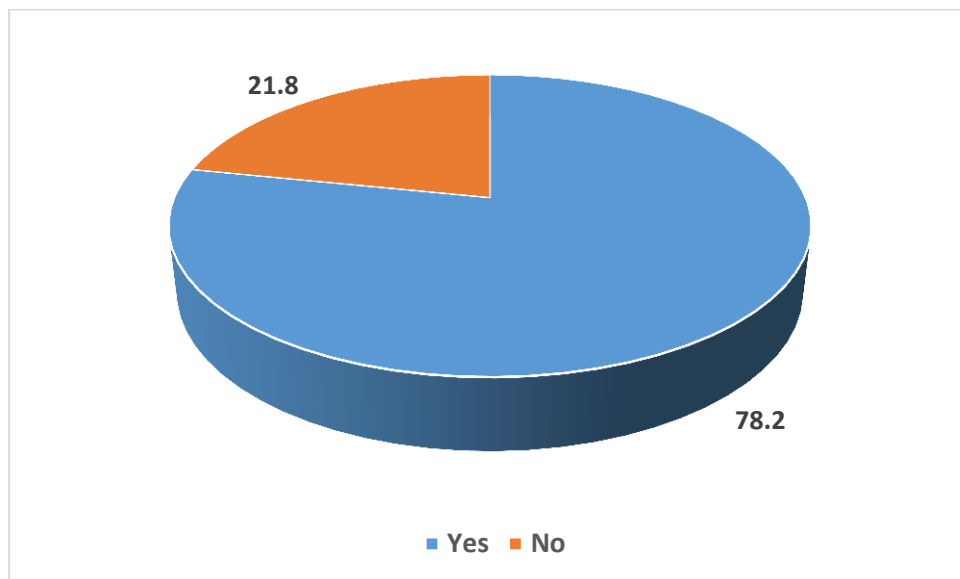


Figure 28: Supply chain officer in an emergency

In response to the question, have you ever worked as a supply chain officer, it was revealed that 43(78.2%) respondents have worked as supply chain officers whilst 12(21.8%) respondents have not worked in an emergency before as a supply chain officer (Figure 4.29).

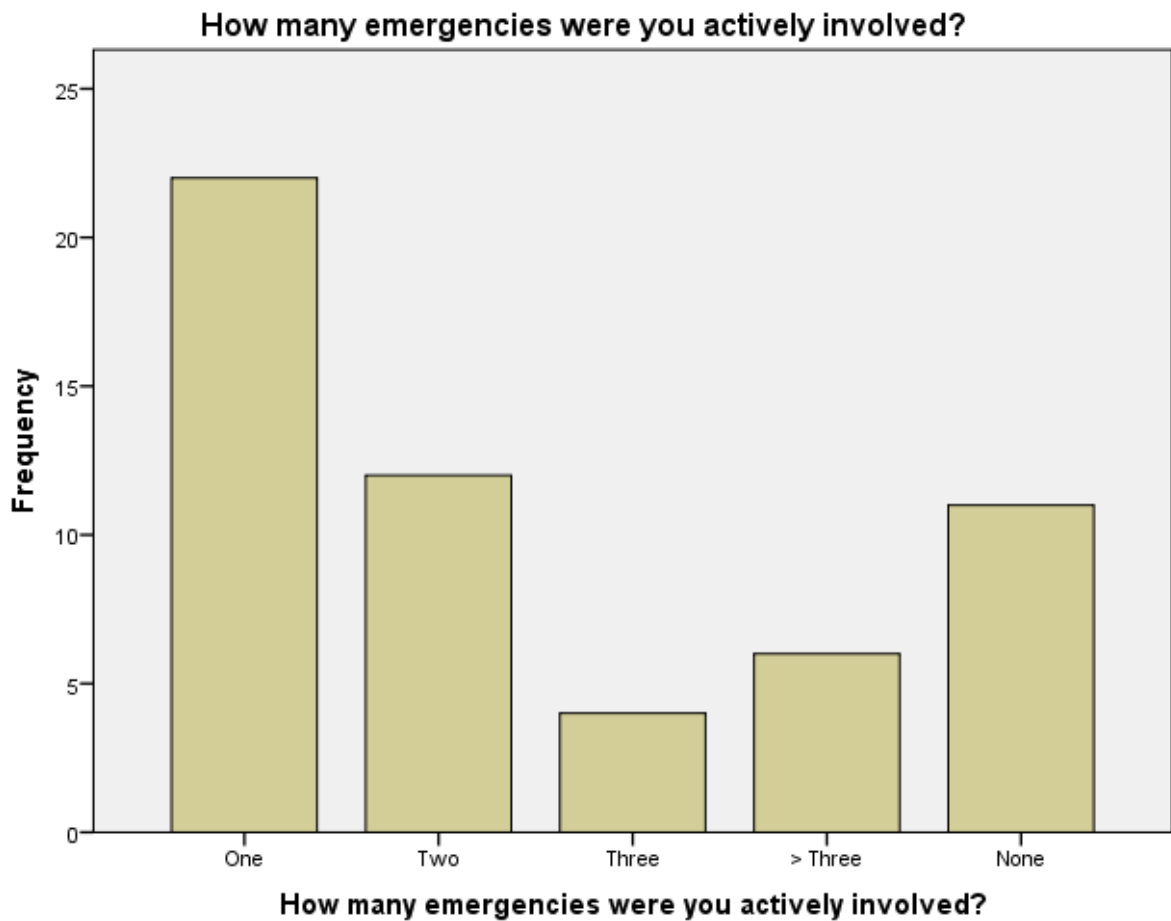


Figure 29: Number of Emergencies respondents have been active in.

Based on the data collected, it revealed that 22(40%) respondents had been actively involved in at least one emergency, 12(21.8%) had been actively involved in at least two emergencies whilst 11(20%) have not worked in any emergencies (Figure 4.30).

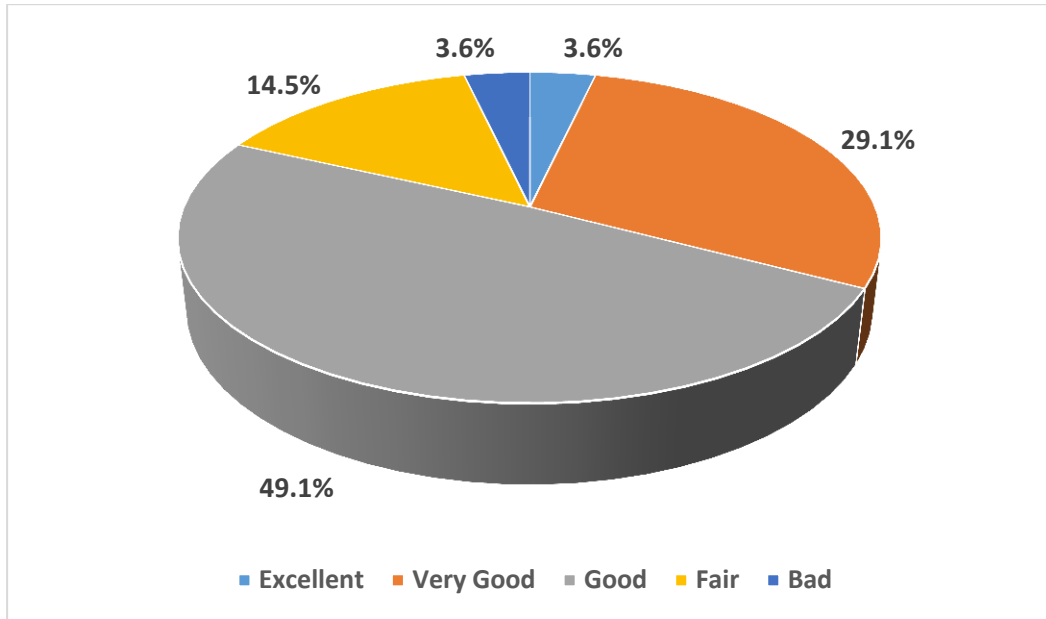


Figure 30: *Performance of Supply Chain in Emergencies*

Description of the supply chain performance at various levels from the respondents revealed that 2(3.6%) noted that the supply chain management system was excellent, 16(29.1%) noted that it was very good whilst 27(49.1%) noted that the supply chain system was good (Figure 4.31).

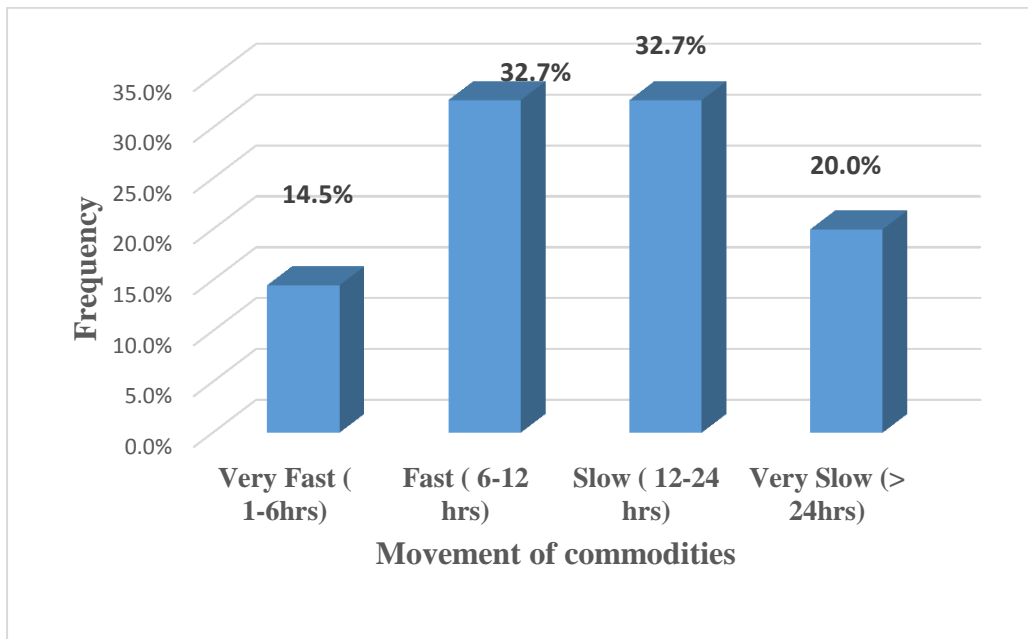


Figure 31: *Efficient movement of commodities in the Supply Chain*

When asked about the description of movement of commodities from up/to down their levels, it was revealed that 18(32.7%) respondents respectively noted that it was either fast with a response rate of 6-12 hours or slow with a response rate of 12-24 hours, 11(20%) noted it was slow with a response rate of more than 24 hours (Figure 4.32).

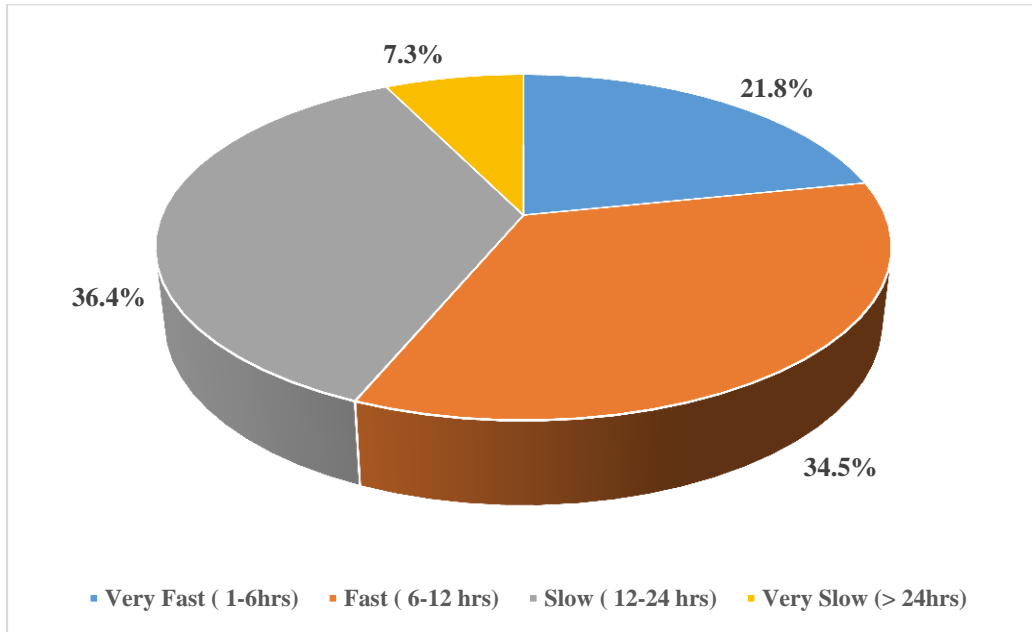


Figure 32: *Efficiency of Information Flow*

With regards to the sharing of information from up/to down their levels, 12 (21.8%) respondents revealed that it was very fast averaging between 1-6 hours, 19(34.5%) revealed it was fast averaging between 6-12 hours whilst 20 (36.4%) revealed it was slow averaging between 12-24 hours (Figure 4.33).

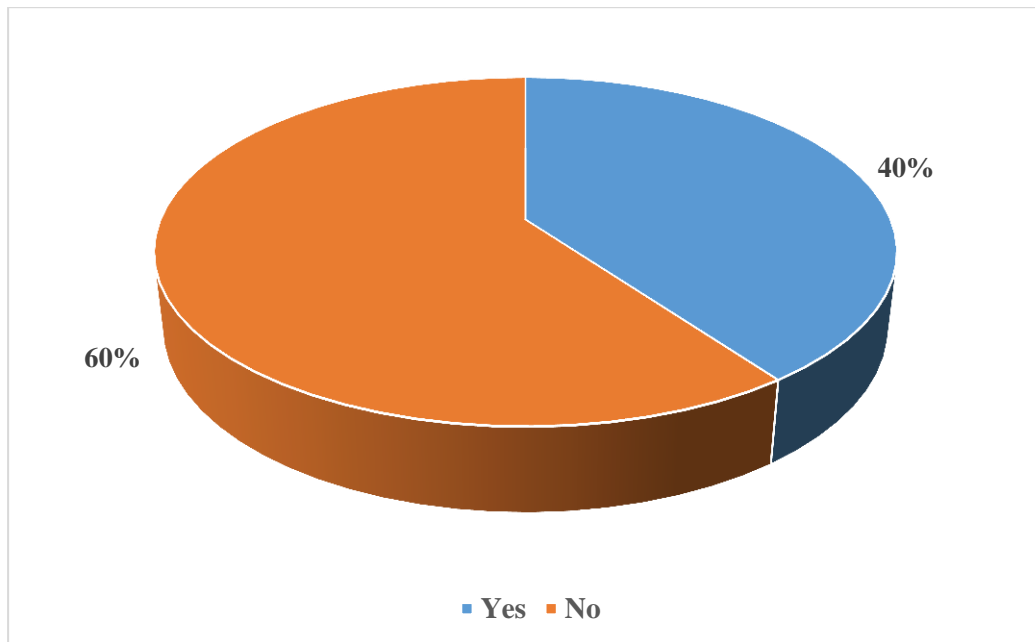


Figure 33: *Availability of an Emergency Plan*

The investigation revealed that most respondents 33(60%) had an emergency response plan at their levels at the time of the emergency whilst 22(40%) did not have an emergency plan at the time of the emergency (Figure 4.34).

4.4 Section D: Preparedness for future emergency/outbreak

This section investigated the level of preparedness of supply chain units at district and central levels.

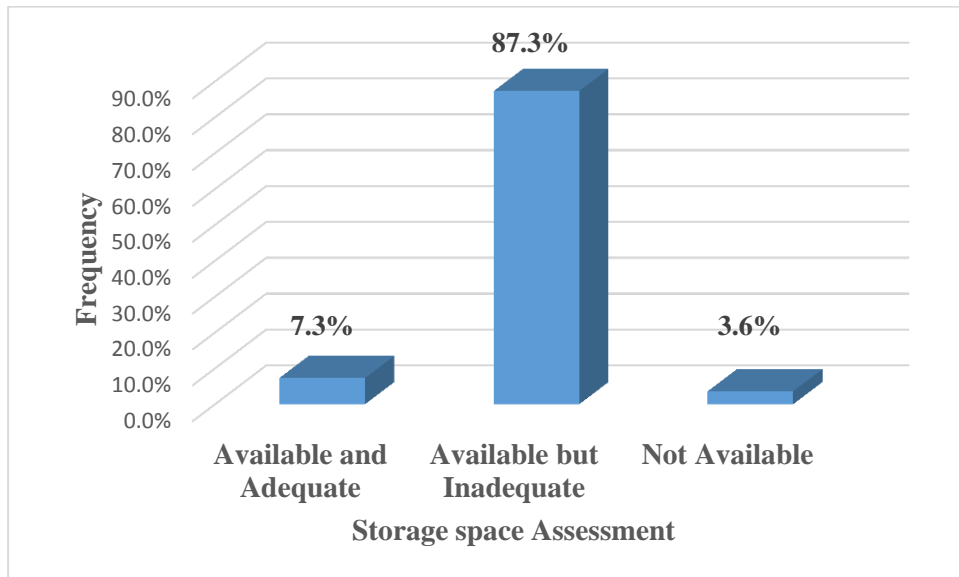


Figure 34: *Assessment of Storage Space*

Forty eight-48(87.3%) respondents revealed that storage space was available but inadequate in the eventuality of an emergency, 4(7.3%) noted that space was available and adequate whilst 2(3.6%) noted that storage space is not available (Figure 4.35).

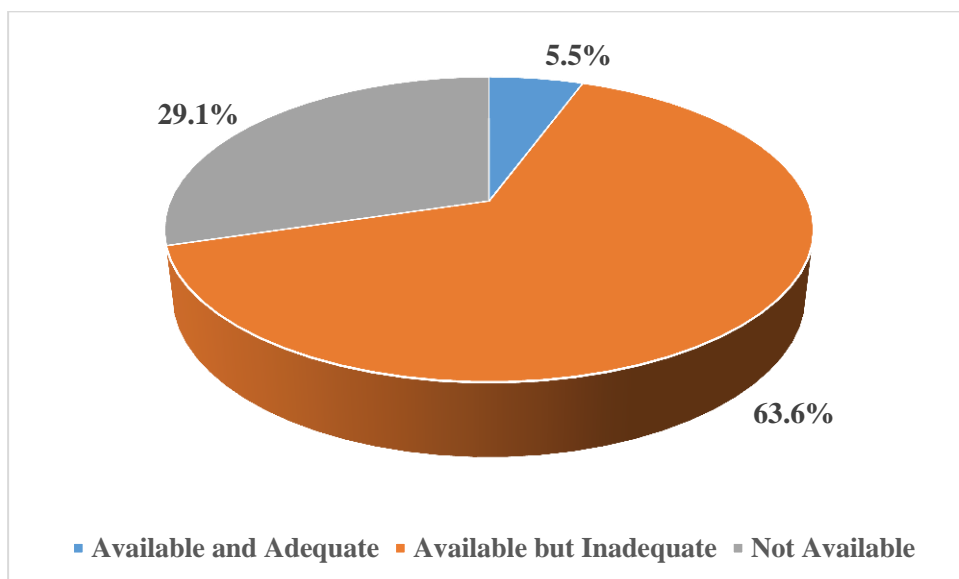


Figure 35: *Assessment of Buffer commodities*

When asked about the availability of buffer commodities, 35(63.6%) respondents revealed that they were available but not adequate, 16(29.1%) revealed they were not available (Figure 4.36).

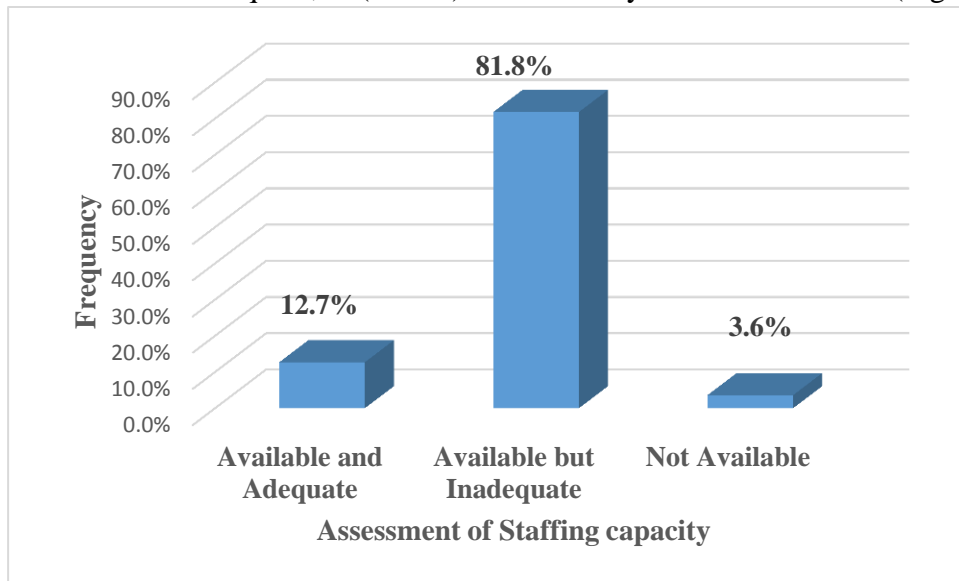


Figure 36: *Assessment of Staffing Capacity*

Assessment of staffing capacity revealed that 45(81.8%) respondents noted having staff but not enough to meet the needs of the operations, 7 (12.7%) noted having staff in adequate numbers (Figure 4.37).

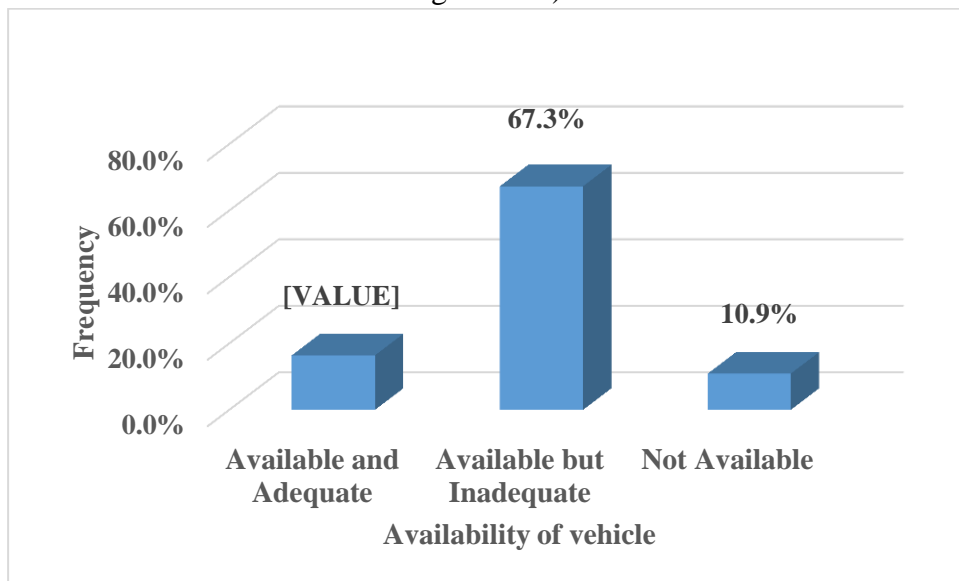


Figure 37: *Assessment of Stand by Vehicle Availability*

Thirty-seven- 37(67.3%) respondents stated having a stand by vehicle but not adequate for the level of operations, 9(16.4%) stated that a stand by vehicle was available and adequate for operations, 6(10.9%) did not have stand by vehicles (Figure 4.38).

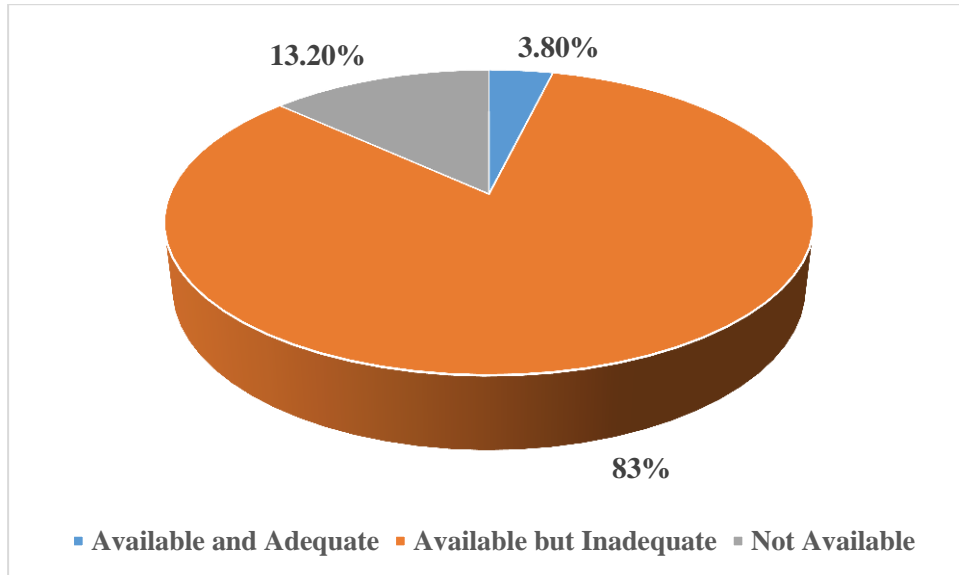


Figure 38: *Assessment of Support from Higher Level*

Forty-four – 44 (83%) respondents stated that they had support from top management although inadequate, 7(13.2%) had no support from top management (Figure 4.39).

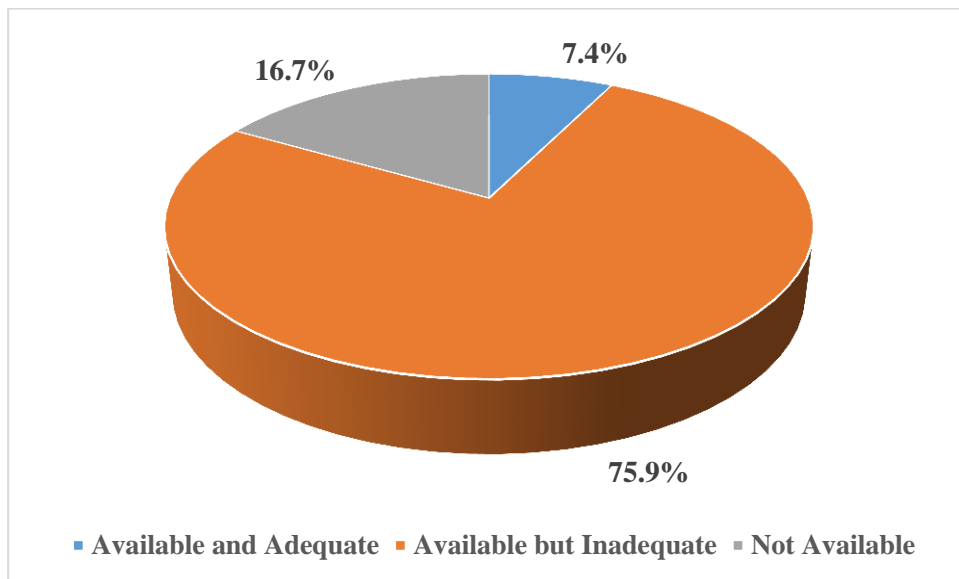


Figure 39: *Assessment of Support from Supervisors*

From the data, it was revealed that 41(75.9%) respondents noted that they had support from supervisors although not adequate, 9(16.7%) had no support from supervisors (Figure (4.40)).

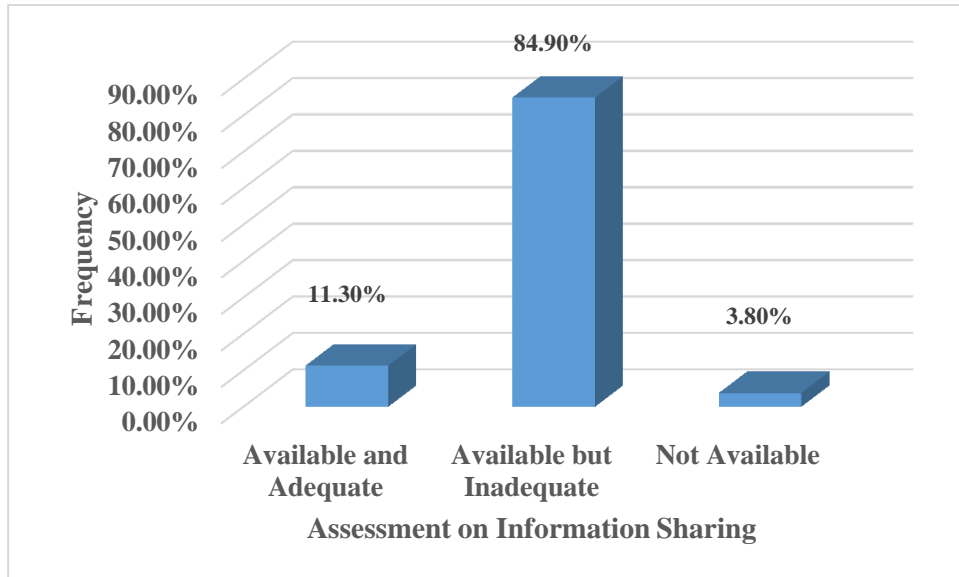


Figure 40: *Assessment on Information Sharing within the Supply Chain*

Forty-five- 45(84.9%) respondents revealed that information sharing across all levels was occurring but not adequately, 6(11.3%) respondents revealed that information sharing was adequate at their levels (Figure 4.41).

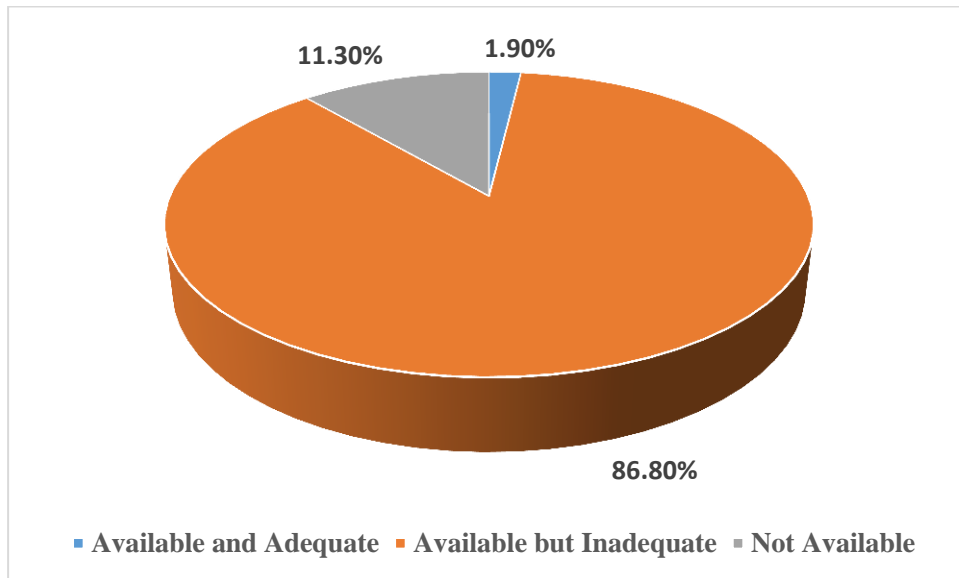


Figure 41 : *Assessment of Available Equipment*

With regards to the assessment of available equipment, 46(86.8%) respondents stated that equipment was available but inadequate, 6(11.3%) respondents stated that equipment was not available (Figure 4.42).

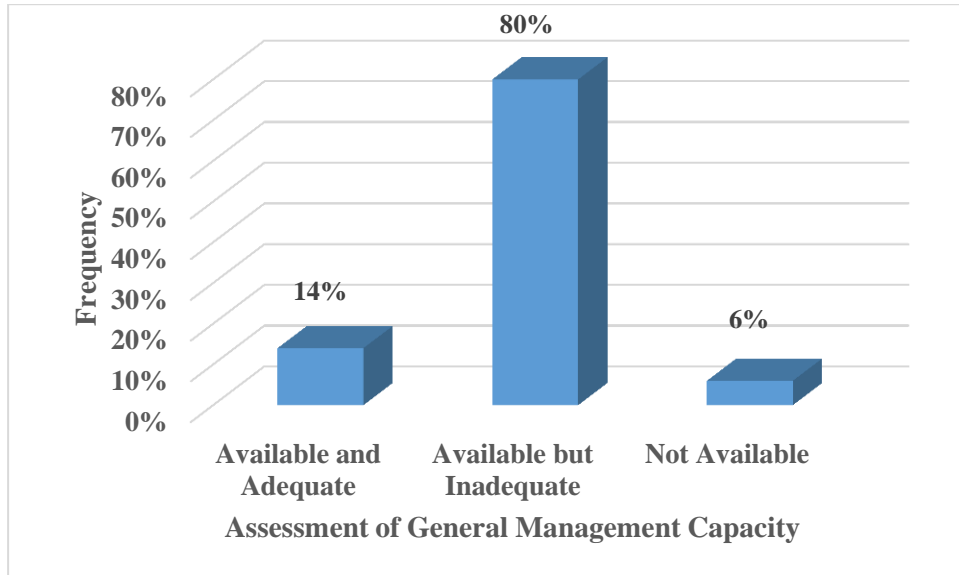


Figure 42: *Assessment of General Management Capacity*

Forty -40 (80%) respondents revealed that general management capacity of supply chain units were available but inadequate, 7(14%) revealed that the general management capacity was available and adequate (Figure 4.43).

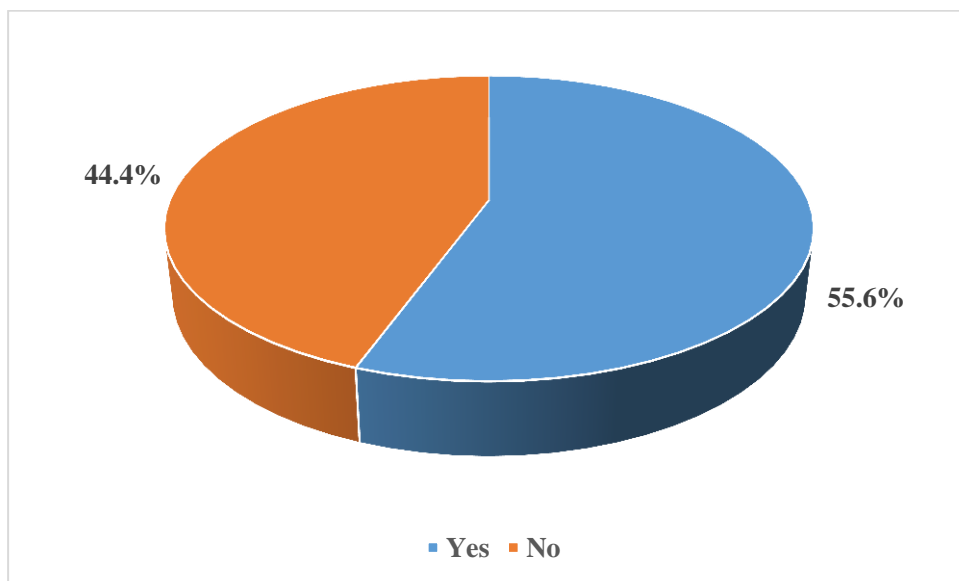


Figure 43: *Availability of an Emergency Plan at facility level.*

To the question, do you currently have an emergency plan at your level: the following data was captured, 30(55.6%) respondents stated that an emergency plan was available at their level whilst 25(44.4%) stated that they were not in possession of an emergency plan (Figure 4.44).

CHAPTER: 5

DISCUSSION

5.1 Summary of Key Findings

The study was designed to assess the current health supply chain system at District and Central level in Sierra Leone, to assess the performance of the Health supply chain during the ebola crisis and to ascertain the level of preparedness of supply chain units in the event of an emergency. Assessment of the current storage conditions in the health facilities showed that 76.4% of respondents stated that storage space was available but not adequate for the current routinely distributed stock whilst 23.6% stated that storage space was both available and adequate. When asked on the availability of Logistics management information system (LMIS) tools for inventory management, 42(76.4%) respondents noted that LMIS tools were available but inadequate, 10(18.2%) noted LMIS tools were available and adequate whilst 3(5.5%) noted that LMIS tools were not available currently at facility level. The study revealed several limitations for the improvement of supply chain systems in Sierra Leone including but not limited to: Inadequate number of staff: 32(58.2%) of respondents stated that this is a limitation whilst 23(41.8%) did not think this was a limiting factor in supply chain systems. Parallel supply chain systems within the Ministry of Health and Sanitation structure was also highlighted by 31 (56.4%) respondents as a limiting factor in supply chain improvements whilst 24(43.6%) noted this was not a limiting factor in their operations.

Investigations also highlighted funds availability as a limitation as noted by 50(90.9%) respondents whilst 5(9.1%) respondents did not note this as a limiting factor.

Having asked to indicate factors that represented improvements to supply chain at their respective levels of operations, Forty-four -44 (80%) respondents revealed that the need for integration of supply chain management activities was an opportunity at their level whilst 11(20%) did not hold that view. Availability of more qualified staff, 39(70.9%) stated that this was an opportunity whilst 16(29.1%) didn't hold this view for operations at their level.

With regards to experience in emergency, most of the respondents 22(40%) have been involved in at least one emergency, with 12 (21.8%) respondents having been involved in at least two emergencies, a total of 11 (20%) of respondents have not been involved in an emergency. During the ebola outbreak, out of the 44 respondents that had witnessed at least one outbreak, 2 (4.5%) revealed that the supply chain performance was excellent, 14(31.8%) revealed that it was very good whilst 22(50%) revealed that the performance was good. Investigation revealed that most

respondents 33(60%) had an emergency response plan at their levels at the time of the emergency whilst 22(40%) did not have an emergency plan at the time of the emergency.

A total of 30 (55.6%) respondents admitted to having an emergency response plan at their level at the time of the data collection whilst 25 (44.4%) did not have an emergency response plan at their level.

5.2 Detailed discussions

In this present study, it was important to look at three phases in the supply chain system: the performance of the supply chain during ebola, the current status of the supply chain and the level of preparedness in the supply chain for future emergencies.

5.2.1 Current Supply chain Status.

Current supply chain systems must be robust enough to adequately provide health commodities in a timely manner. In the technical report from USAID titled Best practices in supply chain preparedness for public health emergencies (January 2018, p 29), it was revealed that routine supply chains have to be effective enough and separated from emergency supply chains. In this way, the important aspects of routine supplies are kept ensuring that the use of essential commodities is on-going and made available to facility levels. A key component for discussion should be the harmonization of the two components, at the end of the emergency.(Liu & Lane, 2013) Emergency stock will be transferred for routine stock use. The issue of stockpiling comes into play then. In this research it was clearly highlighted that buffer stock at facility level was available but not adequate for most facilities. In the Medical Counter Measures Plan, being implemented currently in Sierra Leone, warehouse mapping and focal persons to share stock information have been identified at both central and district levels and captured in an Emergency Supply chain Guideline that will be updated by these focal leads to ensure that the data is always current and provide the most true pictures of stock at present.(Jones, 2015) In the research conducted, warehouse infrastructure challenges were highlighted that included space constraints, warehouse equipment inadequacies such as pallets, handling equipment, availability of auxiliary staff and a stand by vehicle to ensure that the routine activities around warehousing and inventory management are met. The Medical countermeasure plan details within its contents, operational plans that the Ministry of Health and Sanitation (MoHS) would use to manage routine systems and the response systems.(Session, 2019)

The use of logistics management information systems as revealed in the research shows that the majority of facilities use both manual and electronic systems depending upon the level of operations. Some facilities are only using manual systems which at both district levels and central levels, such a case should not occur. LMIS when used accurately during routine operation feeding

the right information for decision making, only then can it be used for emergencies. (Project & USAID Deliver Project, 2011) The article on the best practices in Supply Chain (USAID, 2018) stated that however in third world countries, there are usually poorly functioning LMIS for routine supply chains. This statement is in agreement with data revealed from the study. Therefore for an LMIS to be effective during emergencies, its full potential for use should be employed with tracking of shipments, supplier base developments to get its maximum use during emergencies. (Session, 2019)

5.2.2 Performance of Supply chain during the ebola crisis

It was revealed that overall the performance of the supply chain during the ebola outbreak was fairly good. On average, the movement of commodities from central to district level was fair and highlighted reasons were due to lack of adequate stock at the central level and poor transportation systems. Staffing capacity needs were highlighted clearly as a gap with a significant number of staff not trained in supply chain management systems nor have been part of emergencies. (“201906_ESC SL Playbook Technical User Guide_vf,” n.d.) The article International Journal of Disaster risk reduction states the importance of adequately trained staff to contribute to emergency preparedness so that the processes and procedures are understood. The article is also in agreement that staff need basic supply chain training skills in order to understand the system and deal with the overload during emergencies.

5.2.3 Emergency Preparedness

In preparing for emergencies, there are a lot of components that include planning, equipment, training, practices, and improvements. The emergency preparedness component is always considered the most important of the components(Skryabina, Reedy,Amlot,Jaye, Riley (2016)), According to this article, the demands of health emergencies can be major, therefore staff need to practice the procedures and skills required so that they are versed with the plans

As defined by USAID (Best practices in supply chain preparedness for public health emergencies, January 2018), current state capability assessment of the supply chain will help the country understand their baseline of operations in terms of both routine supply chain capabilities and emergency supply chain capabilities.

Practical steps towards beefing up preparedness plans include: Stakeholder mapping ahead of time of all supply chain partners to understand clearly their roles and responsibilities, Different institutions within the government that might deal with the emergencies should be identified with roles and responsibilities note down- they might include local institutions, NGOs, international organisations,etc. (Sheu, 2007) According to a case study conducted in the Philippines, the

government was able to map out stakeholders and established a coordinating mechanism that brought all stakeholders together to give meaningful input in the preparedness process.(Natarajarathinam, Capar, & Narayanan, 2009) This meant that as a country they were better able to identify existing opportunities and leverage on them to improve response of future emergencies.(Safety, 2011)

5.3 Limitations of the study

It is key to note that this study has some limitations. A study designed as a cross-sectional study has its limitations as findings should be interpreted with caution. Due to the fact that the questionnaire provided a range of options for responses, it might have limited the number and type of responses received.

Study was only focused on central level participants and district level participant, strategic elements around emergencies such as procurement and financing of emergencies were not investigated.

However, despite the limitations, the range of issues investigated has given new insight on health supply chain performance in emergencies and this information gathered can be used by policy/decision-makers to improve on the gaps at present with regards to emergency preparedness.

CHAPTER :6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on the study findings, the following conclusions can be drawn:

Supply Chain Infrastructure

1. The current supply chain has existing challenges with maintaining pharma-grade storage that has the basic support elements in terms of staffing, infrastructure, allocated vehicle and policy guidance.

Supply Chain Systems

2. Despite the availability of inventory control systems, a significant percentage of facilities corresponding to respondents are still not fully automated.
3. Several factors were highlighted as enablers or inhibitors to improvements in supply chain systems such as the availability of qualified staff, use of push versus pull systems, availability of vehicles, and number of stakeholders supporting supply chain-related efforts, capacity building and integration of systems depending on the perspective of the respondents.
4. The performance of the supply chain during the ebola crisis was good on average.
5. Level of preparedness for future emergencies shows that support structures are in place but not adequate to cater to routine activities and by extension emergencies.
6. Despite the fact that most respondents had an emergency plan at the facility level, a significant proportion of respondents admitting to not having an emergency plan at the facility level.
7. Even though emergency plans are available at most facilities, at the time of the ebola crises, availability of an emergency plan at the facility level was higher than at current times.
8. The level of preparedness of supply chains has improved over the years but more to be done to have a robust supply chain system wherein the routine service provision and planned emergency service provision is adequate enough to support service delivery.

Human Resources

9. A significant number of supply chain leads in health facilities have not been involved in emergencies

6.2 Recommendations

Based on the findings and conclusion of the study, the following recommendations are proffered:

1. A targeted intervention on warehouse improvements nationwide at district and central levels to a standard pharma-grade storage across the various levels to keep the volumes of drugs routinely used.
2. A training program to be developed around supply chain management systems that is rolled out on a scheduled basis. Components of training to include emergency plans and simulations for newly posted staff to facility levels.
3. Factors that act as enablers and limitations to supply chain improvements in Sierra Leone, to be looked at and actionable interventions developed.
4. The use of the inventory management system though largely used across facilities should be rolled out to those using only manual systems so that there is a standardized way of managing stock appropriately at each level.
5. A buffer stock policy for routine and emergency services to be developed.
6. Human resources- Adequate number of staff that will fully complement the functions in the supply chain unit to be provided with clear cut roles and responsibilities.
7. The emergency plan to be disseminated to all health facilities with accompanied training as and when needed.

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

HEALTH SUPPLY CHAIN PERFORMANCE IN EMERGENCIES IN SIERRA LEONE

QUESTIONNAIRE

SECTION A: Personal information of respondent

1. Age (Years) _____
2. Sex: 1. Male 2. Female
3. Highest level of education: 1. Certificate 2. Diploma 3. Bachelor's Degree 4. Masters Degree
5. Doctorate (Ph.D) 6. Others (please specify).....
4. Cadre: 1. Pharmacist 2. Pharmacy Technician 3. Nurse 4. CHO 5. CHA
6. Others (please specify).....
5. Years of Employment: _____
6. Level of operation: 1. Central 2. District
7. Designation:

1	District Pharmacist	
2	District Information Officer	
3	District Logistics Officer	
4	District Storekeeper	
5	District Hospital Pharmacist	
6	National Storekeeper	
7	Head of Unit, Pharmaceutical Management Information System	
8	Staff, Access and Availability Unit	
9	Others (Please specify)	

8. How many years of experience do you have in Supply Chain? :
1) 0-5 years 2) 6-10 years 3) 11-15 years 4) Above 15 years

9. Do you have any special training in Supply Chain? 1. Yes, 2. No

10. If Yes, please specify the special training in Supply Chain:.....
.....
.....
.....

SECTION B: Assessment of storage facility

NAME OF FACILITY REGION

CATEGORY OF FACILITY DATE

1. At your level, please indicate the following by ticking under available and adequate, available but inadequate, or not available to describe your current situation

	Available/Adequate (1)	Available/Inadequate (2)	Not Available (3)
Storage Space
Shelves
Pallets
LMIS Tools
Stand by vehicle
Paid Staff
Axillary staff/labour
Guideline document on Supply Chain

2. Inventory Management

Is there an inventory control system available for the storage of pharmaceuticals? 1. Yes 2. No

If Yes what is the nature of the inventory control system?

1. Electronic 2. Manual 3. Electronic and Manual 4. Not Applicable

3. Apart from the GoSL/MoHS, at your facility, list other partners who participate in supply chain system strengthening:

.....

4. At your level, indicate all that applies as limitations for improvement of supply chain systems.

- Qualification in supply chain management
- Number of staff
- Available equipment
- Available funds
- Management support
- Number of participating stakeholders/partners
- Parallel system of supply
- Push vs Pull
- Others; Please specify

.....

5. At your level, indicate all that applies as opportunities for improvement of supply chain systems.
- Building capacity in supply chain management
 - More qualified personnel in supply chain management
 - Need for integration of supply chain management activities
 - Introducing short courses in supply chain management
 - Stakeholders/partners involved in supply chain management
 - Others; Please specify
-
-

Section C: Experience in Emergency

6. Have you ever worked as a supply chain officer in an emergency situation (e.g. Ebola outbreak, land slide, etc)?
1. Yes 2. No
7. How many emergencies were you actively involved?
- 1) One 2) Two 3) Three 4) >Three 5. None
8. During this/these Outbreak at your level
- i. How will you describe your supply chain management system
1. Excellent 2. Very Go 3. Good 4. Fair 5. Bad
- ii. How will you describe the movement of commodities from up/to down your level
1. Very fast (1-6hrs) 2. Fast (6-12hrs) 3. Slow (12-24hrs) 4. Very slow (>24hrs)
- iii. How will you describe the sharing of information from up/to down your level
1. Very fast (1-6hrs) 2. Fast (6-12hrs) 3. Slow (12-24hrs) 4. Very slow (>24hrs)
9. Did you have an emergency response plan at your level at the time?
1. Yes 2. No

Section D: Preparedness for future emergency/outbreak

10. In preparedness for future emergency describe the following with available and adequate, available but inadequate, or not available

	Available/Adequate (1)	Available/Inadequate (2)	Not Available (3)
Storage Space
Emergency Commodities (Buffer)
Staffing Capacity
Stand by mobility
Support from higher level
Support from supervisors
Information sharing
Available Equipment
General Management Capacity

11. Do you currently have an emergency response plan at your level?

1. Yes

2. No

Thank you for your valuable inputs, time and kind cooperation

Appendix 2: Informed Consent Form

COLLEGE OF MEDICINE & HEALTH SCIENCES
EAC REGIONAL CENTRE OF EXCELLENCE FOR VACCINE,
IMMUNIZATION & HEALTH SUPPLY CHAIN MANAGEMENT
MASTERS IN HEALTH SUPPLY CHAIN MANAGEMENT
INFORMED CONSENT

Title of Study:

“HEALTH SUPPLY CHAIN PERFORMANCE IN EMERGENCIES IN SIERRA LEONE”.

Supervisors: Prof. Mohamed H. Samai and Dr. Joseph Sam Kanu

Student Researcher: Pharm. Jatu J. Abdulai

I am asking for your voluntary participation in my research project. The study has been approved by the College of Medicine and Allied Health Sciences, University of Rwanda and the Ethics Committee of the Ministry of Health and Sanitation in Sierra Leone. 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:

The main purpose of this study is to assess the status of the Pharmaceutical Supply Chain System at Central and District levels of operations. The study will also assess the level of preparedness of the supply chain in case of any emergencies.

If you participate:

The study will require you to answer to questions related to participant’s identification, Organizational Data, your experience in supply chain, and the level of emergency preparedness planning of your facility for emergency.

Time required for participation:

The study will require about 15 to 30 minutes answering to the questions and the assessment of your facility.

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 any relevant governmental agency, Department of EAC Regional Centre of Excellence for Vaccine, Immunization & Health Supply Chain Management, College of Medicine & Allied Health Sciences, University of Rwanda or by the persons conducting this study, (provided that such inspectors are legally obligated to protect any identifiable information from public disclosure, except where disclosure is otherwise required by law or a court of competent jurisdiction. These records will be kept private as best as possible.”

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

Supervisors:

Prof. Mohamed H. Samai; Tel.: +232-78-841262, Email: dhmsamai@yahoo.com

Dr. Joseph Sam Kanu. Tel.: +232-76-656781, Email: samjokanu@yahoo.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.

Consent

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 Clearance Approval



Adobe Acrobat
Document

References

1. 201906_ESC SL Playbook Technical User Guide_vf. (n.d.).
2. Aronovich, Dana, MarieTien, Ethan Collins, Adriano Sommerlatte, and L. A. 2010. (2010). Measuring Supply Chain Performance: Guide to Key Performance Indicators for Public Health Managers. *U.S. Agency for International Development*, (May), 62.
3. Hale, T., & Moberg, C. R. (2005). Improving supply chain disaster preparedness: A decision process for secure site location. *International Journal of Physical Distribution and Logistics Management*, 35(3), 195–207. <https://doi.org/10.1108/09600030510594576>
4. Health, G., Chain, S., Assistance, T., & Task, F. (2018). Emergency Supply Chain Preparedness Overview Guide, (June).
5. HPRT_final-e clearance_Disaster-Preparedness-Manual-PCO-Cleared_April-27. (n.d.).
6. Jones, C. (2015). Evaluation of UNICEF Supply Division ' s Emergency Supply Response Final report, (January).
7. Liu, M., & Lane, D. E. (2013). Faculty of Graduate and Post-Doctoral Studies Master ' s Program in Management Thesis Proposal Supply Chain Management in Humanitarian Aid and Disaster Relief Student Name : Mingli Liu Student Number : 6836114 University of Ottawa October 2013, (October), 1–109.
8. Natarajarathinam, M., Capar, I., & Narayanan, A. (2009). *Managing supply chains in times of crisis: A review of literature and insights. International Journal of Physical Distribution & Logistics Management* (Vol. 39). <https://doi.org/10.1108/09600030910996251>
9. Project, U. D., & USAID Deliver Project. (2011). The Logistics Handbook A Practical Guide for the Supply Chain Management of Health Commodities.
10. Safety, A. F. (2011). Best Practices in Supply Chain Management, 0–16.
11. Session, W. (2019). MCM and ESC Framework - Implementation in Sierra Leone.
12. Sheu, J. B. (2007). Challenges of emergency logistics management. *Transportation Research Part E: Logistics and Transportation Review*, 43(6), 655–659. <https://doi.org/10.1016/j.tre.2007.01.001>
13. Skryabina, E., Reedy, G., Amlôt, R., Jaye, P., & Riley, P. (2017). What is the value of health emergency preparedness exercises? A scoping review study. *International Journal of Disaster Risk Reduction*. <https://doi.org/10.1016/j.ijdrr.2016.12.010>
14. VanVactor, J. D. (2012). Strategic health care logistics planning in emergency management. *Disaster Prevention and Management: An International Journal*, 21(3), 299–309. <https://doi.org/10.1108/09653561211234480>

15. 201906_ESC SL Playbook Technical User Guide_vf. (n.d.).
16. Aronovich, Dana, MarieTien, Ethan Collins, Adriano Sommerlatte, and L. A. 2010. (2010). Measuring Supply Chain Performance: Guide to Key Performance Indicators for Public Health Managers. *U.S. Agency for International Development*, (May), 62.
17. Hale, T., & Moberg, C. R. (2005). Improving supply chain disaster preparedness: A decision process for secure site location. *International Journal of Physical Distribution and Logistics Management*, 35(3), 195–207. <https://doi.org/10.1108/09600030510594576>
18. Health, G., Chain, S., Assistance, T., & Task, F. (2018). Emergency Supply Chain Preparedness Overview Guide, (June).
19. HPRT_final-e clearance_Disaster-Preparedness-Manual-PCO-Cleared_April-27. (n.d.).
20. Jones, C. (2015). Evaluation of UNICEF Supply Division ' s Emergency Supply Response Final report, (January).
21. Liu, M., & Lane, D. E. (2013). Faculty of Graduate and Post-Doctoral Studies Master ' s Program in Management Thesis Proposal Supply Chain Management in Humanitarian Aid and Disaster Relief Student Name : Mingli Liu Student Number : 6836114 University of Ottawa October 2013, (October), 1–109.
22. Natarajarathinam, M., Capar, I., & Narayanan, A. (2009). *Managing supply chains in times of crisis: A review of literature and insights*. *International Journal of Physical Distribution & Logistics Management* (Vol. 39). <https://doi.org/10.1108/09600030910996251>
23. Project, U. D., & USAID Deliver Project. (2011). The Logistics Handbook A Practical Guide for the Supply Chain Management of Health Commodities.
24. Safety, A. F. (2011). Best Practices in Supply Chain Management, 0–16.
25. Session, W. (2019). MCM and ESC Framework - Implementation in Sierra Leone.
26. Sheu, J. B. (2007). Challenges of emergency logistics management. *Transportation Research Part E: Logistics and Transportation Review*, 43(6), 655–659. <https://doi.org/10.1016/j.tre.2007.01.001>
27. Skryabina, E., Reedy, G., Amlôt, R., Jaye, P., & Riley, P. (2017). What is the value of health emergency preparedness exercises? A scoping review study. *International Journal of Disaster Risk Reduction*. <https://doi.org/10.1016/j.ijdr.2016.12.010>
28. VanVactor, J. D. (2012). Strategic health care logistics planning in emergency management. *Disaster Prevention and Management: An International Journal*, 21(3), 299–309. <https://doi.org/10.1108/09653561211234480>