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Medical Laboratory Supply Chain Management Reviews; Implications in Achieving a Standard Diagnostic Outcome

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ABSTRACT
Medical laboratory Supply Chain Management is the planning and management of all processes from sourcing through procurement and logistics management of the laboratory commodities and services through commodity security and reduction of laboratory wide cost to ensure client satisfaction. The performance measurement of Medical Laboratory Supply Chain Management revealed low percentage statistics globally especially in Africa and Nigeria in particular which has affected the nation's health system and outcomes. It was recommended that appropriate policy guidelines implementation and documentations, continuing professional development for medical laboratory professionals and other health workers especially stores/procurement officers are quite essential. Baseline and periodic horizontal supply chain management laboratory audit to establish and monitor status is quite imperative.

I. INTRODUCTION

BACKGROUND OF THE STUDY

Supply Chain Management involves the planning, coordinating and controlling of series of interconnected activities involved in moving a firm's raw materials ,equipment component parts and finished products from suppliers to end users in order to increase service or reduce system wide costs. Supply chain of medical laboratories typically involves raw materials, manufacturers, distributors and end users. The successful management of supply chain aim to increase productivity and efficiency in medical laboratories.

In 1979, Thomas A and Davis SE introduced the concept of supply chain management to control the cost of Medical Laboratories. Supply Chain Management involves the coordination and partnering with suppliers, manufacturers, vendors, .service providers and customers within and across companies (USAID, 2011).It comprises the planning and management of all processes from sourcing through procurement and logistics management of the goods /services to ensure the satisfaction of customers. However, the medical laboratory supply chain management has been found to be at its infant stages globally though collaborative efforts by stakeholders (governments, donors, implementing partners and health facilities staff) will reduce the challenges and bring the laboratory commodity upfront with pharmaceutical supplies(ASML Newsletter,2012).The supply chain in Nigeria in particular is described as poorly coordinated platform thereby leading to poor quality healthcare often the reason for medical tourism(Nsikan et al,2019).

Logistics management is a component of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods /services between the point of origin and the point of consumption in order to meet customers' requirement(Kumurya ,2015;Ughweoghene et al ,2017;Cooper and Ellram,1993).

It is a branch of management that studies the process of planning, implementing and controlling the efficient and cost effective flow and storage of materials, information, goods, services from point of origin to point of consumption

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between suppliers and consumers (Edward, 2002,Hugo et al.,2002).

Owens and Warner (2003) conceptualized logistics as time related positioning of resources.

According to Chandani (2004), logistics is having the right commodity in the right quantity at the right time at the right place for the right price.

Larkia (2008) views logistics from two concepts either as a steady flow of material through network of transport links and storage mode or a coordination of sequence of resources to carry out some project.

Logistics is the process of strategically managing acquisition, transport and storage of commodity through the organization and its marketing channel so as to maximize profit by cost effective fulfilment of orders (Stock and Lambert, 2001).

The Chartered Institute of Logistics and Transport (CILT) of the United Kingdom defined logistics as the management of the flow of goods, information and other resources, including energy and people, between point of origin and point of consumption in order to meet the requirements of consumers. It also involves the integration of information, transportation and inventory, warehousing, material- handling and packaging

Logistics Management integrates with marketing, sales manufacturing ,finance and information technology(Monczka et al,1998) and it is an operational aspect of supply chain management which tend to focus on specific task within a public health program(CSLI,2018).Logistics management ensure that health facilities receive commodities from National warehouses

through the regional warehouses as is obtainable in Nigeria (FMOH,2016) which ensures customer satisfaction by fulfilling the six rights (to the right customer right ,in the right place, the right quantity, the right condition , the right time and at the right cost) with each activity delivering excellent customer service by ensuring commodity security(USAID,2010a).

HISTORY OF LOGISTICS

Stock and Lambert (2001) opined logistics has always been a critical part of 4Ps in marketing; Product, Price, Place and Promotion. The 'Place' component ensures that the product is at the right place, at the right time, in the right quantity and the right quality.

The term logistics comes from the late 19th century: from French logistique (logger means to lodge).Others attributed a Greek origin to the word λόγΟς, meaning reason or speech; λΟγΙστΙΚός, meaning accountant or responsible for counting (Tepic et al, 2011).Logistics is said to have originated in the military's need to supply themselves with arms, ammunition and rations as they move from their base to a forward position. In ancient Greek, Roman and Byzantine empires, there were military officers with the title ''Logistikas'' who were responsible for financial and supply distribution services. The arrangement was for efficient movement of the soldiers from their base to the next location which was important in determining the outcome of wars. This also involved disrupting the supply location of the enemy and protecting one's own supply locations. This brought about which can be related to the present system of logistics management (Coyle and Novak, 2006)

THE LOGISTICS CYCLE: ORGANIZING LOGISTICS SYSTEM ACTIVITIES

Logistics management includes some activities that support the six rights. Logisticians developed a model called the logistics cycle to demonstrate the relationship between the activities in a logistics system. An effective laboratory logistics system meets the six RIGHTS:

- RIGHT reagents in the
- RIGHT quantities in the
- RIGHT condition delivered …..to the
- RIGHT place at the
- RIGHT time for the
- RIGHT cost

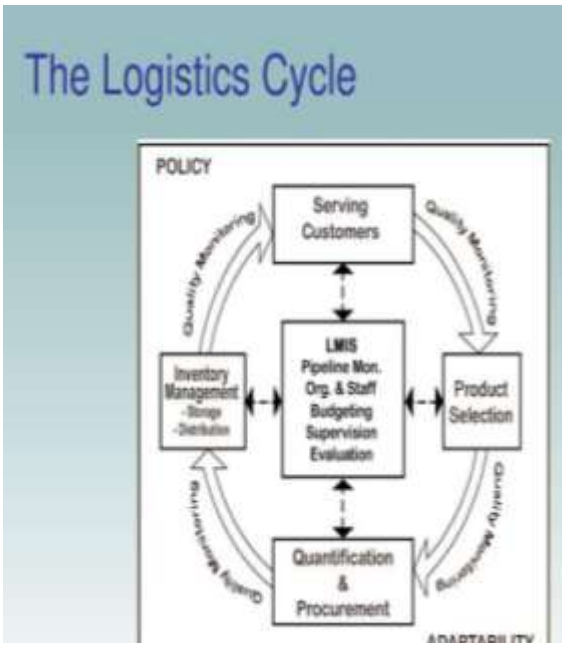

Figure 1.1: The Logistics Cycle(USAID/DELIVER PROJECT(2011)

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SERVING CUSTOMERS: The logistics system ensures customer service by fulfilling the six rights by series of activities promising commodity security which contributes to excellent customer service. The ultimate goal of medical laboratory supply chain management is to ensure clients satisfaction through proper selection of commodity, procurement and quantification based on logistics management information system, inventory management by appropriate distribution and storage in place. Serving clients is the purpose of a logistics system and so understanding customer needs is essential as they should inform product selection.

PRODUCT SELECTION: The health logistics system require that product be selected based on certain performance characteristics or specifications with the goal of meeting clients health needs by the medical laboratory testing. The Medical Lab Scientist has been trained and empowered by law governing the professional practice to ensure compliance with appropriate standards of professional best practices by end users. When a need is identified, commodities, technologies and other health products needed to address the needs bare selected. Products should be selected based on predetermined standard specifications.

QUANTIFICATION: Quantification is the process of estimating the quantity and cost of the products required to ensure an uninterrupted supply as well as determining when the products should be procured and distributed using a supply plan(USAID,2011).Following the selection of the right product the quantities needed in the short and long term are determined through quantification, the medical laboratory scientist is saddled with the responsibility of the quantification using the consumption rate or historical data generated as well as putting into plan the procurement ,storage and distribution network .

PROCUREMENT: Procurement is the process in which commodities are obtained via international, regional, or local sources of supply or even through a local agent. However, transparency and openness is required following a set of specific procedures to achieve the six rights of logistic management. The procurement process is usually preceded by selection and quantification of commodities .Having developed a supply chain plan,a procurement should be done even by a non-medical lab scientist provided it is verified and certified by a Medical lab scientist. Commodities must be procured after selection and quantification of the products.

INVENTORY MANAGEMENT: At the completion of product procurement and commodity received by the health program, the product must be warehoused and then transported to the service delivery points where the client will receive the product. This process called inventory management, product are received, assessed, and stored until they are distributed to the next level or until the customer needs them. A third party logistics (3PL) are usually charged with this responsibility of storage and distribution system (FMOH, 2017).

LOGISTICS MANAGEMENT INFORMATION SYSTEM: The logistics cycle require information as an engine in the form of historical data which is at the center of the cycle to drive the process. The onset of the cycle requires the laboratory manager to gather and analyze information about each activity in the system in order to take decisions and policies to coordinate future actions (USAID, 2010a).Logistics Management Information System (LMIS) is important for laboratory product selection, quantification ,procurement and distribution. Information about a product consumption and inventory levels should be gathered to guide the manager to know how much of the product to request or procure(USAID,2010a).Moreover, LMIS guides decisions at different levels of the system such as how long the supplies will last?; Do I have enough stocks until my next order is received?; Do we need an emergency order?; How to determine the order quantity?;where is the consumption highest?; Which unit needs more resources ?;Are we experiencing losses from the system that require us to take action?;Are products about to expire ?;Is there need to retrieve and distribute to other health facilities before they expire? It is the responsibility of a medical laboratory scientist to ensure appropriate laboratory commodity inventory management, storage and distribution (USAID, 2009a). The Medical laboratory Scientist should also determine the product shelf life and storage condition of the commodity , assign different maximum and minimum stock levels for slow-moving and fast- moving commodities, maintain laboratory LMIS to track the actual consumption stock on hand(SOH) and when redistribution is needed to avoid expiration(USAID,2009a).

ORGANIZATION AND STAFFING: Logistics system needs well trained, competent staff to

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monitor stock levels, place orders and provide products that meet customers' needs. The health program assign the requisite resources to staff e.g. supervision and technical knowledge to complete logistics activities. Some countries have established national logistics management units that analyze logistics data and provide feedback throughout to the system. E.g. In Nigeria , the National Product Supply Chain Integration Project(NSCIP) a component of the National Product Supply Chain Management Program (NPSCMP) established Logistics Management Coordinating Unit (LMCU) in the 36 states to collect ,validate and analyze logistics data flag off nonconformance and institute performance to correct anomalies for customer satisfaction(FMOH,2016). Facilities also need have staff properly trained to ensure proper inventory management information system established.

BUDGET: The allocation and management of finances affect the logistics cycle including the quantities of products that can be procured, the storage space available, available vehicles that can be maintained and number of personnel working for efficient logistics operations. Adequate provision and allocation of resources for medical laboratory commodities is important to ensure effective logistics scale up program.

SUPERVISION: Supervision of the staff members and their continuous on- the- job training in logistics ensure efficient supply chain management as well as prevention and resolution problems and human resource challenges (FMOH, 2016; USAID, 2011).The recruitment of non-qualified health workers in the supply chain management due to the level of unemployment makes the supervision of personnel employed in logistics management expedient.

MONITORING AND EVALUATION; Quality monitoring or periodic evaluation of the logistics management activities is relevant to ensure effectiveness of the system performance and impact on service delivery (USAID, 2011; FMOH, 2016).

POLICY: Government Policies and regulations affect all elements of the logistic system and countries have established national procedures and guidelines on selection of Medical laboratory products; how the items are procured; when the items are distributed ;where/ how the items are stored and the quantities supplied to the clients(FMOH,2016). Fiscal and budget policies are major determinants affecting the logistics system in terms allocation of funds for products procurement, critical infrastructure provision such as storerooms and transportation.

ADAPTABILITY: The ability of the logistics system to respond to the dynamics in product demand, changes in funding policies for logistics activities is a characteristic of all successful program called adaptability which will impact commodity availability. Adaptability requires the system to be flexible enough to respond to the constantly changing circumstances without redesigning the logistics system each time a new product is introduced or when commodity consumption increases by building more warehouses and purchasing more vehicles or increasing the frequency of resupply to avoid the need for larger storage facilities (FMOH, 2016).

Medical laboratory commodities can be categorized into the following:

- Equipment: include machines,analysers,instruments, automations used for or in testing;
- Kits: such as test kits and devices(e.g. rapid testing devices for the component of interest)
- Reagents and chemicals: chemicals (solid and liquid) and reagents are used in a chemical reaction to detect, measure, measure, examine or produce other substances. They vary widely in cost, stability, cold chain requirements, availability associated hazards. e.g. CD4Mab
- Consumables: Items that are used once while performing a test and are not reused, they are test-specific and general items that are used and discarded .e.g. Microscopic slides, EDTA Vacutainer and cover slips, bleach, pipette tips and hand gloves.
- Durables: Reusable items for multiple tests such as glassware and plastic ware, vortex mixer, micro pipette

Medical laboratory commodity supply chain system is challenging due to the nature of the commodities in use which in resource limited settings are often affected by the following:

- limited resources for procurement ;
- weak tracking and distribution ;
- the existence of parallel system (central, local and donor) and
- Challenges in forecasting future needs.

Statement of the Problems

- The status of Public /Private Medical laboratories most times are partially functional due to stock out of commodities , frequent breakdown of machines ,overstocking ,expiration

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of commodities and absence of guidelines etc. which are strong quality indicators of absent or poorly coordinated supply chain management and paucity of data and publications on this important aspect of healthcare program hence the need to carry out a study review of the medical laboratory supply chain management.

AIM: This work is done with the purpose to review and improve on the operations of supply chain management in medical laboratory practice.

SPECIFIC OBJECTIVES

1. To determine the degree of implementation with respect to medical laboratory supply chain management.
2. To find out the obstacles /hindrances towards Supply chain management specifically for medical laboratory commodities,
3. Success strategies to achieve medical laboratory supply chain management which can improve health outcome indices and quality medical laboratory services using indicators like customers satisfaction, productivity etc.

SIGNIFICANCE OF THE REVIEW STUDY

This reviewstudy of the supply chain management will benefit the customer so that the improvement in services will result in greater confidence and availability of quality test results for improved clinical decisions and management. The health facilities will be able to improve in proper quantification and procurement of required commodities reducing wastages and improve resource management. The nation will eventually have a more coordinated health system that is working and delivering good health outcomes to its citizenry.

DEFINITION OF TERMS

USER, CLIENTS, and PATIENTS AND CUSTOMERS: They are end users or receives services/supplies .The terms are used interchangeably throughout the article.

SUPPLIES, COMMODITIES, REAGENTS, MATERIALS, PRODUCTS AND STOCK:

The items flow through a logistics system .The terms are used interchangeably throughout this article.

USERS: People who use a product that is not given to a patient or client but is used for them e.g. the medical Laboratory Scientist is the user of the products.

PATIENTS:Often associated with the health facility and customers for whom medical products are used to test their body samples to establish a diagnosis.

CUSTOMERS:Typically used by the private sector to reinforce the concept of customer service. In public health programs, all users, clients and patients are considered to be customers, the health facility laboratories are there to serve them.

CONSUMPTION/DISPENSED/DISPENSED TO USER/USAGE DATA: Data on the quantity of goods given or used by the customers.

SERVICE DELIVERY POINT: Any facility or medical laboratories where users receive supplies related to health services.

LEAD TIME: The time between when new stock is ordered and when it is received and available for usage.

PIPELINE: The entire chain of physical storage facilities and transportation links through which supplies move from the manufacturer to the user including port facilities, central /regional /district warehouse, all service delivery points, transport vehicles and community based distribution network.

SUPPLY CHAIN MANAGEMENTS encompasses the planning and management of all activities involved in sourcing, procurement and all logistics management activities that ensure customer satisfaction through commodity security.

LOGISTICS MANAGEMENT is defined as the part of supply chain management that plans, implements and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and point of consumption in order to meet customer requirement.

II. REVIEW OF RELATED LITERATURE

Medical diagnostic and treatment decisions are based on the investigations carried out by Medical laboratory Professionals (AMLSN, 2014). Lack of access to medical Laboratory commodities could result to delayed laboratory results which could lead to incorrect or misdiagnosis which is counterproductive in health care service delivery. Medical laboratory commodity security therefore is an important component of quality management system which provides for quality and competence necessary to meet customer satisfaction. Statistics from the World Health Organization (WHO, 2004) show that about one third of the world population do not

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have access to vital medical products. In some African and Asian Countries about 40 percent of the population do not have access to vital medical products. A vital medical product is one that is essential and lifesaving on the basis of being available, affordable and quality assured and properly used by an individual or community.

Studies observed that about two billion of the world's population; mostly less developed nations lack access to vital lifesaving medical products resulting in many people still suffering from treatable diseases. Human development index (HDI) has been found to be poor in Nigeria with bad performance of the nation in health outcome. Lack of access to qualitative healthcare is a major cause of poor health outcome (Nsikan et.al, 2019).

In Nigeria, the federal Ministry of Health in 2010 carried out a survey which summarily described the medical supply system in the country as poorly coordinated and fragmented resulting in wastage of resources and denying the populace of access to essential medical products, drugs and medications (Nsikanet al, 2019).

There is need therefore for evidence-based study on this important aspect of healthcare management and quality assurance of the supply chain.

Supply chain management is bedeviled with inadequate planning and monitoring, logistics issues, storage and access drawbacks resulting in high amount of expired medicalcommodities and wastages (Tull, 2018). This can be avoided through improved and well-coordinated network and capacity development of health personnel's in order to achieve high and efficient utilization of health commodities (Aturakaet al., 2017). Decentralization of the supply chain management no thought has be found to shorten the lead time supply chain process thereby improve quality assurance and better health outcome (Olakundeet al., 2019)

The Medical Laboratory performs different laboratory tests with biomedical gadgets, equipment, materials and chemicals using biological samples(Berhanu, 2006). Medical Laboratories tests are important in the diagnosis and treatment plan for patients and have impact on the overall quality national health services delivery. In developed climes, the cost of supply represents a critical portion of the operating Medical Laboratories which are estimated between 15% to 40 %{ Sana'a A. Alsalameh& Mohamed F. Ababeneh , 2018}.

The Medical Laboratory has a responsibility of providing quality healthcare service delivery to meet the societal need of a responsive and functional health system. A well functional health system plays important roles in meeting the following needs for the populace:

- Improve the status of individuals ,families and communities;
- defend the population against what threatens its health;
- protect people against the financial consequence of ill health;
- provide equitable access to people centered care;
- Makes it possible for people to participate in decision making affecting their health and health and health system in the form of essential medical products and technologies.

The Medical laboratory services is a component of the health system building blocks which also require other components such as leadership and good governance ,health information system,health financing, human resource for health and service delivery to make up the structural framework of a functional health system. The essential medical products and technologies arecritical to a viable health systemby serving the following purposes:

I. confirmation of disease identification and drug susceptibility testing;
II. identification of management of adverse effect(e.g. monitoring of pharmaceutical toxicity);
III. screening of "at risk patients";
IV. disease surveillance studies;
V. confirmation of medical intervention efficacy;
VI. quality control(pharmaceutical quality,proficiency testing);
VII. Education-training physicians, Medical laboratory professionals and health care workers.

The Medical laboratory therefore plays a pivotal role in community health for disease control and surveillance as well as individualized patients diagnosis and care to provide the results required for appropriate management of patients (Efren et al ,2019).However, in less developed nations many people lack access to a functional and effective medical laboratory services and vital ,lifesaving medical products thereby suffering preventable and treatable diseases(WHO,2014;MSH,2012).Medical laboratories are located in health institutions to provide and promote health services delivery .Lack of access to qualitative healthcare is one of the fundamental causes of poor health outcomes in most African countries. In Nigeria, poor access to medical products is worsened by multifactorial issues such as meagre funding, insufficient /unutilized research findings and development, inadequate human capacity and undeveloped network of healthcare supply and distribution.

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REVIEWS OF RELATED STUDIES ON EVALUATION OF LOGISTICS MANAGEMENT

Historical empirical data from a number of studies conducted to assess the logistics management implementation shows deficiencies in many areas indicated by inaccurate logistics data, frequent expiration and stock outs of key commodities and absence of the use of key essential logistics tool variables (Stock on Hand, consumption rate..,losses and adjustments) required for policy formulations and decision making(Allers and Riwa,2001;JSI/DELIVER,2003;Jubulani et al,2005;Akwei et al,2006;Francis et al 2006;Andy et al,2008;Pharasi,2007;Butao et al.,2009).

Ali (2006) postulated that contraceptives use will drop by twenty percent (20%) in developing countries due to less efficient supply chain management which was the outcome of his studies on interaction between logistics activities and other variables influencing contraceptives use.

Assessment conducted in Lesotho to determine the status of Laboratory capacity to support the scale –up of ART program reported that laboratories experienced frequent and prolonged stock-outs of key reagents for months. No minimum and maximum stock levels set laboratories and absence of Bin cards to track laboratory commodities .No standard guideline/SOP or procedure developed to determine orders and inadequate and poorly ventilated storage spaces. Some of the labs did not store according to first expiry first out (FEFO) practice and expired and no laboratory separated expired /damaged supplies from usable products. Few laboratory staff members were trained in Logistics Management Information System (LMIS).Lack of guideline led to erratic, inconsistent order placement and unreliable data due to poor record keeping (Pharasi, 2007).

Jabulani et al, 2005 conducted a cross sectional facility-based survey in Zimbabwe which showed that 34.4% and 31.9% of the facilities studied reported stock out for Unigold and Determine HIV raid test kits respectively during six months before assessment. Sixty percent (60%)of the facilities recorded stock on hand that differed from the physical inventory on the day of visit.

Akwei et al ,2006 reported that a study in Ghana showed no minimum/maximum stock level for laboratory supplies, no stock bin cards was maintained for tracking commodities, no ordering guideline or standard operating procedures(SOP) in the system.

Health facility survey in Uganda showed supply chain deficiencies due to inadequate training of staff members on LMIS, frequent stock out of reagents of key commodities which affected the accessibility and quality of laboratory services (Francis et al, 2006).

Butao et al, 2009 reported that a study in Malawi showed minimum/maximum stock level and emergency order points (EOP) were not set for laboratory commodities and stock/bin cards were not used in the laboratory store .Moreover, CD4 and chemistry reagents were stocked out in twenty-eight and sixty percent of the facilities as well as HIV rapid testing kits, there was no written storage guideline of commodities.

Allers et al ,2007 reported that a cross sectional descriptive and qualitative assessment in Sierra Leone indicated lack of standardized LMISprocedures forcollection, monitoring, controlling and reporting of essential logistics data which affected the timely detection and management of stock imbalances to avoid stock outs and overstocking throughout the country's supply pipeline.

In Rwanda, an assessment of the health commodity supply showed 42% of facilities had expired HIV related laboratory commodities and 39% and 3.4 had stock outs of rapid test kits and chemistry reagents respectively. The inventory control procedures were substandard and inadequate storage conditions found in the laboratory stores (Lijdsman et al, 2003).

Barrey et al, 2005 reported that an assessment of integrated logistics system performance in Tanzania showed 35% of laboratories had stock out of laboratory commodities.

Desale et al, (2013) reported that in Ethiopia there was a well-designed logistics system for laboratory commodities, standard LMIS formats and established inventory control procedures but most laboratory professionals were not trained in LMIS resulting in poor implementation. The assessment revealed 73.5% expired ART monitoring commodities in stock and key ART monitoring commodities were stock out at many facilities for up to six months.

A study in Uganda on assessment of laboratory commodities showed that LMIS was available in only 5% of the facilities assessed and reported that 23% had expired stocks out and sixty six percent (66%) of the facilities made emergency orders for commodities in six months prior to the study even though more than 50% of the facilities assessed had staff trained on logistics management system of health commodities (MAUL, 2013)

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III. MATERIALS AND METHODS

Data collection

Literatures were obtained from Global Health and PubMed databases; USAID Project and other relevant websites using Chrome search engine and type in the key words Medical Laboratory Supply Chain Management, Logistics management of medical lab commodities.

IV. DISCUSSION AND RECOMMENDATIONS

The review of surveys and assessment of supply chain and logistics management system practices were found to be poorly coordinated in most developing countries and in its embryonic developmentalstages globally requiring strong commitments from government agencies, donors ,implementing partners ,health facility staff , supply chain organizations and logistics agents(Nsikanet al, 2019). The logistics management implementation shows deficiencies in many areas shown by inadequate / inaccurate logistics data resulting from improper documentations/records, frequent expiration and several stock outs of key commodities in many health facilities which are poor quality indicators of key variables in supply chain program tools(Allers and Riwa,2001;Jubulani et al,2005;Akwei et al,2006;Francis et al 2006;Andy et al,2008;Pharasi,2007;Butao et al.,2009).

Some of the numerous challenges that have hampered the development of supply chain management include:

- Weak human resource capacity to implement and monitor supply chain programs by health facilities and regulatory agencies(Tull,2018);
- Poor supply and demand logistics management of laboratory commodities issues based on conflicting government policies and inadequate personnel training/3PL contractual arrangements;
- Absence of standardized/harmonized guidelines by health facilities and parallel program implementation of donors and government agencies;
- Inadequate planning and funding by donors and government agencies/ministry or departments responsible;
- Unstable funding and budgeting pattern by donors and government agencies
- Poor infrastructure and professional interferences (USAID, 2011).

The commitment and support of donor partners and government agencies to implement and embrace the quality management system(QMS) practices will help to domesticate the supply chain management in our health facilities and systems .Supply Chain Management is a continuous strategic process that cannot be achieved in isolated steps, it is performed to maintain steady laboratory operations (Sana'a et al, 2018).The implementation of supply Chain and logistics management will work to deliver timely ,cost effective and quality laboratory services in our health institutions. The purpose of robust Medical laboratory Supply chain cannot be overemphasized which among other things includes:

- To enable Medical labs provide patients with quality testing services for diagnosis of diseases;
- Build human resource of medical lab staff skilled to perform reliable, effective and efficient testing services;
- To guarantee consistent availability of testing commodities for continuous medical lab services for patients management and care;
- Preparedness against epidemics and disease outbreaks in terms of being equipped to conduct epidemiological studies and case contact analysis.

RECOMMENDATIONS

The following recommendations have been made based on the findings and conclusions made in this review study:-

1. Further survey/researches / studies should be carried out in all health facilities especially secondary and tertiary health institutions to ascertain baseline and improvements on implementation of supply chain management program in the healthcare institutions;
2. All staff members in logistics/stores/procurement should be trained in supply chain management /logistics as an orientation program;
3. All Medical Laboratory professionals/Scientists who are unit supervisors/heads/mangers must have a training certification in Supply Chain Management before assumption of the responsibility ;
4. Periodic assessment of Health facilities compliance with checklist on zero expiries, stock out of essential lab commodities and equipment downtime;
5. The inclusion of supply chain management courses in Medical Laboratory Science program for undergraduates;

6. The advocacy to amend government policies that affect the supply chain management implementation in the healthcare services.
7. The enactment of supply chain management law as prerequisite for establishment of Medical laboratories in health facilities.

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