

## Medical laboratory scientists and the Public Health Laboratory Commodity Supply Chain Management in Nigeria

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### ABSTRACT

#### Background

The job of the Public health supply chain is to manage the Public health laboratory commodities from production to service delivery point. This study analyzed Public health laboratory commodity supply chain management in Nigeria and the role of medical laboratory scientists.

**Methods:** Literatures were obtained from Global Health and PubMed databases; USAID Deliver Project and other relevant websites using Eldis search engine. The conceptual framework for analysing public health laboratory supply chain management in Nigeria and the role of medical laboratory scientists was adapted from USAID Deliver Project Logistics Cycle framework.

**Findings:** Non-medical laboratory scientists dominated Public health laboratory supply chain management in Nigeria. At the federal and state ministries of health, supply chain management of Public health commodities (Pharmaceuticals and Laboratory supplies) were domicile in the Directorate of Pharmaceutical Services. Weak human resource capacity, poor supply/demand management, inadequate funding/infrastructure as well as professional interferences were found to affect laboratory commodity supply chain management.

**Conclusion:** Robust laboratory supply chain management ensures commodity security with an overall impact on quality of care. The Medical Laboratory Science Council of Nigeria, Medical Laboratory Scientists, policy makers and other relevant stakeholders should ensure management of laboratory supplies by experts.

#### Keywords

Laboratory, Supply Chain Management, Nigeria.

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## INTRODUCTION

Approximately 75% of all medical diagnostic and treatment decisions are based on the testing performed by Laboratory Science professionals<sup>1</sup>. This emphasizes the critical role of medical laboratory in health care delivery. Just as an incorrect laboratory test result could lead to a misdiagnosis, unavailability of laboratory commodities could be potentially fatal<sup>2</sup>.

The Public health Laboratory supply chain management system encompasses all activities involved in the sourcing, procurement and all logistics management activities that ensure customer satisfaction through public health laboratory commodity security<sup>3</sup>. The medical laboratory supply chain management is one of the six core components or building blocks of a functional and efficient health system<sup>4</sup> and it validates the role of access to essential medicines/technology. Laboratory commodity security is also an important part of a quality management system, and it requires for quality and competence- a collection of processes focused on consistently meeting customer requirements and enhancing their satisfaction<sup>5</sup>.

There is a growing interest in quality laboratory result predicated on molecular analysis and other high-tech approaches, with limited emphasis on supply chain management of laboratory commodities. Achieving a 99% level of quality means accepting a 1% error rate<sup>6</sup>. Therefore, laboratory supply chain management, which spans through the entire components of laboratory quality management system can introduce the 1% error in quality result if neglected and could result in a situation which could impact adversely on customers/clients<sup>6</sup>, hence the need for the study on supply chain management in medical laboratory science practice.

This study reviewed the laboratory supply chain management system and the role medical laboratory scientists. This was done by defining the supply chain and Logistics management in the context of medical laboratory practice, examining the components of a logistics cycle vis-a-vis the place of a medical laboratory scientist while, enumerating the importance of efficient and effective laboratory supply chain management and, highlighting some of the challenges facing laboratory supply chain management in Nigeria and the way forward.

## METHODS

### Data collection

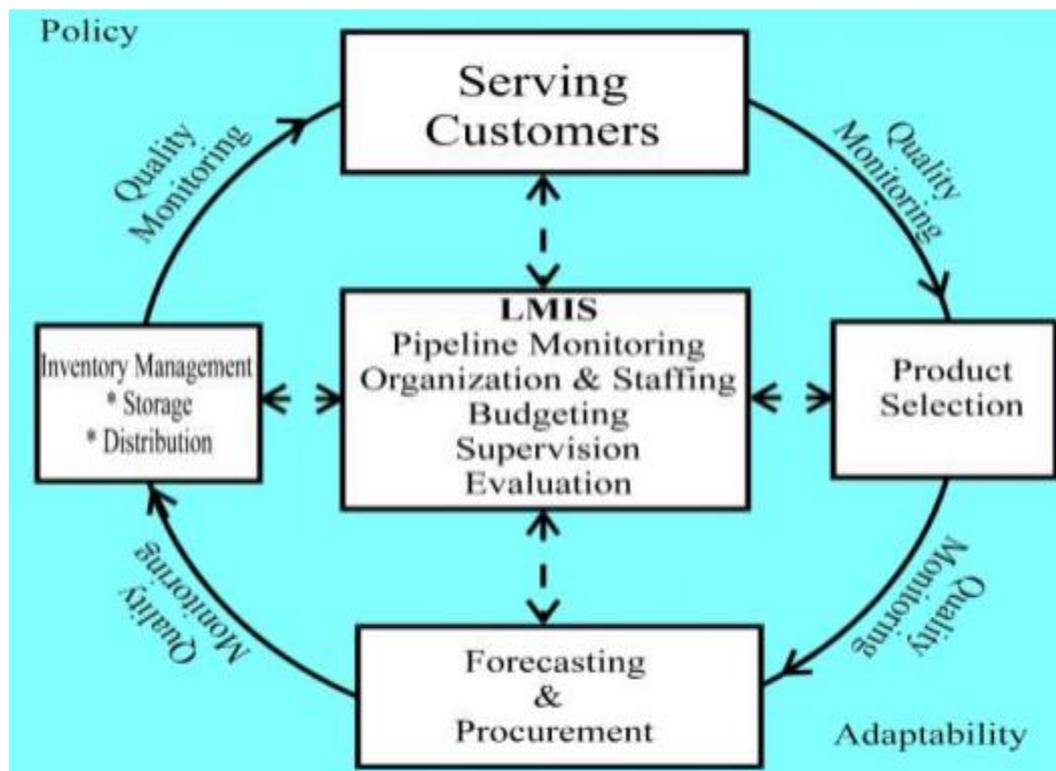
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### Conceptual framework

The conceptual framework for analysing public health laboratory supply chain management in Nigeria and the role of medical laboratory scientists was adapted from USAID Deliver Project Logistics Cycle framework<sup>8</sup>.

### Logistics Cycle Framework

Logistics system is cyclic and consists of the following activities: serving customers, product selection, forecasting/quantification and procurement, inventory management-storage/distribution, logistics management information system (LMIS) which are influenced by policies, funding, personnel, supervision and are expected to be flexible (adaptability), continuously monitored and managed by an expert, a medical laboratory scientist in the case of public health laboratory supply chain management<sup>8</sup>.



### Definition of terms

#### Supply Chain Management

Supply chain management encompasses the planning and management of all activities involved in sourcing, procurement and all logistics management activities that ensures customer satisfaction through commodity security<sup>7</sup>. Importantly, it includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. Supply chain management integrates supply and demand management within and across companies<sup>8</sup>.

#### Logistics management

Logistics management could be 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 the point of consumption in order to meet customers' requirement<sup>9</sup>. Logistics management is a branch of management that studies the process of

planning, implementing and controlling the efficient, cost effective flow and storage of goods, services from point of origin to point of consumption<sup>10</sup>. Logistics management is an integrating function, which coordinates and optimizes all logistics activities, as well as integrates logistics activities with other functions including marketing, sales manufacturing, finance, and information technology<sup>11</sup>.

#### Supply Chain and Logistics compared

Logistics system is the operational component of supply chain management<sup>2</sup>. Activities in Logistics system include: quantification, procurement, inventory management, transportation and fleet management, as well as data collection and reporting<sup>12</sup>. Supply chain management includes the logistics activities plus the coordination and collaboration of staff, levels, and functions<sup>9</sup>.

While supply chain includes global manufacturers as well as supply and demand dynamics, logistics tends to focus more on specific tasks within a particular public health program such HIV/AIDS, Malaria elimination, Reproductive

Health/Family Planning and Tuberculosis /Leprosy, Immunization, Neglected Tropical Disease (NTD), and Nutrition programs- the seven major public health programs with robust supply chain management system in Nigeria<sup>10</sup>. In this work, supply chain management and logistics management will be used interchangeably to mean the same thing.

## FINDINGS AND DISCUSSION

### Analysis of public health laboratory supply chain management in Nigeria Serving Customers

The customer is the rallying point of a logistics system as every activity ranging from product selection, procurement, storage, or distribution is aimed at meeting his needs. Hence, the overarching goal of a logistics system is customer satisfaction predicated on availability of product for laboratory investigation<sup>13</sup>. Storekeepers in medical laboratory stores do not store laboratory reagents just for the purpose of storing; they store them to ensure that the reagents are available for every customer when they need them. In addition to serving the needs of the customer seeking health services, each person in the process is also serving the needs of more immediate customers<sup>14</sup>. In Nigeria, the national warehouse provides customer service when they issue commodities to the regional warehouses, and the regional stores provide customer service when they issue commodities to the health facilities<sup>15</sup>. At the health facility, the storekeeper provides customer service when commodities are issued for use on a customer who needs it. The logistics system ensures customer service by fulfilling the six rights with each activity contributing to excellent customer service by ensuring commodity security<sup>3</sup>.

The overarching role of a medical laboratory scientist is to ensure customer satisfaction through availability of public health laboratory commodities across all levels- the national warehouse, regional

warehouse, state warehouse, facility stores and ultimately to the end user<sup>8</sup>. Hence, a client or patient for any public health laboratory investigation should access it. There should be no uptake of such investigation on the basis of non-product availability.

### 4.2 Product Selection

In any health logistics system, health programs must select products<sup>16</sup>. Laboratory products selection must conform to both the international and local standards. To do this, a medical laboratory scientist should be responsible for product selection because this is best in the hands of a well trained and certified medical laboratory scientist who by virtue of his training knows what is best for a particular test and is capable of using same for customer satisfaction.

It is the primary role of a medical laboratory scientist to make specification and identification (as well as formulation where applicable) of laboratory commodities (reagents and consumables) required for effective and efficient running of the laboratory<sup>17</sup>. Medical laboratory science council of Nigeria (MLSCN) by the act of National Assembly, Act 11, 2003 is charged with the responsibility of regulating the practice of medical laboratory science in Nigeria<sup>17</sup>. The same Act 11, 2003 through the governing board empowers MLSCN to regulate the production, importation, sales and stocking of diagnostic laboratory reagents and chemicals. While MLSCN and the Directorate of Medical Laboratory Services should coordinate medical laboratory product selection at the national level, medical laboratory scientists should assume the same position at the service delivery points in compliance to MLSCN standard. The extent to which this policy/Act has been implemented leaves more to be desired. Selection, quantification and procurement public health laboratory supplies such as rapid diagnostic kits (RDT), consumables and

reagents by public health programmes is dominated by non medical laboratory scientists.

#### 4.3 Quantification

After a laboratory product has been selected, the required quantity and cost of the product must be determined<sup>18</sup>. Quantification is the process of estimating the quantity and cost of the products required for a specific health program (or service), and, to ensure an uninterrupted supply for the program<sup>8</sup>. Medical laboratory scientist being the user of a particular laboratory product should be able to make quantification of the selected laboratory products using consumption or historical data putting into perspective how the products quantified should be procured, stored and distributed<sup>12, 18</sup>.

#### 4.4 Procurement

After a supply plan has been developed as part of the quantification process, quantities of products must be procured<sup>3, 19</sup>. Health systems or programs can procure from international, regional, or local sources of supply; or can use a procurement agent. In any case, procurement should follow a set of specific procedures that ensure an open and transparent process that supports the six rights and organizational policies to put checks and balances must be upheld<sup>12</sup>. Once a product has been duly selected and quantified, procurement could be done by a designated individual who must not be a medical laboratory scientist. However, the procured laboratory product must be certified by a medical laboratory scientist in order to ensure that it meets specification in terms of quality and quantity<sup>3</sup>.

#### 4.5 Inventory Management

After an item has been procured and received by the health system or program, it must be transported to the service delivery point where the client will receive the products<sup>8, 20</sup>. During this process, the

products must be stored until they are sent to the next lower level, or until the customer needs them<sup>3</sup>. The third party logistics (3PLs) are usually charged with this responsibility<sup>21</sup>. However, a medical laboratory scientist should develop guidelines for appropriate storage of laboratory supplies for each level of the system, taking into account any variations that will exist in the types of products at each level of the laboratory network<sup>3, 19</sup>. He should set the maximum and minimum (Max-Min) level for each programme laboratory service, lead time, emergency order point, etc that will ensure product availability for customer satisfaction<sup>22</sup>.

#### 4.6 Logistics Management Information Systems (LMIS)

Information is at the center and hence is the engine that drives the logistics cycle. Without information, the logistics system would not run smoothly. In the beginning of the cycle, laboratory managers should gather and analyze information about each activity in the system to make decisions and to coordinate future actions<sup>20</sup>. Logistics Management Information System (LMIS) is important for laboratory commodity selection, quantification, procurement and distribution. It is especially critical for HIV/AIDS commodities that have high value and requires special handling procedures<sup>14</sup>. For example, information about product consumption and inventory levels must be gathered to ensure that a manager knows how much of a product to procure. <sup>3</sup>LMIS guides decisions at all levels of the system. Such decisions according to include, but not limited to; How long will supplies last? Do I have enough stocks to last until my next order is received? Do we need an emergency order? If you are placing an order, how do you determine the order quantity? Where is the consumption highest? Do these facilities need more resources? Are we experiencing losses from the system that require us to take action? Are products about to expire?

Should we retrieve and distribute to other health facilities before they expire?

It is the responsibility of a medical laboratory scientist to ensure proper laboratory commodity inventory management, storage and distribution<sup>12</sup>. The medical laboratory scientist should determine the product pipeline putting into consideration the shelf life and storage condition of such product, assign different maximum and minimum stock levels for slow-moving and fast-moving commodities, maintain cold chain for laboratory commodities that requires storage under cold temperature, maintain laboratory LMIS to track the actual consumption, stock on hand and to know when resupply is necessary and whether redistribution is important to avoid expiry<sup>12</sup>.

#### 4.7 Organization and Staffing

Like every organization, a logistics system can only work if well-trained, efficient staff monitor stock levels, place orders, and provide products to clients. Health programs assign the appropriate resources to staff (for example, supervision authority and technical knowledge) to complete logistics activities<sup>3</sup>. In fact, some countries have established national logistics management units that analyze logistics data and provide feedback throughout the system. In Nigeria, National Supply Chain Integration Project (NSCIP), an operational arm of National Product Supply Chain Management Programme (NPSCMP) established Logistics Management Coordinating Unit (LMCU) in the 36 states and FCT domicile in the Directorate of Pharmaceutical Service (DPS), State Ministry of Health to collect, validate and analyze logistics data, flag off issues and institute performance improvement to correct non-conformance for the overall customer satisfaction<sup>15</sup>. Organization and staffing, therefore, are important parts of the cycle. For a logistics system to work correctly, logistics staff must possess requisite training and skills

to function effectively in a logistics organization and make the six rights of logistics a top priority.

#### 4.8 Budget

Allocation and management of finances directly affect all parts of the logistics cycle, including the quantities of products that can be procured, the amount of storage space that may be available, the number of vehicles that can be maintained, and the number of staff working in logistics to guarantee the six rights of logistics<sup>8</sup>. Mobilizing resources and securing a budget line item for health commodities and logistics activities is extremely important to ensure that products are available and that the logistics system operates effectively<sup>15</sup>. To determine the resources needed to scale up, supply chain, managers first need to assess what the expected costs are at different levels of the logistics system. When determining supply chain costs, managers should consider the cost of storage, transportation, and management; and determine what share of these costs each group (i.e., Ministry of Health, donors, nongovernmental organizations [NGOs] among others) will cover. Therefore, a medical laboratory scientist should be in charge of budget for public health laboratory supply chain. Personal observation showed that the Policy Development, Planning and Implementation committee in the ministry of health, made up of directors, is the highest decision-making organ that oversees the activities of departments and agencies under the ministry of health. Public health laboratory supply chain management is one of the activities under the control of the committee; yet there is no medical laboratory scientist in the committee due to subjugation of the profession under the Directorate of Medical Services headed and represented in the committee by a medical doctor.

#### 4.9 Supervision

Supervising the staff who works within the logistics system keeps the system running smoothly and helps to anticipate needed changes<sup>8</sup>. Routine and effective supervision, coupled with on-the-job training in logistics, helps to prevent and resolve supply chain problems and human resource constraints<sup>15</sup>. With the dire need of human resource for health in Nigeria, task shifting and sharing has become a routine in the delivery of laboratory and other services in the health care industry. This makes the supervision of the activities of non qualified health workers conducting laboratory investigations by medical laboratory scientist's expedient.

#### 4.10 Monitoring and Evaluation

Routine monitoring and periodic evaluation of the pipeline and logistics system activities help demonstrate how well the system is performing, the areas that can be improved, as well as the system's impact on service provision<sup>8, 15</sup>.

It is important to understand the role of quality monitoring in ensuring an efficient and effective logistics system. Quality monitoring plays an important role in quantifying and procuring the right products, based on the appropriate product selection and use. Procurement decisions should be based on the supply plan that is developed during quantification<sup>8</sup>. To ensure product quality, procurement documents must include detailed product and packaging specifications, and the expectations for quality at the time of receipt<sup>12</sup>. After procurement, program managers in collaboration with medical laboratory scientists must check the quality of public health laboratory commodities before they enter the distribution system<sup>3</sup>. Public health laboratory products that are procured should be cleared quickly through customs, or other inspections, before being distributed to facilities. Currently in Nigeria, neither MLSCN nor its agent is involved in inspection of laboratory supplies at the port of entry. While products are received, stored, and

distributed, it is important to monitor their quality before use at service delivery points<sup>3</sup>. The post market validation of the laboratory supplies is the sole responsibility of a qualified medical laboratory scientist. Anecdotal evidence showed that some of these laboratory supplies find their way into the country without certification by MLSCN mandated by an act of National Assembly, Act 11, 2003 to perform such function. Furthermore, the quality of the storage conditions and transportation mechanisms should be monitored. Programs must determine if clients are satisfied with the quality of the laboratory tests and service they received. This is possible through exit interview. Medical laboratory scientists must adhere to standard operating procedures when serving clients while instituting quality control, quality assurance and quality assessment in the laboratory<sup>14</sup>. Quality monitoring of both the product and the service is critical to the efforts to promote the appropriate use of public health laboratory products<sup>20</sup>.

#### 4.11 Policy and Adaptability

In addition to the elements in the logistics cycle, two additional factors—policy and adaptability—directly relate to the logistics system<sup>8</sup>.

Government regulations and procedures affect all elements of the logistics system. Many country governments have established policies on the selection of medical products, how items are procured (for example, international competitive bidding or using prequalified manufacturers), when items are distributed, where and how items are stored, and the quantities customers receive<sup>8</sup>. Fiscal and budget policies are often some of the most influential policies affecting a logistics system, whether related to securing funding for product procurement, or to pay for critical infrastructure, such as storerooms and transportation<sup>15</sup>. Available public health supply chain management policies in

Nigeria are policies for pharmaceuticals and other healthcare product and did not disaggregate pharmaceuticals from other healthcare products where public health laboratory supplies are categorized. Health program managers, medical laboratory scientists and other personnel dedicated to logistics can influence these policies by unbundling pharmaceuticals from other healthcare products for specificity considering the disparity between the two categories of the products. The prominence given to pharmaceuticals at the expense of laboratory products referred to as 'other healthcare product gave the pharmacists the impetus to dominate public health supply chain management in Nigeria. Review of public health supply chain policies is timely. However, these may face great challenges.

Adaptability is a characteristic of all successful logistics systems. Logistics systems must be designed to be flexible and adapt to constant changing circumstances, such as changes in demand for a product, or changes in funding policies for logistics activities<sup>8</sup>. The logistics system cannot be re-designed every time a new product is introduced, or when consumption increases. For instance, the American policy under President Donald Trump is not favourably disposed to supporting development works, such as supply chain management of health commodities, in developing countries as before.

The ability of logistics system to successfully obtain the resources that are necessary to address changes in demand is adaptability<sup>12</sup>. If demand increases, the logistics system should be flexible enough to respond to the increase in the quantities of products that will move through the system, such as building more warehouses and purchasing more vehicles or increasing the frequency of resupply to avoid the need for larger storage facilities.

### **5.0 The importance and challenges of a robust logistics system in Public Health laboratories**

In the past, logistics was considered a custodial activity<sup>10</sup>. Storekeepers were the custodians of supplies stored in stores and warehouses<sup>12</sup>. Consequently, the science and art of logistics, and the people who make the health logistics system work, were not considered an important part of family planning, HIV and AIDS, malaria, Tuberculosis/Leprosy, Nutrition, Neglected Tropical diseases or vaccination programs<sup>10</sup>. Fortunately, with time, more and more program managers have come to understand how important logistics is to a program's success. The goal of a health logistics system is much larger than simply making sure a product gets where it needs to go. Ultimately, the goal of every public health logistics system, including public and private health laboratories is to help ensure commodity security i.e. every customer has commodity required to serve him in the laboratory<sup>3</sup>. Commodity security exists when every person coming for laboratory investigation is able to obtain and use quality essential laboratory supplies whenever he or she needs them. A properly functioning laboratory supply chain is a critical part of ensuring laboratory commodity security<sup>9</sup>.

Effective medical laboratory supply chains not only help ensure commodity security, they also help determine the success or failure of any public health program supported by laboratory services<sup>8</sup>. Both in business and in the public sector, decision makers increasingly direct their attention to improving supply chains, because logistics improvements bring important, quantifiable benefits. Well-functioning laboratory supply chains benefit public health programs in important ways by; increasing program impact, enhancing quality of care, and improving cost effectiveness and efficiency of laboratory services<sup>12</sup>.

### **5.1 Medical Laboratory Logistics Increases Program Impact**

If a medical laboratory logistics system provides a reliable supply of laboratory commodities, more people are likely to use both laboratory and other health services in the facility<sup>12</sup>. Customers or patients feel more confident about medical laboratory services when they have a constant supply of laboratory commodities—it motivates them to seek and use services. For instance; the availability of a mix of rapid test kit (RTK) such as Determine, Stat pack and UniGold improves HIV/AIDS screening uptake<sup>21</sup>. This ensures that results produced are accurate and reliable. It also serves as an entry point to HIV/AIDS Care and Treatment for the overall reduction in HIV/AIDS morbidity and mortality as well as reduction in the spread of the infection<sup>16, 21</sup>.

### **5.2 Medical Laboratory Logistics Enhances Quality of Care**

Medical laboratory scientists are important in disease diagnosis and treatment evaluation. Well-supplied laboratory program can provide superior service, while poorly supplied program cannot<sup>8</sup>. Likewise, well-supplied laboratory personnel can use their training and expertise fully, directly improving the quality of care for clients<sup>5, 23, 24</sup>. Customers are not the only ones who benefit from the consistent availability of commodities<sup>25</sup>. An effective medical laboratory logistics system helps provide adequate, appropriate supplies to medical laboratory service providers (Medical laboratory scientists, technicians and assistants), increasing their professional satisfaction, motivation, and morale. Experience showed that motivated staff are more likely to deliver a higher quality of service.

### **5.3 Medical Laboratory Logistics Improves Cost Efficiency and Effectiveness**

An effective supply chain contributes to improved cost effectiveness in all parts of

a program, and it can stretch limited resources<sup>21</sup>. Strengthening and maintaining the logistics system is an investment that pays off in three ways. Firstly, it reduces losses due to overstock, waste, expiry, damage, pilferage, and inefficiency. Secondly, it protects other major program investments; and finally, it maximizes the potential for cost recovery<sup>8</sup>.

### **5.4 Challenges of Public Health Laboratory Supply Chain System in Nigeria**

Over the years, laboratory supply chain has been plagued with numerous challenges. Some of the specific challenges include: weak human resource capacity, poor supply and demand management of laboratory products, establishment of parallel systems by different programs and implementers, inadequate funding, poor infrastructure and professional interferences<sup>8</sup>. These have resulted in stock outs, damage, expiries and other forms of wastages, which ultimately lead to sub-optimal laboratory services impacting adversely in health outcomes<sup>15</sup>.

### **5.5 Conclusion**

Supply chain management encompasses the planning and management of all activities involved in sourcing and procuring of commodities as well as all logistics activities that ensures customer satisfaction through commodity availability to the right customer, in the right place, right quantity, right condition, right time and at the right cost. Supply chain management/ logistics management is an integral part of a well-functioning healthcare and quality management system. Hence, a qualitative healthcare delivery cannot be complete in the absence of healthcare products and technology. Although faced with enormous challenges including lack of SCM skill by most medical laboratory scientists, professional interference among others, stakeholders should rise to the challenge of improving

public health laboratory supply chain management in Nigeria to make laboratory services and patient care more efficient and effective.

### 5.6 Recommendations

Medical laboratory scientists should develop interest and skill in laboratory supply chain system by getting involved in Laboratory and other health commodities supply chain management in Nigeria. Schools offering medical laboratory sciences could make this happen by introducing Laboratory Supply Chain as a course in their training curriculum to improve human resource capacity.

Medical Laboratory Science Council of Nigeria should rise up to its constitutional responsibility of regulating laboratory supply chain in Nigeria.

Directorate of Medical Laboratory Services should be created in the Ministry of Health at both the state and the federal level to oversee public health laboratory supply chain management at the primary, secondary and tertiary levels of health care delivery thereby reducing professional interferences.

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