

An Overview of Strategies to Overcome the Rising Demand for Laboratory Services in the Sri Lankan Public Health Sector

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Abstract

The demand for laboratory services is increasing gradually and continuously. New technologies, epidemiological and demographic transitions, and new disease strains continue to drive the need for more and more tests and testing. The technology continues to improve the productivity of today's laboratories. The existing public medical laboratory system in Sri Lanka is widespread islandwide, from primary care institutions, secondary care institutions, and tertiary care institutions to medical research institutes with varying capacities and capabilities for a wide range of investigations. These laboratories are managed either by the line or provincial health ministries. There is a separate unit for medical laboratories in the Ministry of Health under the Deputy Director General (Laboratory Services). This study report aims to provide an overview of strategies to overcome the rising demand for laboratory services in the Sri Lankan public health sector. Desk review of the available literature, focus group discussions and key informant interviews with the stakeholders used for data collection. The situation is analysed using the SWOT analysis tool to find the internal and external environment of the laboratory services. The TOWS matrix is used to develop alternative strategies. Human resource planning, continuous capacity building, laboratory infrastructure development, national laboratory quality assurance programme with accreditation, public-private partnership, cluster laboratory system, Laboratory Information Management System, empowering citizens, improved monitoring and evaluation are identified as alternative strategies. As the demand increases, more than these strategies alone can achieve the objective of meeting the demand. Therefore, the contribution of all strategies is needed to complete the aim.

Keywords —Laboratory service, strategy, demand

I. INTRODUCTION

International Organization for Standardization [1] defines the medical (clinical) laboratory as a "laboratory for biological, microbiological, immunological, chemical, immuno-haematological, haematological, biophysical, cytological, pathological or other examinations of materials derived from the human body to provide information for the diagnosis, prevention and treatment of disease in, or assessment of the health of human beings, and which may provide a consultant advisory service covering all aspects of laboratory investigation

including the interpretation of results and advice on a further appropriate investigation".

Laboratories are a source of health information and act as surveillance centres. Disease outbreaks are mainly detected initially at the laboratories. The information is vital for diagnosis, treatment, and epidemiological surveillance. Reliable laboratory facilities are essential to the community's health, national well-being, maintenance of health, and economic development.

The healthcare delivery system considers laboratory service to be an essential component. Accurate, timely laboratory investigation reports influence the treatments of patients. Quality in

every aspect of healthcare is recognised globally. The current healthcare system is complex; clinical laboratorians provide information and services for effective healthcare delivery. They ensure the proper test is performed on the correct person at a suitable time. The accurate test results enable healthcare providers to make the right diagnostic and treatment decisions based on the available resources.

Clinical laboratory services are the most cost-effective, least invasive source of objective information used in clinical decision-making. Clinical laboratory services directly impact many aspects of patient care, including, but not limited to, length of stay, patient safety, resource utilisation, and customer satisfaction [2]. When the reports are unreliable, it could lead to wrong diagnosis and incompatible treatment courses for the disease condition. All these failures add up to the financial burden on the healthcare service provider. At the same time, out-of-pocket expenditures of patients and families also increase.

Currently, technological development continues to improve the productivity of laboratories. New technologies, epidemiological and demographic transitions, and new disease strains continue to drive the need for more tests and testing. Changes in the world, such as bioterrorism and pandemic diseases, drive the demand for rapid, sophisticated diagnosis.

The Directorate of Laboratory Services of the Ministry of Health is responsible for establishing and enacting essential and relevant legislation and providing technical and managerial guidelines for maintaining laboratories in compliance with nationally and internationally accepted standards in Sri Lanka. The laboratory services sector of the Ministry of Health aims to provide high-quality laboratory services by ensuring efficiency in the functioning and equity in the clustering of government laboratories.

Ministry of Health published the National Strategic Framework for Development of Health Services 2016 – 2025 in 2016 [3], providing a strategic framework for strengthening the health

sector. The plan regarding laboratory services is to chart a course for improving and enhancing the provision and delivery of laboratory services to ensure equitable access to quality services based on the adequacy and availability of skilled human and other financial and material resource inputs [4]. The mission and objectives of the health master plan are as follows.

Mission: Improve the health status of Sri Lanka by providing quality services by advancing the capabilities of all laboratories in laboratory technology, related public health disciplines, training, research and well-motivated staff.

Objective: To strengthen and enhance the planning, management, and operational/service capacity of Laboratory Services (including Blood Transfusion Services and Medical Research Institute) to provide efficient and quality services.

General Strategic Objectives:

- To define and operational network laboratory structure, system, roles, and responsibilities.
- To plan a framework for the development of integrated laboratory services.
- To establish a Delivery system.
- To establish and implement operational standards and guidelines.
- To well staff and manage laboratory services.
- To develop and implement Quality Assurance (QA) and Continuous Quality Improvement (CQI) programmes for laboratory services.
- To establish a centralised Management Information System (MIS) for the laboratory service network.
- To establish and implement an efficient and effective procurement and maintenance system.
- To design and implement a marketing, advocacy and promotional programme to ensure quality laboratory services nationally.
- To develop new legislation and regulations in support of laboratory service reform and accreditation of laboratories.

Public health laboratory services in Sri Lanka consist of a network of diverse institutions and public laboratories that work in undefined collaborations with private clinical laboratories (Fig. 1).

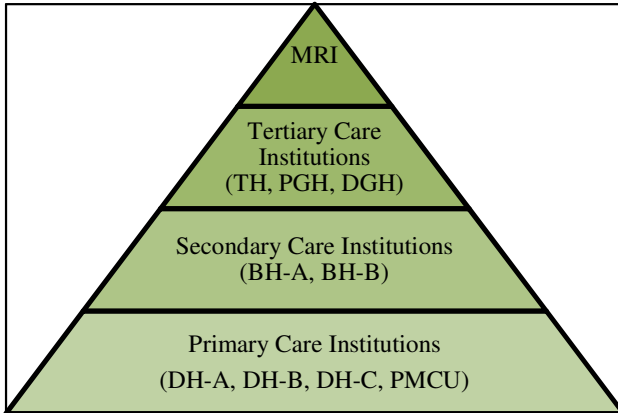


Fig. 1 The existing public laboratory services facilities in Sri Lanka [5]
[TH – Teaching Hospital, PGH – Provincial General Hospital, DGH – District General Hospital, BH - Base Hospital, DH - Divisional Hospital, PMCU – Primary Medical Care Unit]

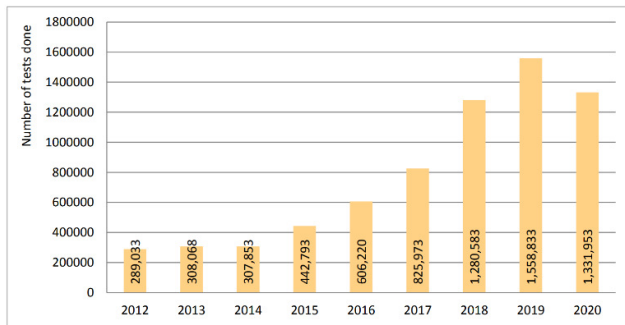


Fig.2 Number of tests done at MRI, 2012-2020 [6]

Medical Research Institute (MRI) is the apical laboratory for the Ministry of Health's laboratory network. The MRI has well-equipped medical laboratories covering many human and animal investigations. MRI is the national reference laboratory. The number of tests performed at MRI is increasing yearly (Fig. 2). Besides, MRI has a Medical Laboratory Technologists school for training Medical Laboratory Technologists. It provides training for postgraduate medical officers in various specialities.

The Director/MRI manages the MRI under the purview of the Deputy Director General (Education, Training and Research). Hospital laboratories are functioning under the direct management of the respective heads of the institutions.

The Objective of This Study

To provide an overview of strategies to overcome the rising demand for laboratory services in the Sri Lankan public health sector.

Methodology

The following methodologies were used to gather data for this report. Desk review of the available literature. Key informant interviews and focus group discussions with the director/MRI, medical superintendents, consultants, medical officers, superintendent MLT, MLTs, and patients.

The following are the related laboratory services issues identified from the data collection.

1. Weak human resource management.
2. Human resource shortage, especially MLTs.
3. Maldistribution of human resources among healthcare institutions, especially in provincially managed hospitals.
4. Demotivated staff.
5. Increasing workload.
6. Underutilisation of high-cost equipment.
7. High capital cost for machinery.
8. High cost for machine-specific reagents.
9. High maintenance expenses.
10. Improper usage of high-cost machinery.
11. Increasing demand for investigations.
12. Increasing workload for laboratories.
13. 24-hour laboratory services are non-available in most peripheral hospitals, including divisional hospitals and some base hospitals.
14. Delays in report delivery.
15. Non-accreditation of hospital laboratories.
16. Lack of usage of Laboratory Information Management System (LIMS).
17. Inadequate infrastructure for laboratories.

18. Limited space for laboratories.
19. Inadequate monitoring and evaluation of laboratory service and performance by the authorities.
20. Lack of timely transport facility.
21. Less priority on quality improvement.
22. Lack of awareness among the public regarding service availability.

Tools used in this study.

1. The present situation of the Sri Lankan public healthcare laboratory services was analysed using SWOT (Strength, Weakness, Opportunity, Threat) Analysis.
2. The TOWS matrix is used to develop strategies to meet the rising demand.

SWOT analysis is a framework used to evaluate an organisation's competitive position to develop strategic planning [7]. SWOT means Strengths, Weaknesses, Opportunities, and Threats. It assesses the internal and external factors and current and future potential. Internal factors are Strengths and Weaknesses. Opportunities and Threats are external factors.

The TOWS Matrix is the tool to analyse, generate, compare, and select strategies to attain the organisation's overall goals and objectives [8]. The TOWS Matrix helps organisations to identify their strategic options. An organisation gets the opportunity to make the most of its strengths, get around its internal weaknesses and learn to deal with them appropriately. Externally, an organisation learns to look for opportunities and recognise possibilities carefully. And they learn how to control and overcome potential threats. There are four strategies: SO (Strength and Opportunities), ST (Strength and Threat), WO (Weakness and Opportunities), and WT (Weakness and Threat).

II. Problem Analysis

Human resources are a vital resource in laboratory services. Shortage of MLTs is a significant issue in most of the provincially managed health institutions. At the same time, there

is a maldistribution of MLTs in this island, especially in urban areas.

Underutilisation of expensive laboratory equipment is another major problem. Not only MRI but also many health institutions (both line ministry and provincial Ministry) are not using the costly machinery at night. The efficiency of usage in the day is also below the expected level. At the same time, improper usage of the machinery is another issue, which leads to an increase in downtime and the cost of repair.

Laboratory equipment is costly. They require machine-specific reagents, which also cost a lot. The maintenance agreement with the agents also increases the total cost of laboratory services. Most public laboratories in Sri Lanka need help to meet the internationally accepted ISO 15189:2012 standards for medical laboratories. The cost of accreditation is very high and requires dedicated staff involvement. The Sri Lanka Accreditation Board (SLAB) registry of accredited medical laboratories confirms that there are 18 medical laboratories accredited up to 2019, all of which are private. In the state sector, the MRI virology laboratory has a Polio Laboratory. It was upgraded to the Polio Regional Reference Laboratory (Polio RRL) in 1992. This Polio laboratory is accredited annually by WHO and is the National Reference Laboratory in Sri Lanka. SLAB has accredited the Food and Water Laboratory of the MRI for five tests since 08 July 2019. The National Blood Centre, the National Blood Transfusion Service Sri Lanka, had SLAB accreditation of ISO 15189:2012 on 17 August 2011 and expired on 05 February 2019 [9]. The reliability of the reports becomes questionable, and repeating the same test in accredited private laboratories becomes a practice.

Providing 24-hour laboratory service is still problematic in a few Base Hospitals and most Divisional Hospitals. It leads to increased out-of-pocket expenditures for patients. In 2016, out-of-pocket spending was 50.12% of current health expenditures. Around six per cent of the current health expenditure was for laboratory services [10].

TABLE 1
SWOT ANALYSIS

Strengths	
S1	Availability of specialists for laboratory service.
S2	Availability of Well-trained, experienced human resources.
S3	Availability of advanced diagnostic equipment.
S4	Ability to do a wide range of tests in laboratories.
S5	MRI provides external quality assurance services for laboratories.
S6	Separate directorate for laboratory services.
Weaknesses	
W1	Weak human resource management.
W2	Demotivated staff.
W3	Increasing workloads.
W4	Inadequate infrastructure for laboratories.
W5	Limited space for laboratories.
W6	Lack of accredited public laboratories.
W7	Underutilised expensive equipment.
W8	Inadequate monitoring and evaluation by the authority.
W9	Limited availability of LIMS.
W10	Lack of timely transport facility.
W11	Less priority on quality improvement.
W12	Lack of awareness among the public regarding service availability.
Opportunities	
O1	The emergence of accredited private laboratory services.
O2	Availability of private laboratory services in remote areas.
O3	Regular production of MLTs and other staff.
O4	Provincial authorities develop laboratories.
O5	Availability of private courier service
O6	Widespread use of social media.
O7	Availability of qualified medical administrators.
O8	Availability of funds through projects for strengthening laboratory service.
O9	I am functioning quality secretariat.
Threats	
T1	Attractive packages for trained human resources in the private sector.
T2	Competitive rivalry.
T3	High capital cost for advanced equipment.
T4	Costly machine-specific reagents.
T5	Delay in delivery of machine-specific reagents.

The changing demographic, epidemiological, and health transitions increase the demand for more laboratory investigations, increasing the workload of the existing laboratory service with the available capacity.

Not delivering the laboratory investigation reports on time is another reason for the poor satisfaction of clients and end-users and leads to delayed treatment and increased length of stay.

Currently, there needs to be more monitoring and evaluation of laboratory services. Establishing a proper Laboratory Management Information System can effectively perform laboratory activities. Now, only a few institutions use the system. The initial cost for the establishment and maintenance of the system is high.

Situation analysis of the current laboratory services using SWOT analysis is shown in Table 1. Strategies to expand the laboratory services to meet the rising demand are developed using the TOWS matrix in Table 2.

TABLE 2
TOWS MATRIX

Internal Factors	Strengths S1-S6	Weaknesses W1-W12
External Factors	Opportunities O1-O9	Threats T1-T5
SO Strategies		
S1 S2 O3 Continuous capacity building for laboratory staff.		
S5 S6 O7 O9 Develop and implement a National Quality Assurance Programme.		
WO Strategies		
W1 W2 O7 Prepare a strategic human resource plan for laboratory staff.		
W3 W4 O1 The utilisation of private sector laboratories		
W4 W5 O4 O8 Development of the cluster laboratory system.		
W7 O4 Relocating underutilised laboratory equipment to needy places.		
W10 O5 Utilising private sector courier service to collect and dispatch samples and reports		
W4 W5 O8 Develop infrastructure by construction/ modification of primary, secondary, and tertiary care institutions.		
W9 O7 O8 Establish a Laboratory Information Management System.		
W12 O6 Empowering citizen.		
W8 O7 Regular monitoring and evaluation of laboratory service.		
W11, O7 O9 Provide adequate human resources for Quality Management of Laboratories (consultant/medical officer to the relevant field, MLT)		
W6 O7 O9 Formulate national laboratory standards and plans for laboratory accreditations.		
ST Strategies		
S1 S2 S6 T2 Obtain accreditation for tests.		
WT Strategies		
W1 W2 W3 T1 Prepare a strategic human resource plan for laboratory staff.		
W7 W8 W9 T3 T4 T5 Establishment of effective monitoring and evaluation system.		

III. Proposal

Several alternative strategies were proposed to meet the rising demand for the laboratory services in Sri Lankan public health sector laboratories. The alternative strategies are assessed with their advantages and disadvantages, shown in Table 3.

TABLE 3
EVALUATION OF ALTERNATIVE STRATEGIES.

Alternative Strategy	Advantage	Disadvantage
1. Continuous capacity building for laboratory staff.	<ul style="list-style-type: none"> • Knowledge is power. • The motivation for staff. • Additional knowledge provides recognition of staff. • Knowledge sharing. • Financial gain for the organisation as well as for staff. • Improve productivity of laboratory service. 	<ul style="list-style-type: none"> • Delay in performing investigations. • Shortage of staff leads to difficulties in releasing for training.
2. Develop and implement a national Quality assurance programme and Obtain accreditation for tests.	<ul style="list-style-type: none"> • High quality. • Zero error. • Prevent the repetition of tests. • Obtain the trust of clients. • Economic benefit for institution and government. 	<ul style="list-style-type: none"> • High cost. • Maintenance needs careful management. • Need regular reviews for maintenance. • It increased the aggregated cost per test.
3. Prepare a strategic human resource plan for laboratory staff.	<ul style="list-style-type: none"> • Motivate employees. • Forecasts recruitment requirements. • Establishes recruitment criteria. • Plan a continuous supply of staff. 	<ul style="list-style-type: none"> • Rigid rules and regulations. • Practical difficulties in implementation.
4. The utilisation of private-sector laboratories	<ul style="list-style-type: none"> • Cost-effective than capital investment on selected tests. • No need for human resource and infrastructure maintenance. • Accredited laboratories available. • Quality reporting. 	<ul style="list-style-type: none"> • Sustainability of service. • Unrealistic demand of the service provider. • No control over service. • Human resources have shifted from the public sector to the private sector.
5. Development of cluster laboratory system.	<ul style="list-style-type: none"> • Need less equipment at the cluster. • No need for every piece of equipment in all institutions. • Human resource management is easy. • Cost-effective. • Maintenance of equipment is easy. • Easy for accreditation. • Underutilised equipment in other institutions can be used at the cluster centre. 	<ul style="list-style-type: none"> • Need for a proper transport mechanism. • Delays in delivery of reports. • Need for an effective communication system. • Need an effective monitoring system for management.
6. Relocating underutilised laboratory equipment to needy places.	<ul style="list-style-type: none"> • Increase the efficiency of the machinery. • Extend the available range of tests. • Provides maximum benefit on investment. 	<ul style="list-style-type: none"> • Protest from local politicians. • Resistance from consultants. • Lack of protection for administrators.
7. Utilising private sector courier service to collect and dispatch samples and reports.	<ul style="list-style-type: none"> • Private sector courier service. • Availability of quality service. • Can optimise patient transfer. 	<ul style="list-style-type: none"> • High cost • Islandwide service is not available. • We need to find a local transport service in the peripheries.
8. Develop infrastructure by construction/ modification of primary, secondary and tertiary care institutions and strengthening them.	<ul style="list-style-type: none"> • The system is already established. • Requires limited capital. • Capacity is already available. • Need to increase capability. 	<ul style="list-style-type: none"> • Fund flow is limited. • Duration for action is prolonged. • Tight rules and regulations on implementation.
9. Establish a Laboratory Information Management System (LIMS).	<ul style="list-style-type: none"> • Easy to monitor. • Facilitates easy data sharing. • Easy to communicate within and among laboratories and other units. • Quick response on time. 	<ul style="list-style-type: none"> • The initial cost is high. • Need regular maintenance. • Fast-changing information technology. • Need ICT experts. • Data security.
10. Regular monitoring and evaluation of laboratory service.	<ul style="list-style-type: none"> • Provide information regarding the function of the laboratory. • Can take corrective action on time. • Provides information on the efficiency and effectiveness of laboratory service. • Helps to plan future activities. 	<ul style="list-style-type: none"> • Resistance from staff and union. • Feedback is not provided to stakeholders. • Data quality.

TABLE 4
ACTION PLAN

Strategy	Activity	Responsibility
Continuous capacity building for laboratory staff.	<ul style="list-style-type: none"> Inservice training program. Workshop. Field visit. 	DDG/LS, DDG (ET&R), D/LS, D/Training, Head of the institution
Develop and implement a national quality assurance programme and obtain accreditation for tests.	<ul style="list-style-type: none"> Module preparation. Inservice training. Accreditation process. 	DDG/LS, D/LS, D/HQS, Head of the institution, Consultants
Prepare a strategic human resource plan for laboratory staff.	<ul style="list-style-type: none"> Situation analysis Trend analysis Forecasting the need 	DDG/LS, DDG/Planning, D/LS, DD/MSU, HR unit/MoH
The utilisation of private-sector laboratories	<ul style="list-style-type: none"> Cost analysis Demand analysis 	Secretary/MoH, DGHS, DDG/LS, Head of the institution, Consultant
Development of cluster laboratory system.	<ul style="list-style-type: none"> Situation analysis Pilot project 	Minister of Health, Provincial Minister, Secretary, DGHS, DDG/LS
Relocating underutilised laboratory equipment to needy places.	<ul style="list-style-type: none"> Situation analysis Monitoring and evaluation 	Minister of Health, Provincial Minister, Secretary, DGHS, DDG/LS, D/LS
Utilising private sector courier service to collect and dispatch samples and reports	<ul style="list-style-type: none"> Situation analysis Guidelines Circular 	Secretary, DGHS, DG/Finance, DDG/LS, D/LS, Head of the institution
Develop infrastructure by construction/ modification of primary, secondary and tertiary care institutions and strengthening them.	<ul style="list-style-type: none"> Situation analysis 	Minister of Health, Provincial Minister, Secretary, DGHS, DG/Finance, DDG/LS, DDG/Planning, DDG/Logistics, D/LS, Head of the institution
Establish a Laboratory Information Management System (LIMS).	<ul style="list-style-type: none"> Situation analysis Field visits Estimation Piloting Monitoring 	Secretary, DGHS, DG/Finance, DDG/LS, DDG/Planning, D/Health Information, Head of the institution
Regular monitoring and evaluation of laboratory service.	<ul style="list-style-type: none"> Situation analysis Monitoring plan Evaluation plan 	DGHS, DDG/LS, D/LS, Head of the institution

[MoH - Ministry of Health, DGHS - Director General of Health Services, DG - Director General DDG-Deputy Director General, D-Director, DD - Deputy Director, LS-Laboratory Services, ET&R-Education Training and Research, HQS-Healthcare Quality and Safety, MSU - Medical Statistics Unit, HR - Human Resource]

IV. Recommendation

Based on the TOWS matrix, several strategies have been identified to meet the rising demand for laboratory services. None of the single objectives will achieve the general purpose alone. Therefore, combining all the strategies is necessary to achieve the goal. The external environment should be vigilantly analysed before implementing a strategy because it is not in the organisation's control. The chosen strategy will be analysed using the PESTEL tool. A PESTEL analysis is a tool used to analyse and monitor the macro-environmental (external environment) factors that impact an organisation [11]. It includes Political, Economic, Social, Technological, Environmental and Legal factors.

V. Implementation

The strategies with an action plan include activities, targets, means of verification, responsibility, and time frame to be planned for smooth implementation and monitoring of achievements (Table 4). Currently, a cluster laboratory system is successfully implemented in Kalmunai Regional Directorate of Health Services to provide the service to provincially managed healthcare institutions.

VI. Conclusion

Medical laboratory service is an integral part of any healthcare system. There is an increasing demand for laboratory service due to demographics transition, epidemiological transition,

defensive medicine, and the continuous development of technology. The public medical laboratory service is available island wide with varying capacities and capabilities. Several alternatives were identified to meet the rising demand for laboratory services. But more than one of the single alternative strategies alone can accomplish this goal. Therefore, all the alternative strategies should be implemented to achieve this continuously increasing demand for laboratory services. A few are strategic human resource planning, capacity building for laboratory staff, quality improvements, public-private partnership, monitoring and evaluation, etc. The emergence of the private sector in various aspects of laboratory services is a promising sign. The availability of specialists in multiple specialities in the public sector will help to achieve this objective.

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