

**Ministry of Health, Nutrition and Indigenous Medicine
The Democratic Socialist Republic of Sri Lanka**

**Preparatory Survey
on
Health and Medical Service
Improvement Project
in
Sri Lanka**

FINAL REPORT

OCTOBER 2017

JAPAN INTERNATIONAL COOPERATION AGENCY

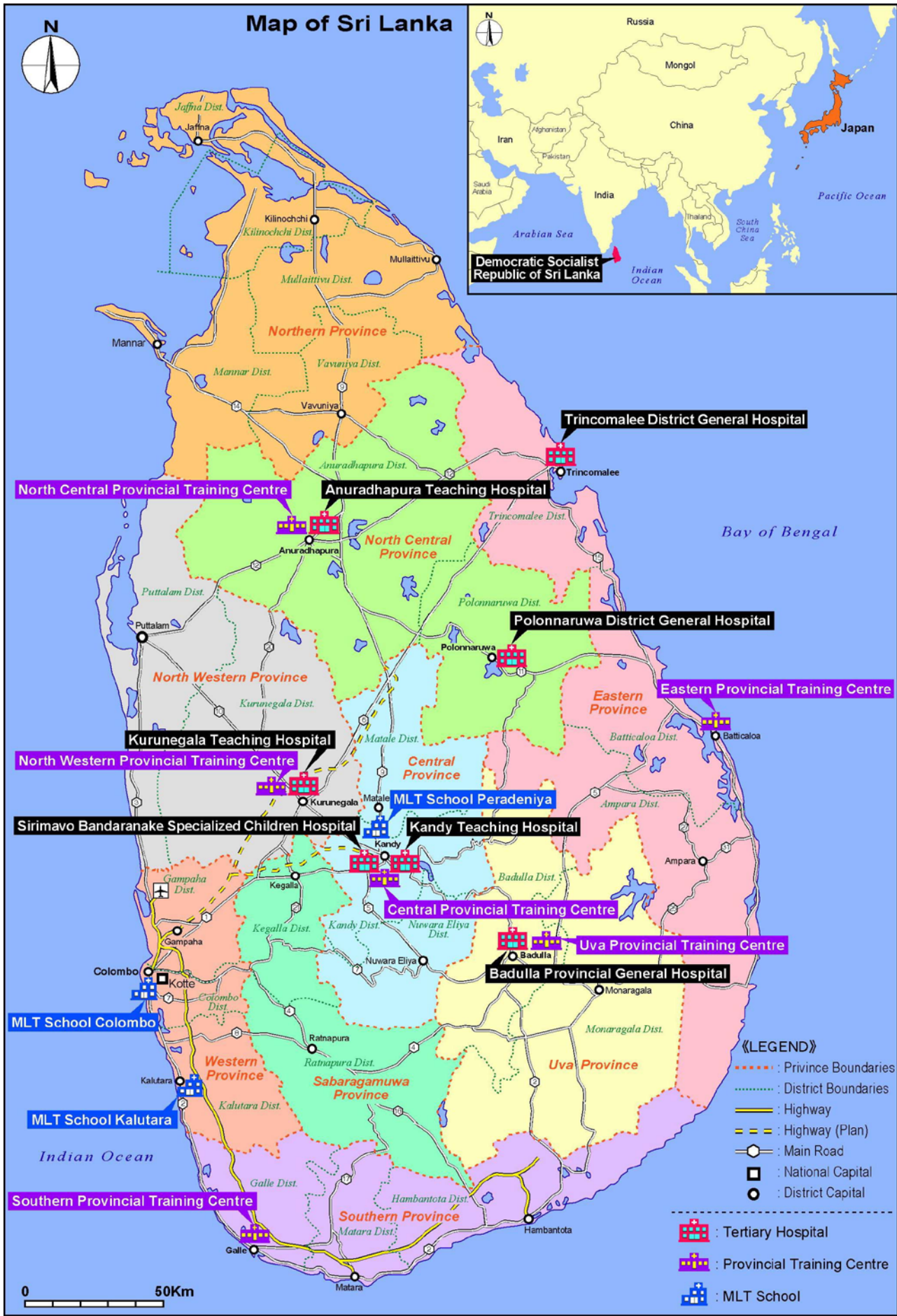
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MAP SHOWING SURVEY SITES

Summary

1. Background of the Project

The Government of the Democratic Socialist Republic of Sri Lanka (referred to hereafter as “Sri Lanka”) submitted a request for ODA Loan to the Government of Japan for a Project to contribute to an improvement in the medical services in Sri Lanka targeting patients of cardiovascular diseases by making improvement to medical services for control of proliferating Non-Communicable Diseases (NCDs) by providing diagnosis/treatment equipment primarily for cardiovascular diseases in tertiary level medical institutions and by providing equipment for related personnel training institutions as follows:

- 1) Facility construction and equipment procurement for diagnosis/treatment mainly for cardiovascular diseases in tertiary healthcare institutions
- 2) Equipment procurement for Medical Laboratory Technologist (MLT) Schools
- 3) Improvement of Bio-medical Engineering Services (BES) network with Biomedical Engineering Engineer (BME) (procurement of equipment and tools for medical equipment maintenance)
- 4) Facility construction and equipment procurement for Provincial Training Centres that train Public Health Inspectors and Public Health Midwives that conduct prevention awareness activities for NCDs

This preparatory survey for the Project was conducted to support the study of the Project in terms of the objectives of the Project, Project components, Project implementation systems, operations and maintenance systems, and environmental and social considerations and others, and for examining its feasibility for extending the ODA Loan.

2. Position and necessity of the Project

The study resulted in identifying the position and necessity of the Project confirmed as follows.

- In health sector of Sri Lanka, with the improvement of maternal and child health and infectious diseases, Non-Communicable Diseases (NCDs) have become an important health concern. As of 2014, the annual mortality rate in Sri Lanka totaled 138,000, 75% of which was due to NCDs (according to WHO). The Ministry of Health, Nutrition and Indigenous Medicine (MOH) considers cardiovascular diseases to be a particularly important concern as they are the major cause, comprising 40% of total annual deaths. (Note: The others include cancer at 10%, chronic respiratory diseases at 8%, and diabetes at 7%).
- The National Health Policy 2016-2025 of MOH states, as its mission, “To contribute to social and economic development of Sri Lanka by achieving the highest attainable health status through promotive, preventive, curative and rehabilitative services of high quality made

available and accessible to people of Sri Lanka,” and the provision of equitable and comprehensive treatment care for cardiac disease as the strategy for treatment. Also, in connection to treatment, the strategy includes the improvement of research and training institutions and the procurement of more effective equipment for medical institutions. This Project is considered to be an important step in implementing the National Health Policy.

- The abovementioned Health Policy takes into consideration the “Sustainable Development Goals 2030 (SDGs),” namely SDG3, in which the achievement target for NCDs is set as “By 2030, reduce by one third premature mortality from NCDs through prevention and treatment.” Therefore, this Project is consistent with the SDGs, as the Project will contribute to the achievement of the target for NCDs.
- Japan has continuously extending its assistance to the Health Sector in Sri Lanka for especially the improvement of healthcare facilities and human resource development, in line with its Country Assistance Policy to Sri Lanka. The Project is consistent with this Policy, which focuses on the “mitigation of vulnerabilities” as one of the priority areas.
- Access to diagnosis and treatment is a decisive factor in order to reduce deaths from cardiovascular disease. However, in Sri Lanka, only 6 of 9 provinces nationwide have hospitals equipped with diagnosis and treatment facilities (catheter laboratory, hereinafter referred to as cath lab). In addition, the concentration of patients at facilities equipped with a cath lab exceeds the processing capacity, which results in the problem of the inability to provide appropriate timely treatment.
- The aging population will cause increased demand for diagnosis/treatment due to ischemic heart disease, and by 2025, the number of cases is expected to rise from the current 30,600 cases per year to 43,500 cases, an increase of around 12,900 cases per year. Currently, the most important issue in the reduction of mortality due to ischemic heart disease is the establishment of facilities in provinces without a cath lab and strengthening the processing capacity of existing cath lab facilities.

3. Project Scope

The scope of the Project is summarized below:

(1) Purpose of the Project

1) Overall goal

To contribute to the reduction in mortality from cardiovascular disease

2) Project objective

The medical service for the diagnosis and treatment of ischemic heart disease is improved by developing the medical facilities and equipment in tertiary healthcare institutions and training institution as well as strengthening the equipment maintenance capabilities.

3) Project output

- Access to catheter diagnosis/treatment is improved by developing medical facilities and equipment in the tertiary healthcare institutions.
- Diagnostic functions for cardiac disease care are strengthened by improving medical equipment in the MLT Schools.
- Maintenance functions at the tertiary healthcare institutions are enhanced by improving the equipment in BES.

(2) Prioritization of target facilities

An evaluation of priority was made based on the consistency between the Sri Lanka Health Policy and the plan of targets institutions, and the surrounding conditions of target institutions. As a result, the following facilities were selected as the priority targets for the Project.

1. Badulla Provincial General Hospital
2. Trincomalee District General Hospital
3. Kandy Teaching Hospital
4. Kurunegala Teaching Hospital
5. Anuradhapura Teaching Hospital
6. MLT Schools (Colombo, Peradeniya, and Kalutara)
7. Bio-medical Engineering Services (BES) and BES workshops at hospitals

(3) Forecast of number (demand) of catheter diagnoses/interventions and of capable cases of diagnoses/interventions by the target hospitals in 2025

The nationwide number (demand) of catheter diagnosis and treatment for ischemic heart disease patients in 2025 was forecast. The result shows the annual demand will increase from 30,550 cases (actual) in 2014 to 43,463 cases in 2025 with increment of 12,913 cases. Similarly the result shows that the demand in the five target hospitals will increase from 5,306 cases in 2014 to 19,051 cases in 2025 with increment of 13,745 cases. (The increment in the five hospitals exceeds the nationwide increment because, in addition to the increased demand in the catchment area of the five hospitals, a part of patients who currently visit the National Hospital of Sri Lanka and other hospitals in other areas would start visiting the target hospitals after completion of the Project.)

On the other hand, capable cases of diagnoses/interventions in the five hospitals in 2025, after completion of the Project, are forecast to be 16,302 cases in total. This is 2,749 cases in short in comparison with the demand in 2025 (19,051 cases). It seems possible, however, to deal with the excess in demand because the number of cath lab teams is expected to increase in Kurunegala Teaching Hospital and others as a result of increase in the number of cardiology specialists who are currently being trained overseas. It is also possible to refer the patients who cannot be treated in the target hospitals to National

Hospital of Sri Lanka in Colombo which will have more room in future by establishing additional facilities in the Project.

4. Project plan

(1) Facilities and equipment plan

The facilities and equipment plan for the Project was made to improve facilities and equipment centring on ischemic heart disease, which will have a major effect on decreasing the mortality rate from cardiovascular disease. The plan was also made for the procurement of equipment to cope with more difficult treatments at the target hospitals of the Project that should fulfill core functions in the country with high demand for diagnosis and treatment of ischemic heart diseases, such as Kandy Teaching Hospital. For MLT Schools, the procurement of equipment needed according to the training curriculum at MLT Schools was planned.

(2) Plan for strengthening capacity of project implementation

Plans were made for (a) technical assistance on operation, management and maintenance of equipment, (b) assistance for coordination of works and human resources required for “cath lab” operation within a hospital, and (c) setting up a system for collection, recording and monitoring of information and data in a hospital. These works would be implemented as a part of consulting services for the Project.

(3) Operation and maintenance plan (Catheter treatment personnel assignment)

It was confirmed that the core personnel required for catheter treatment are employed in all of the target hospitals. However, more staff, particularly the nurses and MLTs, will be required in the future in order to cope with the increased demand and to raise the operating ratio of cath labs.

5. Project evaluation

(1) Operation and effect indicators

Operation and effect indicators are established for each output and target institution in order to monitor the achievement of the Project goals. The target of each indicator is set for 2025, 2 years after completion of the Project.

(2) Economic analysis

The benefits of this Project will be the reduction of opportunity costs due to improved access to ischemic heart disease treatment (patient transportation costs and family visiting costs, etc.) and the reduction of mortalities from ischemic heart disease (lost opportunity in terms of economic activity). As a result of an economic assessment on this basis, the economic internal rate of return (EIRR) is found to be higher than the social discount rate, the cost-benefit is 1.0 or more, and the expected net present value is 0 or more.

In addition, the provision of medical services to the patients of ischemic heart diseases in rural areas will contribute to the betterment of people’s lives in those areas, particularly such services in the Eastern

part of the country with a large group of poverty will benefit the reduction of regional disparity. With these social benefits together with the economic impact, the implementation of this Project is considered significant.

6. Technical cooperation for the enhancement of Project outcomes

As one of the means to cope up with the issues of NCDs, including ischemic heart diseases, improvement of technical level and quality of hospital laboratory service needs be addressed in order to identify the causes and seriousness of NCDs. With the objective of improving the technical level and quality of laboratory service in hospitals as the basis to identify the cause of disease and seriousness, the “Project for strengthening the quality management of hospital laboratory service” is proposed as a mid-term technical cooperation.

Preparatory Survey on Health and Medical Service Improvement Project in Sri Lanka

Final Report

Map Showing Survey Sites

Summary

Abbreviations

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Abbreviations

Abbreviation	Description
ADB	Asian Development Bank
ASD	Atrial Septal Defect
BD	Basic Design
BES	Bio-medical Engineering Services
BME	Bio-medical Engineer
BMI	Body Mass Index
CAG	Coronary Angiogram
CAPC	Cabinet-Appointed Procurement Committee
CCU	Coronary Care Unit
CICU	Cardiac Intensive Care Unit
CEA	Central Environmental Authority
CF	Capital Formation
CHE	Current Health Expenditure
CLSI	Clinical Laboratory Standard of International
CSSD	Central Sterile Services Department
CT	Computed Tomography
DD	Detailed Design
DF/R	Draft Final Report
DGH	District General Hospital
DR	Digital Radiography
ECG	Electrocardiograph
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ELISA	Enzyme Linked Immunosorbent Assay
EP	Electro Physiology
ERD	Department of External Resources, Ministry of National Policies and Economic Affaires
FDA	Food & Drug Administration, USA
FIRR	Financial Internal Rate of Return
GBD	Global Burden of Disease
GDP	Gross Domestic Product
GF	Ground Floor
HASU	Hyper Acute Stroke Unit
HD	Hemodynamics
HDU	High Dependency Unit
HLC	Healthy Lifestyle Centre
IBC	International Building Code
ICB	International Competitive Bidding
ICD	International Classification of Diseases
ICU	Intensive Care Unit
ICCU	Intermediate Coronary Care Unit
IT/R	Interim Report
IVR	Interventional Radiology
JICA	Japan International Cooperation Agency
LA	Loan Agreement
LC	Letter of Credit
MDGs	Millennium Development Goals
MLT	Medical Laboratory Technologist
ME	Medical Equipment
MICU	Medical Intensive Care Unit
MOF	Ministry of Finance

Abbreviation	Description
MOH	Ministry of Health, Nutrition and Indigenous Medicine
MRI	Magnetic Resonance Imaging
MRI	Medical Research Institute
NCDs	Non-Communicable Diseases
NMRA	National Medicine Regulatory Authority
NPD	Department of National Planning
NPISH	Non-Profit Institutions Serving Households
ODA	Official Development Assistance
OPD	Out Patient Department
PC	Personal Computer
PCI	Percutaneous Coronary Intervention
PI	Pacemaker Implantation
PCR	Polymerase Chain Reaction
PGH	Provincial General Hospital
PHC	Primary Healthcare
PHI	Public Health Inspector
PHM	Public Health Midwife
PHS	Public Health Services
PHTC	Provincial Health Training Centre
PIU	Project Implementation Unit
PMU	Project Management Unit
PQ	Prequalification
PTMC	Percutaneous Transluminal Mitral Commissurotomy
Rs	Sri Lankan Rupee
SDGs	Sustainable Development Goals
SICU	Surgical Intensive Care Unit
SLMA	Sri Lanka Medical Association
SLMC	Sri Lanka Medical Council
SOP	Standard Operation Procedure
SPMC	State Pharmaceutical Manufacturing Corporation
STEP	Special Terms for Economic Partnership
TEC	Technical Evaluation Committee
TFR	Total Fertility Rate
TH	Teaching Hospital
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
UV	Ultraviolet
WB	World Bank
WHO	World Health Organization

Chapter 1 Outline of the Project and the Survey

1-1 Background of the Project and Outline of the Survey

Due to population aging and lifestyle changing, since the 1980s the Democratic Socialist Republic of Sri Lanka (referred to hereafter as “Sri Lanka”) has been experiencing an increase in the occurrence of Non-Communicable Diseases (NCDs). According to the World Health Organization (WHO), roughly 75% of deaths in Sri Lanka are caused by NCDs; cardiovascular diseases¹ in particular are the leading cause of death, accounting for approximately 40% of the total (as of 2014).

As it is difficult for primary and secondary hospitals to provide specialist diagnosis/ treatments including for cardiovascular disease, such diagnosis/treatment is only provided at tertiary healthcare institutions. However, even the doctors, who are stationed at regional tertiary healthcare institutions, are not able to provide proper treatment due to a lack of medical equipment such as a catheter laboratory (referred to hereafter as “cath lab”) for the diagnosis and treatment of cardiac diseases (ischemic heart diseases and arrhythmia), in particular. As a result, it is difficult for patients at the tertiary healthcare institutions in urban areas of cities of Colombo and Kandy, to receive quick examination and treatment when critically-ill; thus there is an urgent need to enhance the capacity of the urban tertiary health care institutions and to upgrade the medical facilities/equipment of regional tertiary healthcare institutions.

Also, the equipment used for training is either insufficient or in poor condition at training institutions where Medical Laboratory Technologists (MLTs) that perform diagnostic examinations at secondary hospitals or above are trained, and at Provincial Training Centres where Public Health Inspectors (PHIs) and Public Health Midwives (PHMs) who are engaged in the prevention of diseases including NCDs are trained. Therefore the trainings are not conducted properly in accordance with the curriculum. In addition, some provinces have no Provincial Training Centre. Hence, there is a need to strengthen the institutions that educate and train healthcare providers.

In addition, Bio-medical Engineering Services (BES) Unit of the MOH, which is responsible for the maintenance of the medical equipment owned by the healthcare institutions, has problems such as the lack of usable equipment and materials, for repair and maintenance and absence of communication and correspondence system between BES and the institutions, and absence of preventive maintenance system and low level technology of maintenance are also the problematic issues. Because of this situation, the BES does not have information of equipment at the institutions and has difficulty in equipment maintenance management. It is necessary therefore to establish the system to get the information on equipment whenever necessary and to be equipped with the maintenance tools and equipment.

¹ Cardiovascular diseases are grouped into Cardiac Diseases (need diagnosis and intervention by catheter) and Vascular Diseases (need cardiothoracic surgery). The Project aims to improve the cardiac services for heart diseases, the terminology of “Cardiac Diseases” is used in the report.

Under these circumstances, in June 2016 the Government of Sri Lanka requested ODA Loan from the Government of Japan with respect to the upgrading of facilities for the diagnosis and treatment mainly of cardiovascular diseases in tertiary healthcare institutions, the provision and equipping of MLT Schools and Provincial Training Centres and the capacity enhancement of BESs.

1-2 Outline of the Project requested by the Government of Sri Lanka

The project requested by the Government of Sri Lanka for ODA Loan is summarized as follows.

1-2-1 Project name

Project for Strengthening NCD Treatment Facilities at Tertiary Care Hospitals

1-2-2 Implementing agency

Ministry of Health, Nutrition and Indigenous Medicine (MOH)

1-2-3 Project objectives

The objective of this Project is to improve the medical services for the prevention, diagnosis and treatment of NCDs, especially ischemic heart disease, by improving the medical facilities and equipment in tertiary healthcare institutions and training centres for medical staff as well as strengthening the maintenance of medical equipment: hence to contribute to the health of the people of Sri Lanka.

1-2-4 Project components

To identify the details of components of the Project proposed by the Government of Sri Lanka, the Survey Team made clarification through the first and second field survey by visiting the target facilities. The project components which were initially proposed by the Government of Sri Lanka and the ones after the clarifications are shown in the table below.

Table 1-1 Target Facilities and Details of the Requests made under the Project
(Upper row: Building/ Lower row: Equipment)

Description	Province	City	Institution	Initial Request	Final Request
Tertiary healthcare institutions	Uva Prov.	Badulla	Badulla Provincial General Hospital	Construction of operating Theatre, Intensive Care Unit (ICU) and wards, improvement of Cardiology Units	No request (A 10-storied building will be constructed by GOSL budget by 2020, before delivery of the equipment by the Project.
				Supply of equipment related to above and radiological equipment	For cath. lab., clinic for out-patient dept. (OPD), Coronary Care Unit (CCU), Intermediate Coronary Care Unit (ICCU), etc.
	Eastern Prov.	Trincomalee	Trincomalee District General Hospital	Improvement of Cardiology Units	Construction of a new Cardiology Unit Building (6 stories)
				Supply of equipment related to above	For cath. lab., clinic for OPD, CCU, ICCU, etc.
	Central Prov.	Kandy	Kandy Teaching Hospital	Construction of Laboratory (5 stories)	Construction of a new Laboratory Complex Building (10 stories), etc.
				Supply of equipment related to above	For the new building including equipment for cath lab, etc.

Description	Province	City	Institution	Initial Request	Final Request
		Peradeniya	Sirimavo Bandaranayake Specialized Children's Hospital	No request	A multistoried complex building
				Supply of Equipment of Cardiology Unit	For the complex building
	North Western Prov.	Kurunegala	Kurunegala Teaching Hospital	Construction of operating Theatre, ICU and wards, improvement of Cardiology Units	Renovation of existing CCU to add a cath lab and construction of radiology unit building
				Supply of equipment related to above and radiological equipment	For cath. lab. (2 units) and CT scanner and MRI etc.
	North Central Prov.	Anuradhapura	Anuradhapura Teaching Hospital	Improvement of Cardiology Units	Construction of Cardiology and Cardiothoracic Complex Building (5 stories)
				Supply of equipment related to above	For cath. lab., clinic for OPD, CCU, ICCU, including CT scanner and MRI, etc.
		Polonnaruwa	Polonnaruwa District General Hospital	Construction of operating Theatre, ICU and wards	Construction of Cardiology Department Building (4 stories) and Circulatory building (4 stories)
				Supply of equipment related to above and radiological equipment	For cath. lab., Physiological function test, CCU, etc.
MLT Schools	Western Prov.	Colombo	MLT School	No request	No request
				Provision of microscopes and other equipment	Microscope, bacti-cinerators, safety cabinet, bus, etc.
	Central Prov.	Peradeniya	MLT School	No request	Construction of Hostel, renovation work of existing schools, etc.
				No request	Bacti-cinerators, safety cabinet, bus, etc.
	Western Prov.	Kalutara	MLT School	No request	Construction of Hostel
				No request	Microscope, bacti-cinerators, safety cabinet, etc.
BES	Western Prov.	Colombo	BES Unit	No request	No request
				Provision of tools, testing kits and training to BME	PC network, inspection equipment, and other equipment
Provincial Training Centres	Uva Prov.	Badulla	Uva Provincial Health Training Centre (PHTC) Bandarawela	Construction of new provincial training centre	Construction of Hostel
				Improvement of equipment including cars and furniture	Equipment for hostel and lecture hall building, and vehicle
	Eastern Prov.	Batticaloa	Eastern PHTC Batticaloa	Construction of new provincial training centre	Construction of Hostel and food and water quality testing laboratory
				Improvement of equipment including cars and furniture	Equipment for lecture hall building and vehicle
	Central Prov.	Kadugannawa	Central PHTC Kadugannawa	No request	Construction of Hostel with Lecture Room, Auditorium, Biochemical laboratory, etc.
				Improvement of equipment including cars and furniture	Vehicle
	North Western Prov.	Kurunegala	North Western PHTC Kurunegala	Construction of new provincial training centre	Construction of Lecture Building (3-stories)
				Improvement of equipment including cars and furniture	Equipment for lecture building and vehicle

Description	Province	City	Institution	Initial Request	Final Request
	North Central Prov.	Anuradhapura	North Central PHTC Anuradhapura	Construction of new provincial training centre	Construction of Hostel
				Improvement of equipment including cars and furniture	Equipment for hostel and lecture hall building, and vehicle
	Southern Prov.	Galle	Southern PHTC Galle	Construction of new provincial training centre	Construction of New Training Centre including lecture room, auditorium, etc.
				Improvement of equipment including cars and furniture	Equipment for lecture hall building, and vehicle

Source: Prepared by the Survey Team

1-3 Outline of the Preparatory Survey

1-3-1 Purpose of Survey

This preparatory survey for the Project was conducted to support the study of the Project in terms of the objectives of the Project, Project components, Project implementation systems, operations and maintenance systems, and environmental and social considerations and others, and for examining its feasibility for extending the ODA Loan.

1-3-2 Scope of Survey

The main targets in this Survey were upgrading of facilities for the diagnosis/treatment of mainly cardiovascular diseases in tertiary healthcare institutions, building construction and equipment procurement for Provincial Training Centres and MLT Schools, etc.

1-3-3 Survey Period

This Survey was implemented over a period of around 11 months, from early November 2016 to early October 2017. During this period, data and information related to the Project were collected and interviews were conducted with stakeholders. Coordination Meetings were held by MOH to share the information and discuss the issues related to the Project with the parties concerned. The Coordination Meetings held for the Study are shown below.

Table 1-2 Field Survey Schedule and Coordination Meetings of the Survey

Field Survey	Period	Coordination Meeting
Phase 1 Fieldwork	November 7 th – December 22 nd , 2016	1st Coordination Meeting (November 23 th) 2st Coordination Meeting (December 15 th)
Phase 2 Fieldwork	January 7 th – February 18 th , 2017	3rd Coordination Meeting (January 26 th) 4th Coordination Meeting (February 15 th)
Phase 3 Fieldwork	March 22 nd – April 8 th , 2017	5th Coordination Meeting (April 3 rd)
Phase 4 Fieldwork	June 18 th – 24 th , 2017	
Phase 5 Fieldwork	July 16 th –22 nd , 2017	6th Coordination Meeting (July 19 th)
Phase 6 Fieldwork	August 21 st – 25 th , 2017	7th Coordination Meeting (August 23 rd)

Chapter 2 Current Situation of and Issues in Health and Medical Care System

2-1 Demographics and Health Status of People

2-1-1 Demographics

(1) Overview

Sri Lanka has a land area of 62,705 km² (approx. 4/5 of the land area of Hokkaido). Its population was 20.7 million in 2014 (Annual Health Bulletin 2014, MOH (2016)). Males accounted for 48.4% of the total population, while females accounted for 51.6% (Census 2012). Approx. 6 million Sri Lankans, or approx. 1/3 of the total population of the country, live in Western Province, in which the capital, Colombo, is located. The population of three other provinces (*i.e.* Central, Southern and North Western Provinces) is greater than 2 million and the populations of the remaining five provinces are smaller than 2 million. The percentage of people living in urban areas to the total population in Sri Lanka increased by only 1.9% (from 16.3% to 18.2%) in the period of approximately 10 years between 2001 and 2012. This growth rate indicates that urbanization has progressed at a slower rate in Sri Lanka than in other developing countries².

(2) Demographic Changes

The average annual population growth rate of Sri Lanka between 1981 and 2012 of 1.0%³ was lower than the global average of 1.4% and the South Asian average of 1.9%⁴. The United Nations project the population of Sri Lanka to grow at an average annual rate smaller than the above-mentioned current rate of 1.0%. The decrease in the birth rate is the primary cause of the expected decrease in the population growth rate. Therefore, the proportion of the people at the age of 60 and older is expected to increase from 12.4% in 2014 to 18.8% in 2025.

Table 2-1 Actual and Projected Changes in the Demography of Sri Lanka between 2001 and 2025

	2001	2012	2014	2025 *
Population ('1,000s)	18,914	20,271	20,771	21,417
Population ages 0-14 (%)	26.3	25.2	25.2	21.1
Population ages 15-59 (%)	64.5	62.4	62.5	60.1
(‘1,000)	12,200	12,649	12,982	12,880
Population ages 60- (%)	9.2	12.3	12.4	18.8
(‘1,000)	1,740	2,493	2,576	4,018

Source: “Annual Health Bulletin 2014”, MOH (2016)

* “World Population Prospects: The 2015 Revision. (Medium variant)”, Population Division, Department of Economic and Social Affairs, United Nations

² “Census of National Population and Housing 2001” and “2012”, Ministry of National Policies and Economic Affairs

³ Calculated based on data in Census of National Population and Housing 1981 and 2012, Ministry of National Policies and Economic Affairs.

⁴ World Population Prospects: The 2015 Revision. (Medium variant), United Nations, Department of Economic and Social Affairs, Population Division.

2-1-2 Cause-specific Mortality

Although Sri Lanka was classified as a lower middle-income country in the UN statistics, its MDG health indicators were equivalent or superior to the corresponding figures of upper-middle income countries (as of 2013)⁵. For example, the neonatal mortality rate of Sri Lanka was 5.9 deaths per 1,000 live births, infant mortality was 8.2/1,000 and under-five mortality rate was 9.6/1,000, which is lower than the means of the corresponding figures of upper-middle income countries of 15.6 and 19.6 deaths per 1,000 live births, respectively.

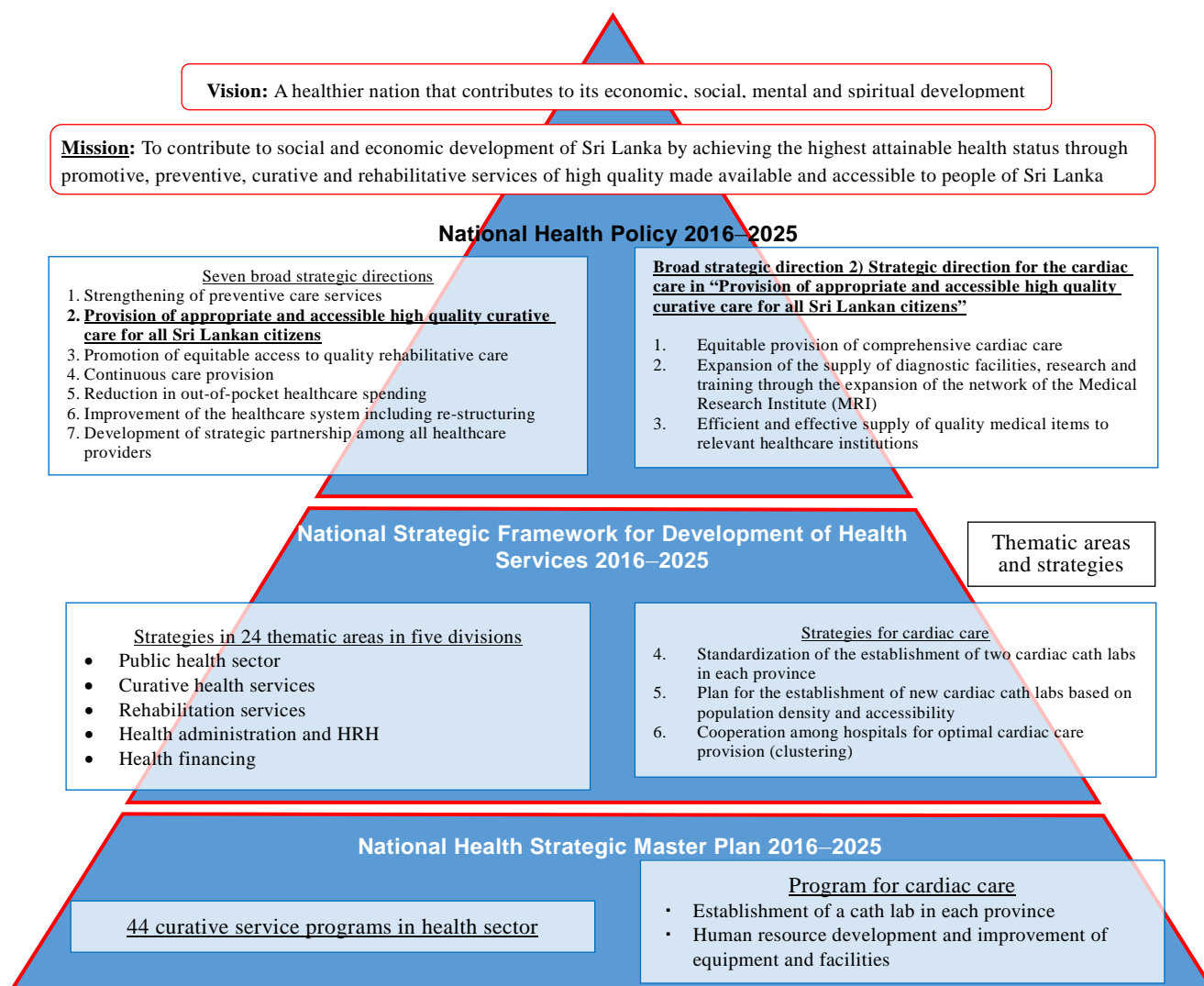
While Sri Lanka has been successful in achieving the MDGs in the health sector as mentioned above, “Noncommunicable Diseases Country Profiles 2014” published by WHO reported the total number of deaths per year in Sri Lanka of 138,000, 75.0% of which were estimated to be caused by NCDs. (Cardiovascular diseases were estimated to account for 40.0%, cancers for 10.0%, chronic respiratory diseases for 8.0% and diabetes for 7.0%, or 65.0% in combination of total deaths in Sri Lanka.) WHO Country Profiles also reported that more males (60,300) died of NCDs than females (43,500) in the country. “Sri Lanka Annual Health Bulletin 2014” also reported that NCDs were the major causes of deaths in Sri Lanka, describing that the five leading causes of deaths in hospitals were: 1) ischemic heart diseases (14.8%), 2) neoplasms (11.7%), 3) zoonotic bacterial diseases and bacterial diseases (9.1%), 4) pulmonary heart and pulmonary vascular diseases (8.6%) and 5) cerebrovascular diseases (8.4%). The findings in these two documents show that the cause-specific mortality in Sri Lanka has shifted from that of developing countries in which communicable diseases are the major causes of deaths to that of developed countries in which NCDs are the major causes of deaths. Therefore, it is essential for the Sri Lankan Government to take proper measures against NCDs. The implementation of measures against cardiovascular diseases, in particular, is urgently required as they account for 40% of deaths in the country.

2-2 Health Policies

2-2-1 Health Policy Structure

The policies in the health sector of Sri Lanka are structured as shown in Fig. 2-1 below. In this policy structure, the “National Health Policy 2016-2025” published by MOH in 2016 presents the vision for, mission and broad strategic directions of the healthcare service delivery, the “National Strategic Framework for Development of Health Services 2016-2025” presents thematic areas and proposes strategies in the health service system and the “National Health Strategic Master Plan 2016-2025” describes actual programmes to be pursued in the sector.

⁵ “World Health Statistics 2015”, WHO (2015)



Source: Prepared by the Survey Team

Figure 2-1 Health Policy Structure in Sri Lanka

2-2-2 Policy and Strategies for Cardiac Care Services

(1) National Health Policy 2016-2025⁶

The National Health Policy aims “to contribute to social and economic development of Sri Lanka by achieving the highest attainable health status through preventive, curative and rehabilitative services of high quality made available and accessible to people of Sri Lanka” as the mission of the healthcare service delivery and presents broad strategic directions in seven areas (Fig. 2-1). The policy also aims “to provide comprehensive cardiac care services in equitable manner” as the highest priority issue in one of the seven broad policy directions, “appropriate and accessible high quality curative care for all Sri Lankan citizens.” The expansion of the supply of quality diagnostic facilities, research and training and the efficient and effective supply of medical items to relevant healthcare institutions are also included in this broad strategic direction. Consistency is recognized between this project and the national policy on these points. Although the policy emphasizes the improvement of maternal

⁶ The National Health Policy published in 2016 has already been implemented, albeit without approval of the parliament at the time of this Survey.

and child healthcare, hygiene management and prevention of communicable diseases, it recognizes the need to put greater emphasis on the reduction of the mortality rate for NCDs, mainly for cardiac diseases, diabetes and cancers in the area of the preventive care service.

(2) National Strategic Framework for Development of Health Services 2016-2025

The strategic framework presents a total of 24 thematic areas in the five divisions of the health system, namely 1) Public Health Sector, 2) Curative Health Services, 3) Rehabilitation Services, 4) Health Administration and Human Resources in Health (HRH) and 5) Health Financing, and proposes strategies in each thematic area. The approaches for the cardiac care services including the establishment of cath labs and human resource development are included in the strategies in the thematic area, “Specialist Services.” The strategic framework refers to the target of reducing by one third⁷ premature mortality from NCDs by 2030 for the SDG-3, “Ensure healthy lives,” as the indicator of the achievement. The table below shows the issues and strategies in the cardiac care services mentioned in this framework.

Table 2-2 Identified Issues and Proposed Strategies in the Cardiac Care Services

Identified issues	<ul style="list-style-type: none"> • Basic facilities for the management of cardiac emergencies are wanting in many peripheral institutions. • Standard cardiac care units have been placed without consideration to population density or accessibility of patients.
Proposed strategies	<ul style="list-style-type: none"> • Appropriate and accessible cardiac care for all Sri Lankan citizens • Clustering of hospitals that provide optimal cardiac care (Networking) • Plan for the establishment of new cardiac catheter labs based on population density and accessibility • Standardization of the establishment of two cardiac catheter labs per province and human resource development
SDG indicator (Reference)	An indicator for a sustainable development goal (SDG-3: Ensure healthy lives): “By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment”

Source: “National Strategic Framework for Development of Health Service 2016-2025”, MOH

(3) National Health Strategic Master Plan 2016-2025

The master plan presents activities to realize the policy. It describes a total of 44 curative service programmes including “Appropriate and Accessible Cardiac Care for All Sri Lankan Citizens” that consists of the establishment of cath labs in all provinces and the assignment of human resources to these labs for the reduction in the mortality rate for cardiac diseases (see Table 2-3 below).

⁷ Baseline is not indicated.

Table 2-3 Program for the Cardiac Care Services Described in the National Health Strategic Master Plan

Project Title	Appropriate and Accessible Cardiac Care for All Sri Lankan Citizens
Focal Point	Deputy Director General (Medical Services) 1
Proposal submitted by	Sri Lanka Heart Association
Goal	Minimize deaths due to cardiac failure
Outline	<p>As cardiac cath labs with highly trained personnel have been established only in major cities in the western, southern, central, and northern provinces, it is desired to develop care facilities in peripheral areas that are accessible to cardiac patients in urgent need for curative services. The cath labs should be established in the tertiary healthcare institutions in order that the primary and secondary healthcare institutions can refer their patients to the hospitals equipped with cath labs. A plan for the construction of healthcare institutions equipped with cath labs in peripheral areas will therefore be prepared and implemented.</p> <p>(Stage 1)</p> <ol style="list-style-type: none"> 1) Provincial General Hospital of Badulla 2) Provincial Hospital of Ratnapura 3) Teaching Hospital, Batticaloa <p>(Stage 2)</p> <p>Once one catheter lab has been established in each province, the number of catheter labs should be increased to two per province. Each centre should have the services of at least 5 cardiologists.</p>

Source: “National Health Strategic Master Plan 2016-2025”, MOH

(4) Other Policies and Strategies for Cardiac Care Services

The health policies in Sri Lanka include thematic policies and strategies in addition to those in the basic policy system mentioned above. One of them, the “National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases 2016-2020,” aims at reducing the risk of NCDs mainly with preventive services and sets the targets shown in the table below including “a 25% relative reduction in premature mortality⁸ from cardiovascular disease, cancer, diabetes or chronic respiratory diseases” for the risk reduction.

Table 2-4 Targets to be Achieved by 2025 Presented in the “National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases”

Strategic areas	<ol style="list-style-type: none"> 1. Strengthening of advocacy, partnership and leadership 2. Health promotion and risk reduction 3. Strengthening of health system for early detection and management of NCDs and their risk factors 4. Strengthening of the surveillance, monitoring, evaluation and research
Targets to be achieved by 2025	<ol style="list-style-type: none"> 1. A 25% relative reduction in the mortality from cardiovascular disease, cancer, diabetes or chronic respiratory disease of persons aged under 70 years 2. A 10% relative reduction in the use of alcohol 3. A 10% relative reduction in prevalence of insufficient physical activity (number of persons) 4. A 30% relative reduction in mean population intake of salt/sodium 5. A 30% relative reduction in prevalence of current tobacco use in persons aged 15 years or older 6. A 25% relative reduction in prevalence of raised blood pressure and/or contain the prevalence of raised blood pressure 7. Halt the rise in obesity and diabetes (number of persons) 8. A 50% of eligible people receive drug therapy and counselling (including glycemic control) to prevent heart attacks and strokes 9. An 80% availability of affordable basic technologies and essential medicines including generics, required to treat major noncommunicable diseases in both public and private facilities

Source: “National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases 2016-2020”, MOH

⁸ Mortality rate among hospitalized patients, Baseline level as of 2012 is 17.6%.

2-3 Health and Medical Services

2-3-1 Overview

The public sector provides a large part of the health and medical services in Sri Lanka. Diagnosis, treatment and medication at public hospitals are basically free of charge in Sri Lanka. In 2014, the numbers of public hospitals with inpatient care service and beds were 622 and 80,105, respectively, which corresponded to approx. 73% and 93%, respectively, of the total numbers of hospitals and hospital beds in Sri Lanka.⁹ Table 2-5 shows the referral system of public healthcare institutions.

Table 2-5 Numbers of Healthcare Institutions by Type (2014)

Type of Institution	Referral level	Number of institutions	Supervising authority
Institutions with inpatient care services		622	
National Hospital	Tertiary	1	MOH
Teaching Hospital	Tertiary	15	MOH
Provincial General Hospital	Tertiary	3	MOH
District General Hospital	Tertiary	20	Provincial govt. and partly MOH #
(Total for Tertiary healthcare institutions)		39	
Other hospitals (including National Cancer Institute, National Institute of Mental Health and Police Hospital)	-	26	MOH, Ministry of Defence and Urban Development, etc.
Base Hospitals Type-A (two units each in the major clinical departments and specialist services (in otolaryngology, dermatology, psychiatry, radiology, etc.))	Secondary	21	Provincial govt.
Base Hospitals Type-B (assignment of two specialists each in the four major clinical departments and an anaesthesiologist)	Secondary	48	Provincial govt.
(Total for Secondary Institutions)		69	
Divisional Hospital Type-A (more than 100 patients' beds)	Primary	45	Provincial govt.
Divisional Hospital Type-B (between 50 and 100 patients' beds)	Primary	134	Provincial govt.
Divisional Hospital Type-C (fewer than 50 patients' beds)	Primary	291	Provincial govt.
Primary Medical Care Unit, Maternity Home included	Primary	18	Provincial govt.
Institutions only with outpatient care services		475	
Primary Medical Care Unit	Primary	475	Provincial govt.
(Total for Primary Institutions)		963	
Total		1,097	

Source: "Annual Health Bulletin 2014", MOH (2016)

Remarks: There are 16 teaching hospitals in Annual Health Bulletin 2014. JICA Survey Team confirmed with MOH that one of them is National Hospital and the rest of them are teaching hospitals.

Public hospitals are categorized into four in accordance with the concept paper titled "Recategorization of Hospitals" issued by MOH in 2002: (1) Teaching Hospitals/ Provincial Hospitals, (2) District General Hospitals/ District Base Hospitals, (3) Divisional Hospital, (4) Primary Medical Care Units. Hospitals of higher category are expected to provide advanced care services and therefore their facility requirements are high. Among the tertiary healthcare institutions, the Teaching Hospitals and the Provincial General Hospitals provide advanced care services ranked second to the services by the National Hospital. The Teaching Hospitals conduct and resident functioning as the base of medical education in the country. District General Hospital and District Base Hospital are under the same category but the former are expected to provide more advanced care services than the latter and thus have better facility requirements.

#: Trincomalee District General Hospital and Polonnaruwa District General Hospital are under MOH.

⁹ "Annual Health Bulletin 2014", MOH (2016)

2-3-2 Health and Medical Services for Patients with NCDs

(1) Outline of Cardiac Care Services

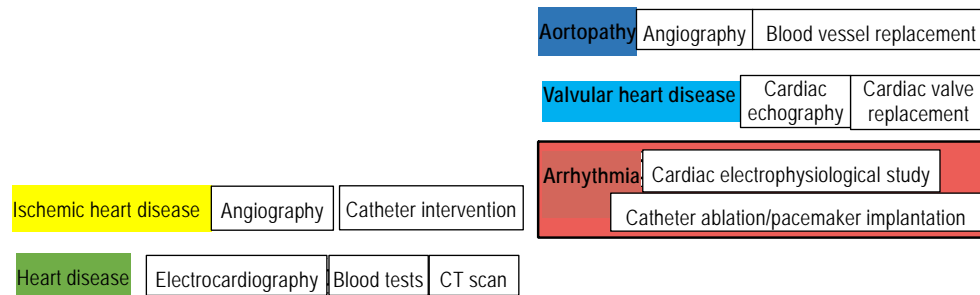
Treatment of heart (cardiovascular) diseases including ischemic heart disease, cardiac failure, arrhythmia, valvular heart disease and aortopathy is a specialised treatment according to different causes of the above-mentioned diseases. Different services and different types of equipment are required for the care of patients of cardiac diseases (ischemic heart diseases, arrhythmia, heart failures), and such cardiac care services are outlined below.

Ischemic heart disease that develops myocardial injuries is classified into acute myocardial infarction caused by the obstruction of a coronary artery which supplies blood to cardiac muscles, and angina pectoris caused by the stenosis of a coronary artery that may later develop into acute myocardial infarction. While the myocardial injury caused by myocardial infarction is irreversible, that caused by angina pectoris is reversible because the stenosis of a coronary artery in angina pectoris is transitory. The objective of the treatment of acute myocardial infarction is to open an obstructed coronary artery. If it takes too long to open the obstructed artery, the area of the myocardial injury caused by ischemia will increase. Therefore, catheter intervention must be performed urgently on a patient with acute myocardial infarction within six hours of the onset. (In other words, the improvement in the accessibility to a cath lab is the key to the reduction in the mortality rate from cardiac diseases.) If acute myocardial infarction is not treated fully, the performance of the heart as a blood pump may deteriorate and the patient may fall into cardiac failure, a state in which the heart of the patient fails to pump sufficient blood to the body to maintain daily life, or the patient may die of cardioplegic arrest. (Proper treatment and rehabilitation are of importance)

Electrocardiography is used for the early diagnosis of ischemic heart disease manifested with chest pain as the chief complaint at a healthcare institution. Blood tests and CT (Computed Tomography) scan are also conducted as supplementary examinations for the diagnosis. When the results of these examinations suggest the possibility of acute myocardial infarction, angiography is performed to locate obstruction or stenosis of a coronary artery. If a patient has been diagnosed with obstruction of a coronary artery, catheter treatment such as stenting is performed on the patient immediately. Meanwhile, if a patient is diagnosed with transitory or minor stenosis, elective catheterization is often performed on the patient. At a healthcare institution not equipped with an angiography system, pharmacotherapy is used on a patient as a diagnostic therapy. If the chest pain disappears immediately with the pharmacotherapy, the probability for the patient to have angina pectoris increases. In such a case, angiography of the patient is usually scheduled for a later date. However, because the pharmacotherapy has little effect on patients with acute myocardial infarction, a patient with the latter is likely to develop severe cardiac failure later.

Arrhythmia refers to a condition when a heart fails to pump blood at a normal rhythm because of disturbance in the cardiac conduction system. An electrophysiological study is to be conducted on a patient to locate the abnormal electric circuit that has caused the disturbance for the treatment of arrhythmia. Then, catheter ablation is performed for the identified abnormal part and a pacemaker is

implanted in the patient to establish normal cardiac rhythms. Special equipment is required for these procedures. Valvular heart diseases caused by the failure of one or more of the four valves of the heart affects the performance of the heart as a blood pump. Aortopathy causes a sudden death of a patient by disrupting blood circulation to the entire body including the brain. Patients with valvular heart diseases are usually treated with the replacement of affected valves and those with aortopathy with replacement of large blood vessels. Catheter intervention and cardiovascular surgery are performed for the replacement. Figure 2-2 below summarizes the types of the cardiovascular disease and the diagnostic and treatment methods for each type of the cardiovascular disease described above.



Source: Prepared by the Survey Team

Figure 2-2 Diagnostic and Treatment Methods Required for the Treatment of Cardiovascular Disease

(2) Referral System for Patients with Cardiovascular Diseases

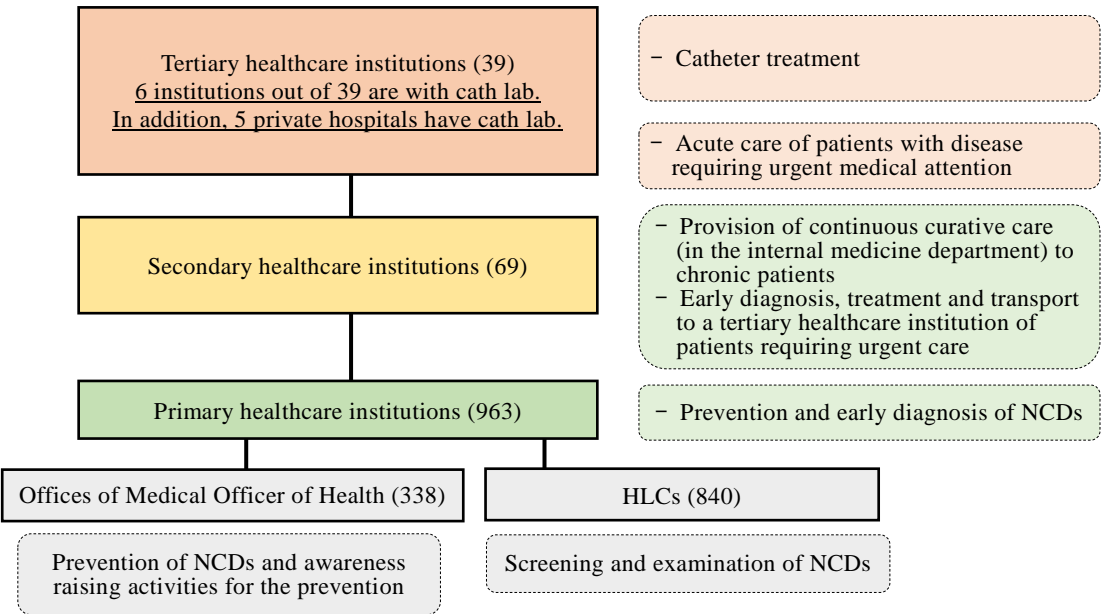
The health and medical services for NCDs consist of preventive, curative and rehabilitation services. The preventive services include awareness raising activities, health education and screening. The Offices of Medical Officer of Health established under the Department of Public Health, MOH, conduct the awareness raising activities in 338 regions in the entire country. Each office provides awareness raising activities to approx. 60,000 people. Public Health Nursing Sisters, Public Health Inspectors (PHIs) and Public Health Midwives (PHMs) are assigned to the offices. Healthy Lifestyle Centres (HLCs) and secondary healthcare institutions are responsible for the NCD screening. The first HLC was established in 2011. (There were 840 HLCs in the country as of August 2017.) HLCs are conducting the following activities (as stipulated in the official notice of MOH dated 15th August 2011).

- To assess people's lifestyle on smoking, unhealthy dietary life, insufficient physical activities and alcohol consumption
- To measure BMI (Body Mass Index), blood pressure and blood sugar; to measure total cholesterol values at HLCs that have the required equipment
- To hold a health study group meeting for approx. 20 patients once a week
- To provide screening of clients and follow-up services to patients
- To provide curative and follow-up services in accordance with the guidelines for curative care
- To manage client information

According to the information of NCD Unit of MOH, the major issues in the current services by HLCs are (1) clients visiting HLC are small in number, and (2) male clients are less than female. To cope with these issues, HLCs are in the recent years promoting outreach services to the villages and offices.

Anyone who has symptoms of cardiac diseases will visit such tertiary healthcare institutions and the clients who are identified to have NCDs risk through the screening at HLC are referred to the tertiary healthcare institutions having cath lab. There are 6 tertiary healthcare institutions and 5 private medical institutions in the country that have cath lab. These institutions provide mainly curative care services, including detailed diagnosis, necessary medication and catheter interventions, to the people who have developed symptoms of NCDs and those who have been found to have risks in the screening. The secondary healthcare institutions provide patients in stable condition who have been referred back to them from the tertiary healthcare institutions with the services for the prevention of recurrence of the disease and follow-up services.

In Japan, patients recovering from cardiovascular disease usually receive rehabilitation services to restore physical strength that they have lost to the disease, prevent recurrence of the disease, and maintain high-quality life. However, the number of healthcare institutions that can provide the rehabilitation services in Sri Lanka is limited. For example, the Kandy Teaching Hospital (one of the target facilities for the Project and the second largest hospital in Sri Lanka next to the National Hospital of Sri Lanka in terms of number of beds and clinical departments) has space for the rehabilitation services but the equipment to be used for exercise therapy is in shortage, which is making them unable to provide necessary rehabilitation services. Many of healthcare institutions are not provided with the facilities and systems required for rehabilitation services.



Source: Prepared by the Survey Team based on the information of MOH

Figure 2-3 Referral System for Patients with Cardiovascular Disease

The tertiary healthcare institutions including the teaching hospitals and the provincial general hospitals can provide acute care services including those for patients with acute myocardial infarction,

cerebral infarction and cerebral haemorrhage who require urgent medical attention, in addition to the curative care for chronic NCDs. However, the number of the facilities in which catheter intervention can be performed is limited. It has been confirmed as of April 2017, only six public hospitals¹⁰ and five private hospitals¹¹ have such facilities. Although the catheterization is performed in the military hospital, the hospital does not provide services to civilians.

(3) Issues in the Medical Care Services for Patients with Cardiovascular Disease

Because HLCs provide the NCD preventive screening only on weekdays when many men are at work and unable to visit the centres, 80% of those who have had the screening are female¹². Therefore, the prevalence of NCD risk factors among men has not been elucidated. The secondary healthcare institutions are expected to provide medical care services to the patients with cardiovascular disease. However, according to the interview with MOH, as some of them have constraints in providing such services because of the lack of electrocardiographs and ultrasound systems required for the screening and diagnosis of cardiovascular disease, they are doing blood tests manually without using automatic blood test instruments required for the general screening of NCDs like the case of Kinniya Base Hospital that the survey team visited.

At present, while the patients with acute myocardial infarction and unstable angina are generally provided with the required curative care, those who require angiography and catheter intervention (including those with acute myocardial infarction and unstable angina) are not always provided with curative care for ischemic heart disease at appropriate time. Lack of cath labs nationally and uneven distribution of them have been recognized as one of the possible reasons for such failure to provide the curative care at appropriate time. This survey has revealed that the hospitals in not only Eastern and Uva Provinces where there is no cardiac cath lab but also North Central and North Western Provinces where the existing cath labs are not operational for catheter examination instruments have become old, need to transport patients requiring catheter intervention to the hospitals in Colombo and Kandy. At the National Hospital of Sri Lanka and Kandy TH, patients have to wait for long to have the examinations in the cath lab¹³ because these hospitals have to examine a large number of patients referred to them from other hospitals and the work load of examining them far exceeds the capacities of conducting the examinations of these hospitals. The current situation mentioned above reveals that the existing curative care system for ischemic heart disease has a quantitative problem of being unable to provide required services to all the patients.

There is also a qualitative problem in the provision of the curative care to the patients with ischemic heart disease. In cath labs, both examinations and curative care are performed. In 2014, approx. 60%

¹⁰ 1) National Hospital of Sri Lanka, 2) Kandy Teaching Hospital (TH), 3) Karapitiya TH, 4) Jaffna TH, 5) Anuradhapura TH and 6) Kurunegala TH

¹¹ 1) Nawaloka Hospital (private), 2) Durdans Hospital (private), 3) Lanka Hospital (private), 4) Central Hospital (private) and 5) Sri Jayawardenapura General Hospital (operated in public-private partnership), all of which are in Colombo

¹² Information obtained in the interview with the Chief Advisor of the Project for Enhancement of Non-communicable Diseases Management of JICA

¹³ Several months at the National Hospital of Sri Lanka and approx. four weeks at Kandy TH

of the work conducted in the cath labs in the National Hospital of Sri Lanka which has the largest scale in the nation and is its top referral hospital was coronary angiography (CAG) and the rest was curative activities including percutaneous coronary interventions (PCI) and pacemaker implantation (PI)¹⁴. On the other hand, the cath lab in Kandy TH, the second largest hospital in Sri Lanka, was used more for the examinations (80%) and less for the curative care (20%). If a patient in need of technically difficult catheter intervention is referred to Kandy TH, it is nearly impossible for the hospital to provide the patient with curative care services superior both in quality and quantity to the currently provided services because the cath lab is being operated at its maximum capacity.

To sum up, in Sri Lanka opportunities for the examinations and emergency medical services have not been provided sufficiently to the patients with ischemic heart disease in some provinces because of the shortage and the regional disparity in the availability of the cath labs. Meanwhile, the hospitals in Colombo and Kandy have difficulty in ensuring the quality of provided services because a large number of such patients visit a small number of hospitals. While the number of cases of arrhythmia, valvular heart disease and aortopathy is expected to increase, the curative care for these diseases is only provided in the National Hospital of Sri Lanka and a few private hospitals. Therefore, the regional disparity in the availability of the cath labs should be rectified.

2-4 Health Administration Organisations

2-4-1 Ministry of Health, Nutrition and Indigenous Medicine (MOH)

MOH aims “To contribute to social and economic development of Sri Lanka by achieving the highest attainable health status through promotive, preventive, curative and rehabilitative services of high quality made available and accessible to people of Sri Lanka” as its mission and the following as its objectives.

- 1) To empower community for maintaining, promoting their health
- 2) To improve comprehensive health services delivery actions
- 3) To strengthen stewardship management functions
- 4) To improve the management of human resources

MOH is functionally responsible for the formulation and implementation of health policies and programmes, monitoring of their implementation, human resource development in the health sector and provision of guidance and medicines to the Provincial Department of Health Services. MOH is responsible for the operation and management of the tertiary healthcare institutions, while the provincial governments (Provincial Departments of Health Services) are responsible for the operation and management of the primary and secondary healthcare institutions and Provincial Training Centres.

As of November 2016, MOH consists of 65,522 staff members in approx. 120 departments. The ministry is headed by the Minister of Health, Nutrition and Indigenous Medicine, who is assisted by

¹⁴ Result of the survey conducted by the Survey Team. In a typical cardiology hospital in Japan 70% of the work in a cath lab is for examination and 30% for curative care.

the Deputy Minister, Secretary, Director General of Health Services, Chief Accountant and Additional Secretaries. A Deputy Director General of Health Service is assigned to each department to manage relevant units in the department. Among the institutions in which this project is to be implemented, the tertiary healthcare institutions and the MLT Schools are under the supervision of the Medical Service Division 1 and Education, Training and Research Division, respectively, and BES is a unit under the Director General of Health Services of MOH. BES has a BES Workshop branch in each hospital in addition to the workshop in its head office.

2-4-2 Provincial Governments (Provincial Departments of Health Services)

The Provincial Department of Health Services (PDHS) of each province administers the health services in the province as stipulated in the Provincial Council Act of 1989. PDHS formulates and implements health policies, provides and manages health services, formulates and enforces guidelines and manages medical personnel in the province. PDHS is headed by the Provincial Director of Health Services. It consists of the General Affairs, Accounting, Planning, Preventive Care, Curative Care, Bio-medical Engineering and Training Units and other units. PDHS assigns a Regional Director of Health Services (RDHS) to each health region¹⁵ in the province to manage the health services in the region. Although each PDHS has formulated an investment plan for the improvement of health services in the province, the implementation of the plan by the PDHS has been restricted by the insufficient budgetary allocation from the Provincial Government to the PDHS.

2-5 Human Resources in the Health Sector

The availability of the human resources in the health sector in Sri Lanka at present is described below.

2-5-1 Doctors

The number of doctors in Sri Lanka was 16,821 in December 2016. The number increased by 521 from the previous year.¹⁶ The number of doctors per 100,000 people increased slightly from 76.8 in 2014 to 79.3¹⁷ in 2016. However, this figure for 2016 is smaller than the average of the non-OECD-member Asian countries, which is 120 (Health at a Glance: Asia/Pacific 2014, OECD). There were 231 doctors (per 100,000 people) in Colombo District, while the numbers of doctors per 100,000 people in all the other districts were less than 100. Although MOH estimates that Sri Lanka needs approx. 8,000 more doctors¹⁸, medical schools have been improved¹⁹ to cover up this shortage of doctors and there are about 1,250 graduates per year. Although about 250 doctors retire every year, the number of doctor increases by around 1,000 per year and the country is expected to have a sufficient number of doctors for the next eight years. The country needs to consider the increase in

¹⁵ The boundaries of the health regions almost coincide with the administrative boundaries of districts.

¹⁶ Calculated by Survey Team based on the interview at the MOH.

¹⁷ Calculated by the Survey Team. Total population in 2016 (21,188,000) was estimated with around 1% yearly increase based on the population in 2014 (Table 2-1). The number of doctors (16,821) in 2016 was divided by the estimated population in the same year.

¹⁸ Same as above

¹⁹ In Sri Lanka, Medical College of the University of Colombo, which was established in 1870, accepted 500 students in the 1990s and currently accepts 1,500 students. Other than that, major universities, such as University of Peradeniya, University of Kelaniya and University of Sri Jayewardenepura, have the faculty of medicine. Recently, Rajarata University in Mihintale, North Western Province, opened the faculty of medicine in 2006 and admitted 171 students.

future demand and the employment of doctors by private institutions and plans cultivation of doctors well.

Table 2-6 Doctor Distribution by Province

Province	2015	2016
Nationwide	16,300	16,821
1. Western Province	7,324	7,586
2. Central Province	1,825	1,913
3. Southern Province	1,564	1,603
4. Northern Province	673	690
5. Eastern Province	1,236	1,235
6. North Western Province	1,238	1,245
7. North Central Province	873	881
8. Uva Province	674	698
9. Sabaragamuwa Province	893	970

Source: The numbers for 2016 are from the results of interview at MOH by the Survey Team and those for 2015 – “Human Resource Profile” issued by MOH (Dec 2015).

Approx. 12% of the doctors in the country (1,960) are specialists. There are many specialists in internal medicine (251), paediatrics (190), surgery (169) and obstetrics/gynaecology (162). The numbers of specialists required for the care of NCD patients, including cardiologists, neurologists and neurosurgeons (52, 29 and 15, respectively), are smaller than the numbers of doctors in the above-mentioned general clinical departments. However, these specialists have sufficient professional knowledge and technical capacities to provide advanced healthcare services for NCDs²⁰.

Approx. 40% of the cardiologists in Sri Lanka, or 21 of them, worked in Western Provinces, where Colombo is located, in 2014. The next largest numbers of them worked in Southern and Central Provinces (8 and 7, respectively). On the other hand, Uva and North Eastern Provinces have the smallest numbers, (1-2 cardiologists); however at least one cardiologist was assigned to the cardiology department of a tertiary healthcare institution in each province in 2014. Although the number of cardiologists, including those who are taking overseas training²¹, is on the increase as many medical students intend to be cardiologists, the Survey Team considers it necessary for MOH to continue its efforts in training cardiologists as it is not certain whether those overseas-trained doctors will work permanently at public hospitals after returning to Sri Lanka. Meanwhile, the number of specialists in surgery-related areas including cardiothoracic surgeons and neurosurgeons is insufficient at present. For example, the Survey Team has found that the neurosurgeon assigned to Anuradhapura TH has to visit Kurunegala TH twice or three times a week because no neurosurgeon is assigned to Kurunegala TH during the field study.

²⁰ Assessment by the doctors of the Study Team

²¹ The total number of cardiologist in 2014 was 52 (Annual Health Bulletin 2014) and additional 50 doctors are being trained for 2 years mostly in the England as of 2017 according to the information of MOH. Furthermore, 10 more doctors planned to study abroad.

2-5-2 Nurses

The total number of nurses in Sri Lanka is 31,354 as of August 2017²². The number of nurses per 100,000 people is 147²³, which is almost equivalent to the level in 2014²⁴ and significantly smaller than the average of 280 nurses per 100,000 people of the non-OECD-member Asian countries²⁵. The ratio of the number of nurses to that of doctors in 2016 is 1.93²⁶; this also indicates the shortage of nurses in Sri Lanka.

The education of nurses is conducted at (a) nurse training courses of 5 national universities (University of Jaffna, Eastern University of Sri Lanka, etc. under the administration of Ministry of Higher Education), (b) 16 Nurse Training Schools, (c) 1 nursing school for mental disease, and (d) 1 post graduate training school (on-the-job training). Administrations of (b) to (d) are under MOH. The nurse training course of the national universities is for 4 years and produce 164 graduates every year from 5 universities. The training schools (in total 17) of (b) and (c) under MOH are for 3 years and produce 2,000 to 3,000 nurses every year from 17 schools.

There are 15 private nurses' training schools nationwide. The duration of the training is 6 months differing from that at public schools and the quality of the graduates is not consistent²⁷. It is very likely that many nurses graduating from the private training schools will seek employment in the private sector after their graduation, and will be employed by private healthcare institutions. For these reasons, public healthcare institutions have no choice but to depend on the public nurses' training schools for the training of nurses.

According to the information of MOH, the number of nurses whose budget has been approved by the Ministry of Finance based on the request of MOH that aggregated the requests from the healthcare facilities is 37,875 in 2017 and the nurses actually in positions are 31,354 as of August 2017. Around 6,500 nurse positions are still vacant. Under such situation, MOH plans to educate and employ an additional 7,400 nurses by 2020 considering the existing training capacity of 2,000 to 3,000 per year. In short, the shortage will be mostly resolved in about 3 years until 2020 by producing around 2,000 to 3,000 nurses a year at the training schools. Considering that some number of nurses may retire, the progress of training should be carefully monitored.

For the specialized nurses who can work in the cath labs, Cardiology Department of National Hospital of Sri Lanka is providing a specialized training for 6 months to the nurses. In order to be a nurse who can work in the cath lab, they need to have 5 years of working experience as nurse after graduation of the school, and must receive the specialized training. Though there is an educational and training system for the specialized nurses who work in the medical team for cath lab of the public

²² The number for 2017 was obtained in the interview by the Study Team.

²³ Calculated by the Survey Team. Total population in 2017 (21,400,000) was estimated with around 1% yearly increase based on the population in 2014 (Table 2-1). The number of nurses (31,354) in 2017 was divided by the estimated population in the same year.

²⁴ "Annual Health Bulletin 2014", MOH (2016)

²⁵ "Health at a Glance: Asia/Pacific 2014", OECD (2014)

²⁶ Calculated by the Survey Team based on the information of MOH (32,499/16,821=1.93).

²⁷ Interview with the MOH

healthcare institutions, it requires a long time to produce such specialized nurses. As it is difficult to produce specialized nurses in a short time, comprehensive education is essential. There is no problem in the technical level of the nurses who received special training to work in cath labs. When they are assigned to a cath lab of a hospital, however, they need to learn team-based medical care centered on the cardiologists of the hospital.

2-5-3 Medical Laboratory Technologists (MLTs)

According to the information of MOH, the total number of MLTs whose budget has been approved by the Ministry of Finance based on the request of MOH that aggregated the request from the health facilities based on the future needs is 1,913 and the MLTs actually in position are 1,494 as of August 2017. Around 400 MLTs still need to be assigned²⁸. The number of MLTs per 100,000 population in Sri Lanka at present is 7.0²⁹. Considering the increase in the number of laboratory tests, it will be necessary to increase the number of MLTs. There is, however, regional disparity in the number of MLTs. Approximately one third of them work in Colombo District. Therefore the number of MLTs per 100,000 population in Colombo District (18.7) is the largest in the country.

Table 2-7 Number of MLT by Province

Province	2015	2016
Nationwide	1,427	1,512
1. Western Province	586	613
2. Central Province	155	176
3. Southern Province	151	145
4. Northern Province	50	64
5. Eastern Province	112	109
6. North Western Province	131	126
7. North Central Province	77	82
8. Uva Province	77	92
9. Sabaragamuwa Province	88	91

Source: The numbers for 2016 are from the results of interview at MOH by the Survey Team and those for 2015 from Human Resource Profile, MOH (Dec 2015)

The training of MLTs is provided at the MLT Schools under the administration of MOH and MLT training course of 5 national universities under the Ministry of Higher Education.

MLT Schools of MOH are located in Colombo (which is attached to the Medical Research Institute, hereinafter referred to as “MLT School in MRI”), Kalutara in Western Province and Peradeniya in Central Province. Each school is operated by a principal, a senior lecturer and four lecturers. The prescribed number of students in each school is 50 per year. The number of students requested by MOH to the schools to accept are fluctuating year by year but it reached to 70 students per school in

²⁸ Interview with MOH, August 2017

²⁹ Calculated by Survey Team. Total population in 2017 (21,400,000) was estimated with around 1% yearly increase based on the population in 2014 (Table 2-1). The number of MLTs (1,494) in 2017 was divided by the estimated population in the same year.

2016. MLT Schools have to accept the number of students exceeding the capacity and manage to train them with the available training equipment and staff.

At present, the training equipment currently used in the training is insufficient in terms of variety and quantity. For example, the number of students per instrument used in the practical training is too large, which adversely affects the training quality. Regarding educational contents, currently secondary and tertiary healthcare institutions mainly use automated equipment (such as automatic analyzer, automatic blood cell counter etc.) that can obtain inspection results more quickly with higher accuracy. On the other hand, in the current curriculum of MLT Schools, acquisition of fundamental examination/inspection methods using manual method is mainly focused and automated equipment is not used. As a result, the trainees cannot receive trainings on operation of automated equipment at the schools and have to learn the operation method through on-the-job training after being assigned to hospitals. MLT Schools, recognizing the necessity to revise the current curriculum in the future, intend to conduct trainings on the use of automated equipment considering the current state of diffusion of automated equipment in hospitals.

Problems of the MLT Schools are as follows: (1) Insufficient quality, quantity and variety of the existing equipment in the schools to provide training in accordance with the current curriculum³⁰, (2) Automated equipment that has become popular in healthcare institutions has not been introduced in MLT Schools and therefore the trainees cannot receive trainings on how to use them while they are enrolled, and (3) Need to increase the MLTs to contribute to the improvement of quality and quantity of diagnosis and intervention for cardiac diseases with due consideration on the future increase of cases of laboratory examination and volume of work of MLTs for NCDs including the ischemic heart diseases at the tertiary healthcare institutions.

To the 400 MLTs of shortage, the MOH plans to educate and employ a total of 150 MLTs every year, with at least 115 from MLT Schools of MOH considering the fluctuation of the number of annually enrolled trainees and dropouts and 35 from the 5 Universities' training course. With this plan, the shortage of 400 MLTs will be solved in less than 3 years. MOH will continue to raise MLTs with the existing training institutions to meet future demand. But since the MLT Schools are accepting the trainees more than the prescribed number, and the reinforcement of training system has become necessary.

2-5-4 Radiographers

The total number and the number per 100,000 population of radiographers in Sri Lanka were 722, and 3.4³¹, respectively, as of December 2016. Although 39% of them work in Colombo District, the minimum required numbers are assigned to every healthcare institution equipped with an X-ray imaging system. New radiographers are trained in a four-year course at the Faculty of Healthcare and Sciences of the national universities that have medical schools and in a three-year course at the

³⁰ Based on the results of survey by the Study Team.

³¹ Calculated by Survey Team. Total population in 2016 (21,188,000) was estimated with around 1% yearly increase based on the population in 2014 (Table 2-1).

Sri Lanka School of Radiography attached to the National Hospital of Sri Lanka. Although these training institutions provide students with the training on not only X-ray imaging systems but advanced medical equipment including MRI and CT systems, in case of angiography, the graduates of these training institutions have to undergo additional on-the-job training at the cath labs in the tertiary healthcare institutions.

2-5-5 Public Health Inspectors (PHIs) and Public Health Midwives (PHMs)

Public Health Inspectors (PHIs) and Public Health Midwives (PHMs) play key roles in the prevention and screening of NCDs. The numbers of PHIs and PHMs were 1,677 and 9,164, respectively, in 2015. The required numbers of PHIs (at least three) and PHMs (at least six) have been assigned to each of the 338 Offices of Medical Officer of Health. (Larger numbers of PHIs and PHMs are assigned to the offices in Northern and Eastern Provinces.) The Provincial Training Centres provide the training of PHIs and PMIs. They provide the Basic Training for students to be PHIs and PHMs and In-service Training to health workers who have a required period of working experience in accordance with the training programme formulated by MOH.

Table 2-8 Numbers of PHIs and PHMs by Province

Province	No. of PHIs		No. of PHMs	
	2015	Per 100,000 population	2015	Per 100,000 population
Western Province	349	5.8	1,871	31.3
Southern Province	217	8.5	1,256	49.1
Central Province	160	6.0	1,101	41.4
North Central Province	142	10.8	630	48.0
Uva Province	105	8.0	719	54.6
Sabaragamuwa Province	164	8.2	897	45.1
North Western Province	176	7.2	1,139	46.5
Eastern Province	218	13.5	983	60.9
Northern Province	146	13.3	568	51.9
Nationwide	1,677	8.0	9,164	43.7

Source: "Human Resource Profile", MOH (Dec 2015). Demographic data obtained from Department of Census and Statistics are used.

2-5-6 Availability of Human Resources for Curative Care of Cardiovascular Disease at Present

The diagnostic and curative services in the cath labs are provided by teams of health personnel. A hospital that provides cath lab services must have health personnel for the required number of teams to provide appropriate diagnostic and curative services. The required number of the cath lab teams is calculated from the number and the operating hours of the cath labs. In Sri Lanka, a cath lab team has six members: a cardiologist, a medical officer, two nurses (one to assist doctors and the other to provide supporting services), a radiographer and an ECG technician. In hospitals including Kandy TH where angiography and cardiac catheterization are performed frequently, two nurses to direct patients outside the labs and a medical officer to take records of the performed angiography and catheterization are assigned to the cath labs. Every target hospital of the Project is able to form at least one operational cath lab team (see Table 2-9).

Table 2-9 Number of Catheter Diagnosis/Intervention Teams by Hospital

Hospital	Kandy Teaching Hospital	Anuradhapura Teaching Hospital	Kurunegala Teaching Hospital	Trincomalee District General Hospital	Badulla Provincial General Hospital
No. of teams	3	2	2	1*	1*

* Badulla PGH and Trincomalee DGH do not have cath lab and the medical team to work there but they have staff to configure the team. Once the team is organized, it is possible to operate the cath lab.

Source: Results of the Survey by the Survey Team

The cardiologists have learned team management during overseas training in the UK and the level of the diagnosis and treatment in the cath labs is comparable to that in Japan. Meanwhile, the Study Team has identified the following problems in the operation of the teams.

In principle, catheter interventions are to be performed 24 hours a day for the treatment of patients with ischemic heart disease because they require treatment urgently. Ten teams are required for each cath lab to establish a system to ensure that one cath lab team is always on standby in a hospital without violating the labour standards³². The number of cath lab teams in Sri Lanka at present is too small. However, as the working hours of the lab teams are limited to 08:00–16:00 at present, a cath lab can be run throughout the year if a hospital can form a third of the required number of teams, *i.e.* three teams per cath lab. If a hospital fails to form three teams per cath lab, catheterization will be performed in the hospital on limited days. Therefore, to enhance the contribution of this Project to the national objective of Sri Lanka of reducing the mortality rate from cardiac disease, not only establishing new cath labs, but increasing the number of members of cath lab teams is an issue to be addressed.

Some public and private hospitals use an on-call system for the operation of cath labs between 16:00 and 08:00 on the following day. In this system, a cardiologist is called up from home to provide emergency care. However, this system does not guarantee the provision of the service all the time³³. Therefore, the Study Team considers this insufficient availability of cardiac catheterization during the night a limiting factor in reducing the mortality rate from ischemic heart disease.

One of the bottlenecks for operation of cath lab is the shortage of nurses and MLTs providing services in angiography. In order to become a specialized nurse to provide service in cath lab, five-years working experience after graduating from nursing school and the training in specific skills at the National Hospital of Sri Lanka are required. Other issue is the concern among nurses about the possible risk of exposure to radiation³⁴. MOH considers it as an issue of all health personnel on the duty in connection with the radiography including nurses and is currently studying the risk and countermeasures including improvement of labour conditions.

³² It is also difficult for hospitals in Japan to sustain 10 teams per cath lab. Therefore, the team members work overtime to provide services to emergency patients 24 hours a day.

³³ Finding in the interview survey by the Study Team

³⁴ Same as above

2-6 Health Information System

2-6-1 Basic Statistics

The Medical Statistics Unit of MOH is responsible for the collection and analysis of the medical statistical data in Sri Lanka. The unit collects the data described in the table below from medical institutions on a regular basis and prepares “Annual Health Bulletin” from the collected data³⁵.

Table 2-10 Main Statistical Data Collected by MOH

Type of data	Collection interval
Data on mothers	Monthly
Data on dental care	Monthly
Data on morbidity and mortality of inpatients	Quarterly
Data on outpatients	Quarterly
Data on healthcare facilities	Quarterly
Duration of hospitalization	Quarterly and annually
Statistics on specialists	Annually
Statistics on health personnel	Annually

Source: “Annual Health Bulletin 2014”, MOH (2016)

The Medical Statistics Unit of MOH began the digitization of statistical data in 2010. It is preparing a system of the electronic Indoor Morbidity and Mortality Record (eIMMR)³⁶ for digitization. eIMMR can be used for Web-based data collection, storage, analysis and dissemination. The unit conducted a pilot operation of eIMMR at six healthcare institutions in 2012. The results of the pilot operation are being used for its installation in healthcare institutions in the entire country. eIMMR has been installed at all the survey target hospitals. Among them Badulla Provincial General Hospital is the only hospital in which eIMMR has not started full operation and is preparing for it while the other 6 hospitals have already started full operation.

2-6-2 Current Situation of and Issues in the Information System on Cardiovascular Disease

It is possible to obtain detailed data on heart disease at the level of individual case from eIMMR because the data on cardiovascular disease at the sub-classification level of the International Classification of Diseases (ICD) 10 classification are entered in it by institution. Therefore, it is advisable to install and operate eIMMR in all the tertiary healthcare institutions treating cardiovascular disease including Badulla Province General Hospital.

On the other hand, as a problem of information concerning heart disease, it should be pointed out that due to the mixed use of manual and electronic systems, necessary information cannot be utilized as appropriate. This has led to such problems as inability to take timely countermeasures because it takes time to capture necessary information.

³⁵ The latest version officially published is 2014 version.

³⁶ MOH is also creating health information maps by combining the data of the geological information system (GIS) and health statistics. These maps show the data on health facilities, health personnel, details of clinical departments, the numbers of outpatients and inpatients, etc. on digital maps. The maps are expected to contribute to the formulation of effective and efficient plans for the construction of new healthcare institutions and assignment of health personnel. The creation of the GIS maps of Northern and North Central Provinces has been completed so far.

In addition, one of the problems in the collection of the data on outpatients suspected of NCDs is lack of standardization of the items to be specified in logbooks of each healthcare institution and the format of logbooks. Because of this problem, the collected data cannot be shared and processed not only at the level of individual institution that provides services to the patient but at the national and regional level. The absence of the record of patient addresses in the logbooks has created a problem in referring them back to appropriate lower-level healthcare institution (or following up their conditions) and in elucidating the prevalence of NCD patients and NCD-high-risk groups. Meanwhile, the results of the NCD screening collected at HLCs are recorded in the individual NCDs record books that the visitors keep. However, as HLCs do not have logbooks to record the results of the screening of individual visitors, the health administration does not have data on NCDs and the patients with NCDs at the community level. This situation hinders the formulation of community-based preventive activities. In addition, the lack of the exchange of patient information between the providers of community-based preventive services and those of curative services by the hospitals is also a factor obstructing the effective implementation of measures against NCDs. The preventive measures should be taken by each community. If the patients that can be normally treated by community hospitals visit tertiary healthcare institutions even for common illness, that would also be a factor hindering efficient use of medical resources, as it produces a situation where a small number of doctors need to see a large number of patients.

2-7 Health Financing

2-7-1 Trends in Health Expenditure and Health Expenditure as a Ratio of the GDP

Health expenditure includes the following costs: curative care, hospitalisation, examination, medicine, equipment, facility, transfer, health system, financing administration and other health-related costs. Health expenditure in 2013 was Rs. 281,200 million (around ¥ 210 billion at rate in March, 2017) and quadrupled from 2003 to 2013. Whilst CHE (Current Health Expenditure) increased 4.1 times during the period, CF (Capital Formation) increased 2.7 times. Therefore, CHE had a major effect on the amount of health expenditure.

Health expenditure, including CHE and CF, as a ratio of GDP was 3.24% in 2013, which was lower than the 5% recommended by WHO³⁷, after health expenditure as a ratio of GDP was 3.92% in 2003. Whilst average GDP increase rate was 17%, increase of the whole health expenditure and that of government was not enough. Consequently, out-of-pocket payment accounts for 87% (2013)³⁸ of private health expenditure (Diagnosis, treatment and medication at public hospitals are basically free in Sri Lanka.). Therefore, most nationals including the poor have treatment at private hospitals at their own expense. Since the poor households spend 10.5% (2010)³⁹ of their nonfood expenditure on health, the health expenditure has a strong impact on the poor household total expenditure. To

³⁷ "Discussion Paper Number-2: How Much Should Countries Spend on Health?" WHO(2003)

³⁸ "Sri Lanka National Health Accounts 2013", MOH (2016)

³⁹ "Household Health Expenditures and Utilization of Private Health Services" World Bank (2012), Cavagnero, E. and Govindaraj, R.

reduce out-of-pocket payment of the poor household, increase of the government's health expenditure is needed based on the increase of amount of health expenditure.

According to the Ministry of National Policies and Economic Affairs, Department of National Planning (NPD), the government has a policy to gradually increase the ratio of expenditure for the health sector to GDP from 1.8% (the average from 2012 to 2014) to 3% no later than 2020⁴⁰.

Table 2-11 Trends in Health Expenditure and Health Expenditure as a Ratio of GDP

(Unit : Rs. million)

Year	Health Expenditure		CHE of Gov.	CF of Gov.	GDP		Ratio of CHE to GDP (%)	Ratio of CF to GDP (%)	Ratio of CHE of Government to GDP (%)	Ratio of CF of Government to GDP (%)
	CHE	CF			Amount	Nominal Growth Rate (%)				
2003	63,191	7,726	24,030	5,439	1,822,468	15	3.5	0.42	1.32	0.30
2004	76,699	10,352	31,765	8,442	2,090,841	15	3.7	0.5	1.52	0.40
2005	88,740	10,364	37,379	8,295	2,454,782	17	3.6	0.42	1.52	0.34
2006	105,869	11,610	47,375	9,822	2,938,680	20	3.6	0.4	1.61	0.33
2007	120,646	12,217	54,560	10,259	3,578,688	22	3.4	0.34	1.52	0.29
2008	138,921	15,564	61,308	11,783	4,410,682	23	3.1	0.35	1.39	0.27
2009	156,072	15,267	68,146	10,415	4,835,293	10	3.2	0.32	1.41	0.22
2010	174,604	16,859	72,605	13,356	5,604,104	16	3.1	0.3	1.3	0.24
2011	199,570	18,042	83,119	13,234	6,542,663	17	3.1	0.28	1.27	0.20
2012	226,953	21,816	92,210	17,311	7,578,554	16	3	0.29	1.22	0.23
2013	260,044	21,106	146,359	18,900	8,674,230	14	3	0.24	1.69	0.22

Source: "Sri Lanka National Health Accounts 2013", MOH (2016) and "Sri Lanka Health Accounts: National Health Expenditure 1990-2014", Institute for Health Policy (2015)

2-7-2 Breakdown of CHE

Ratio of CHE in public health expenditure significantly increased from 38% in 2003 to 56% in 2013. After private health expenditure accounted for 60% of CHE, it increased to 44% in 2013. Although ratio of CHE public health expenditure greatly increased, that of CHE private health expenditure was still more than 40% and private health expenditure had a prominent role in health expenditure.

Table 2-12 Trends in Amount and Ratio of CHE (Unit: Rs. million, %)

Year	Health Expenditure				Health Expenditure (%)		
	Public	Private	Donor	Total	Public	Private	Donor
2003	24,030	37,948	1,212	63,190	38%	60%	2%
2004	31,765	44,503	431	76,699	41%	58%	1%
2005	37,379	50,874	487	88,740	42%	57%	1%
2006	47,375	58,347	147	105,869	45%	55%	0%
2007	54,560	65,302	783	120,645	45%	54%	1%
2008	61,308	76,858	754	138,920	44%	55%	1%
2009	68,146	86,027	1,899	156,072	44%	55%	1%
2010	72,605	100,566	1,433	174,604	42%	58%	1%
2011	83,119	114,894	1,557	199,570	42%	58%	1%
2012	92,210	133,348	1,395	226,953	41%	59%	1%
2013	146,359	113,660	24	260,043	56%	44%	0%

Source : "Sri Lanka National Health Accounts 2013", MOH (2016) and "Sri Lanka Health Accounts: National Health Expenditure 1990-2014", Institute for Health Policy (2015)

⁴⁰ It is based on the interview with NPD.

Governmental expenditure was 56.3% and out-of-pocket payment was 37.9% in terms of CHE in 2013 (Diagnosis, treatment and medication at public hospitals are basically free in Sri Lanka.). 76% of governmental expenditure was paid by central government, whilst 23% was paid by local government. Furthermore, voluntary healthcare payment was 5.8% in terms of CHE in 2013. Private health insurance, Non-Profit Institutions Serving Households (NPISH⁴¹) and enterprise financing are included in the voluntary healthcare payment percentage. The governmental financing institutions are the MOH, other ministries (Defence Ministry and others), the President’s Secretariat and local governments. Finally, foreign development agencies and international organisations expenditure was 0.01% in terms of CHE.

Table 2-13 Amount and Ratio of CHE in 2013 (Unit: Rs. million, %)

Institution		Amount		Ratio in CHE (%)	
Gov.	Central Gov.	146,359	111,846	56.3%	43.0% (76% of Gov. Burden)
	Local Gov.		34,090		13.1% (23% of Gov. Burden)
	Unspecified Gov.		423		0.2% (0.3% of Gov. Burden)
Out-of-pocket payment			98,451		37.9%
Voluntary healthcare payment			15,209		5.8%
Foreign Development Agencies			24		0.01%

Source : “Sri Lanka National Health Accounts 2013”, MOH (2016)

2-7-3 Changes in Healthcare Expenditure by Broader Categories of Illness

Based on Global Burden Diseases (GBD), the amount and ratio of CHE by Broader Categories of Illness in 2013, which is mentioned in “Sri Lanka National Health Accounts 2013” of MOH, are shown in Table 2-14. The highest ratio was non-communicable diseases with 35.2%, and the second highest was infectious and parasitic diseases with 22.1%⁴². The mortality rate of communicable diseases decreased from 24% to 12% during the last 50 years whilst that of cardiovascular diseases increased from 3% to 24%⁴³. According to the above-mentioned changes of disease structure, expenditure with regard to non-communicable diseases increased to Rs. 91.6 billion in 2013, which accounted for a large percentage of healthcare expenditure. Since costs of catheter diagnosis and treatment are expensive, increase of cardiovascular disease can be a big cause of straining the resources of health financing in the future.

⁴¹ Non-Profit Institutions Serving Households (NPISH): A nonprofit institution that is not predominantly financed and controlled by government, that provides goods or services to households free or at prices that are not economically significant, and whose main resources are voluntary contributions by households. It is defined in “System of National Accounts (SNA)”. Source: World Bank. (2015) “Purchasing Power Parities and the Real Size of World Economies: A Comprehensive Report of the 2011 International Comparison Program.”

⁴² “Sri Lanka National Health Accounts 2013”, MOH (2016) made by MOH based on a System of Health Accounts (SHA) 2011 of Organization for Economic Co-operation and Development (OECD). The information was obtained from; 1) Health financing department of central government and local government for the Government expenditure, 2) Central Bank of Sri Lanka, Department of Census and Statistics, for out-of-pocket expenditure, 3) Insurance Board of Sri Lanka, for voluntary healthcare payment, and 4) WHO, UN, NGO etc. for other expenditure.

⁴³ “Health and Development Challenges of Non-communicable Diseases in the South-East Asia Region, Report of the Regional Meeting”, WHO (2011)

Table 2-14 Amount and Ratio of CHE by Broader Categories of Illness in 2013

(Unit : Rs. million)

Illness	Amount	Ratio of CHE
Non-communicable diseases	91,612	35.2%
Infectious and parasitic diseases	57,582	22.1%
Non-disease specific illness/conditions	29,945	11.5%
Reproductive health-related illness/conditions	25,528	9.8%
Nutritional deficiencies	3,753	1.4%
Injuries	20,035	7.7%
Other/unspecified diseases/conditions	31,589	12.1%
Total	260,044	100%

Source: "Sri Lanka National Health Accounts 2013", MOH (2016)

2-7-4 Budget and Expenditure of the Government in Health Sector

After MOH expenditure in 2013 and 2014 increased from 30 to 40% compared to the previous year, it decreased 2% in 2015 and increased 52% in 2016. The budget of MOH from 2017 to 2019 is projected to increase gradually. Personal emoluments (51%) and special development initiatives⁴⁴ (36%) account for around 90% in breakdown of current expenditure in 2013. About breakdown of current expenditure of MOH in 2016, 43% was for personal cost (35% of that was supplies). Both account for 80% of current expenditure. Whilst ratio of personal cost tends to decrease until 2019, that of supplies would increase. Thus, budget allocation for supplies is essential.

Additionally, current expenditure ratio of MOH fluctuates between 70% and 81% whilst capital expenditure ratio fluctuates between 19 and 30%. Capital expenditure is limited compared with current expenditure, and a large increase from 2017 to 2019 in capital expenditure is not planned.

Table 2-15 Trends in the MOH Budget (Unit: Rs. million, %)

Current Expenditure	2012		2013		2014	
1. Personal Emoluments	32,703	57%	38,566	51%	46,183	48%
2. Operational Expenditure	5887	10%	8,280	11%	10,181	11%
3. Transfers to Institutions	1284	2%	1,604	2%	2,363	2%
4. Spetial Initiatives	17,985	31%	27,050	36%	37,000	39%
Sub Total	57,859	100%	75,500	100%	95,727	100%
Capital Expenditure	2012		2013		2014	
1. Institutional Expenditure	216	2%	528	3%	872	2%
2. Transfers to Institutions	81	1%	400	2%	368	1%
3. Special Development Initiatives	13,350	98%	18545	95%	36,260	97%
Sub Total	13,647	100%	19,473	100%	37,500	100%
Grand Total	71,506		94,973		133,227	

⁴⁴ Special Development Initiative is expenditure, which is composed of "Free Medicine for All" and "National Nutrition Programme". (After 2015, framework of special initiative was discontinued, and it was incorporated in each item such as personal emoluments and supplies in current expenditure.)

Current Expenditure	2015		2016		2017 (Estimate)		2018 (Projection)		2019 (Projection)	
1. Personal Emoluments	56,773	56%	59,804	43%	60,413	50%	61,289	48%	62,076	46%
2. Travelling Expenses	182	0%	192	0%	198	0%	208	0%	226	0%
3. Supplies	34,096	33%	47,991	35%	48,354	40%	54,169	42%	58,101	43%
4. Maintenance Expenditure	706	1%	672	0%	662	1%	681	1%	713	1%
5. Services	5,764	6%	24,009	17%	5,790	5%	6,078	5%	6,381	5%
6. Transfers	4,342	4%	5,672	4%	5,136	4%	5,705	4%	6,366	5%
Sub Total	101,863	100%	138,341	100%	120,554	100%	128,130	100%	133,863	100%
Capital Expenditure	2015		2016		2017 (Estimate)		2018 (Projection)		2019 (Projection)	
1. Rehabilitation and Improvement of Capital Assets	4,453	15%	5,136	8%	6,479	16%	7,079	14%	7,775	15%
2. Acquisition of Capital Assets	18,065	62%	26,811	44%	25,122	62%	30,563	62%	35,618	70%
3. Capital Transfers	345	1%	991	2%	1,244	3%	1,368	3%	1,480	3%
4. Capacity Building	96	0%	74	0%	777	2%	764	2%	805	2%
5. Other Capital Expenditure	6,074	21%	27,485	45%	6,796	17%	9,244	19%	5,436	11%
Sub Total	29,033	100%	60,497	100%	40,418	100%	49,018	100%	51,114	100%
Grand Total	130,896	-	198,838	-	160,972	-	177,148	-	184,977	-

Note: The budget of 2017 is an estimation and those of 2018 and 2019 are projections.

Because of rounding off, the totals above do not completely match the total expenditure by items.

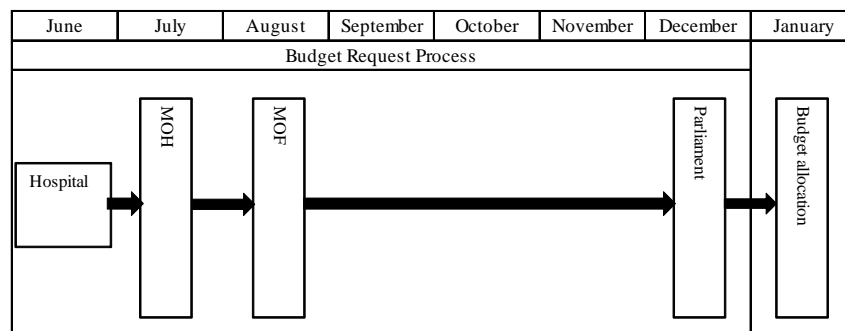
Source: "Estimates 2014, Ministry of Health", MOF (2015) and "Estimates 2017, Ministry of Health, Nutrition and Indigenous Medicine", MOF (2016)

According to the "Public Investment Programme (PIP) 2017-2020" of the Department of National Planning (NPD), Ministry of National Policies and Economic Affairs, although the details of the budget after 2020 are not shown, investment of Rs. 67,600 million for the health sector in 2020 is planned. Especially, investment for "Strengthening NCDs' Treatment Tertiary Care Hospitals" is Rs. 2,500 million in 2020. The following are strategies mentioned in PIP for the health sector: 1) Increase of investment for equipment, medicines, and medical facilities, 2) Reform and policy implementation of necessary sector including national health insurance, 3) Improvement of medical facilities to prevent and treat NCDs and communicable diseases, and 4) Improve quality of healthcare service focused on patient safety.

Budget of the O&M cost after operation starts, which is not included in the project cost, should be allocated by MOH. The O&M cost for small medical products and medicine, which is required for high cost catheter diagnosis and treatment, is spent under "Medical Supplies" of the Supplies category in current expenditure of MOH budget. The O&M cost for medical equipment is under "Plant and Machinery" of the Medical Expenditure category in capital expenditure. The O&M cost of the project should be fully considered in budget formulation after 2020.

2-7-5 Budgetary Flow

The budgetary request process of tertiary healthcare institutions under the MOH such as teaching hospitals, provincial hospitals, and some of district general hospitals is shown in Figure 2-4. Initially, hospitals submit the request for budget to the MOH (June), and MOH submits the budgetary request to the MOF. After MOF conducts the budgetary assessment, it makes a draft of the budget. The budget plan is then submitted to Parliament (December) and following parliamentary approval, the budget is allocated (January).



Source : Prepared by the Survey Team based on information from MOH (2016)

Figure 2-4 Budget Request Process of Tertiary Medical Facilities under the MOH

2-7-6 Issues and Solutions regarding Health Financing

As mentioned above, from 80% to 90% of national and public health expenditure was for current expenditure, and its total amount has increased every year in Sri Lanka. If this trend continues, sufficient budgetary allocation for new capital expenditure would not be implemented in the future. Since private ratio of health expenditure was more than 40%, out-of-pocket payment is not negligible. It is caused by problems of medical service at public hospitals such as long waiting times for treatment and low quality of the service. Constant rate of patients in serious condition needs to have treatment at private hospitals. Although this situation of increasing patient's burden of medical costs is considered as an issue by MOH in the policies, it doesn't have concrete precautionary measures at this time.

Furthermore, the ratio of health expenditure in GDP was lower than 5.0%, which was recommended by WHO. As solutions of health financing, increasing the ratio of health expenditure of government, structural change of health financing, which places a disproportionate emphasis on current expenditure, and securing budget by the introduction of national health insurance are essential.

To introduce national health insurance, consideration of institutional framework of that, liability relief measures for the poor based on their income, and considering issues (such as default of insurance payment) and countermeasures of introducing the national health insurance are necessary. In particular, it is desirable to consider insured persons, the category of insurance payment, and insurance costs regarding national health insurance for study of institutional framework in according with case study analysis of other countries' health insurance system.

Budgetary allocation by MOH based on the estimation of future pattern of diseases is not implemented at this time; the budget is allocated based on that of the former year when there is no special plan. There is no long- or medium-term financial plan for health. Therefore, development of long- or medium-term financial plans for health, based on estimation of diseases, including increase in NCDs, and considering expanding and diversification of funding sources (tax and user charge) to decrease NCDs are essential.

O&M cost of facilities developed by the project is large, and renewal cost of equipment is also required. Thus, coordination between MOH and MOF and budget allocation based on the O&M cost estimated in this survey are vital.

2-8 Issues in the Prevention and Intervention of Cardiac Disease

Various measures are necessary to be taken nationwide for prevention and intervention of cardiac diseases, such as providing timely medical service to the patients in urgent conditions, dissemination of the information on how to prevent cardiac disease and promotion of the screening, rehabilitation and monitoring services, maintaining and monitoring the patients' clinical records, and establishing as well as implementing medical policy based on the analysis of patients' clinical records. Furthermore, human resource development and the establishment of integrated and consistent medical information system are essential in addition to the medical equipment procurement and maintenance together with the necessary budget allocation and execution.

Viewing the current situation of the medical services for cardiac diseases, the following 4 points can be raised as the major issues.

- 1) Reduction in the regional disparity in the availability of the diagnostic and intervention services for ischemic heart disease

The medical facilities providing the services of appropriate diagnosis and intervention are located only in the major cities in the Provinces of Western, Southern, Central and Northern, and the regional disparity is seen. As a consequence, the patients who reside in the other provinces than those major cities are visiting the hospitals in Colombo and Kandy, where the medical facilities are crowded with patients. It is therefore necessary to improve the facilities for the medical services for ischemic heart disease in the areas where such services are not currently available.

- 2) Improvement of medical services for the ischemic heart diseases in the facilities for diagnosis and intervention

As the result of congestion with the patients at the hospitals having the facilities for ischemic heart diseases in Colombo and Kandy, problematic situations are seen in the patients waiting for a long time for the necessary services and the quality of services is degraded. For example, the second largest hospital in the country, the Kandy Teaching Hospital, must concentrate more on the interventions for the serious patients by providing the high level of service that they can, but the ratio of diagnosis to intervention cases is almost equal to that of other tertiary healthcare institution as the Kandy Teaching Hospital has to accept a number of outpatients. By improving the facilities for ischemic heart disease in the areas where such services are not currently available, the Kandy Teaching Hospital and other hospital with high level of technology will become capable of serving for patients of more serious conditions.

3) Strengthening the activities of HLCs for prevention, and improvement of rehabilitation services at the medical institutions

As a countermeasure for cardiac diseases, a comprehensive service from prevention to diagnosis, intervention and rehabilitation should be extended to the patients. For the preventive services, however, actual use of services by the clients (residents) at the HLCs is small, and the services such as screening are not reached to many clients. In addition, the facilities and equipment for rehabilitation are not available in many of the medical institutions. Comprehensive services are not currently provided to the patients. It is therefore important to strengthen the preventive service and to provide the necessary facilities for rehabilitation at the hospitals, so as to complete the chain of services for the patients of cardiac diseases.

4) Maintaining the patients' clinical records, and sharing and making use of information among the medical institutions and government administrations

In order to provide the comprehensive service efficiently and effectively from prevention to diagnosis, intervention, rehabilitation and/or follow up at the facilities below the secondary level, information sharing of patients' clinical records between the medical institutions is important. However, the clinical records of the patients are not maintained at the medical institutions, in general, and not shared among the medical institutions. Such patients' clinical records are not shared with government administrations as well, and the lack of recording and sharing of patients' record is one of the issues to be addressed in the planning of countermeasures for the cardiac diseases.

Chapter 3 Current Situation and Issues of Target Facilities

This chapter summarizes the current situation and issues of the target facilities of the survey: i.e. tertiary healthcare institutions, MLT Schools, Bio-medical Engineering Services (BES) and provincial training centres.

3-1 Tertiary Healthcare Institutions

3-1-1 Badulla Provincial General Hospital (Uva Province)

Outline	A general hospital located in downtown Badulla and having 1,493 beds in total; a tertiary healthcare institution with the longest history of all the hospitals in Sri Lanka. It covers all Uva Province (approximate population 1.3 million) and adjacent provinces. The cardiology department does not have a function of catheter diagnoses/interventions yet.
Cardiac care service	No service related to catheter diagnoses/interventions is provided. This hospital receives patients who are likely to recover with medical treatment and provides them with medication such as treatment with thrombolytic drugs.
Number of beds in cardiology	20 beds in general ward (10 for men and 10 for women), 5 beds in CCU, 4 beds in ICCU
Equipment usage status	There is no angiography system. The existing CT scan machines are not compatible with imaging of circulatory organs. Approx. 7 or 8 cases of stress electrocardiography are conducted per week. Approx. 50 to 60 cases of examinations using ultrasonic diagnostic equipment are conducted per day. Temporary pacemaker placement is conducted with surgical fluoroscope systems.
Human resources (Heart disease treatment)	1 cardiologist, 7 general physicians, and 10 nurses
Issues	<ul style="list-style-type: none"> ◆ Examination and treatment services related to ischemic heart diseases are provided mainly to outpatients. (Some of the patients who need hospitalization are given only medical treatment in the cardiology ward.) ◆ Being a tertiary healthcare institution, the hospital urgently requires introduction of facilities for catheter diagnoses/interventions. ◆ Close coordination between cath lab team to be established and existing departments in the hospital will be required in terms of re-allocation of staff and works when starting operation of cath lab as it is the first time for the hospital to operate the cath lab.

* Service expenses: Communication charges, rent, and utility charges.

3-1-2 Trincomalee District General Hospital (Eastern Province)

Outline	A general hospital located at the southern end of Trincomalee. It has 350 beds in total and covers all Trincomalee City with an approximate population of 400,000. The cardiology department does not have a function of catheter diagnoses/interventions yet.
Cardiac care service	A cardiology clinic, opened about one year and half ago, has minimum facilities for conducting examinations necessary for cardiovascular diseases, such as PACS (Picture Archiving and Communication System), Injector, X-ray machine, ultrasound scanner, ECG, Holter ECG and treadmill except for cath lab equipment. Diagnosis/treatment services required for early detection are provided.
Number of beds in cardiology	No cardiology hospitalization facilities are owned.
Equipment usage status	No angiography system is available. The existing CT scanner machines are not compatible with imaging of circulatory organs, either. Cardiac disease diagnosis is conducted using ultrasonic diagnostic equipment, electrocardiographs, etc.

Human resources (Cardiac disease treatment)	1 cardiologist, 2 general physicians, 1 nurse, 3 ECG technologists, and 1 health assistant
Issues	<ul style="list-style-type: none"> ◆ Examination and treatment services related to ischemic heart diseases are provided mainly to outpatients, using ultrasound scanner and ECG etc. ◆ Introduction of facilities for catheter diagnoses/interventions is urgently required for the tertiary healthcare institution. ◆ Close coordination between cath lab team to be established and existing departments in the hospital will be required in terms of re-allocation of staff and works when starting operation of cath lab as it is the first time for the hospital to operate the cath lab. Another issue in the hospital is that there is no proper system of collecting and recording basic information on outpatients and those referred to other hospitals.

3-1-3 Kandy Teaching Hospital (Central Province)

Outline	<p>A general hospital located 1 km southwest of downtown Kandy and having 2,334 beds in total; the second largest tertiary healthcare institution in Sri Lanka next to the National Hospital of Sri Lanka. This is a general hospital consisting of 37 specialty departments including those for circulatory organs and having 2,334 beds in total. There are 78 general hospitalization wards, 13 special hospitalization wards, 10 ICUs, and 24 operating theatres.</p> <p>This hospital has a cath lab and a record of conducting the second largest number of cases of diagnoses/interventions, next to the National Hospital of Sri Lanka.</p>
Cardiac care service	<p>Bypass surgeries, valve replacement surgeries, stent placements, and balloon catheter interventions are provided.</p> <p>There are two cath lab and two angiography systems are installed, but de facto only one angiography system is in operation. The other system is out of function due to aging. This hospital is ineffective for patients requiring electrophysiological treatment.</p>
Number of beds in cardiology	56 beds in general ward (32 for men and 24 for women), and 16 beds in CCU (ICCU is in the same room as CCU).
Equipment usage status	<p>Approx. 300 examinations/treatments are conducted per month. In August 2016, 272 cases of angiography, 43 cases of Percutaneous Coronary Intervention (PCI), 6 cases of atrial septal defect (ASD), and 1 case of percutaneous transluminal mitral commissurotomy (PTMC) were conducted.</p> <p>Both the operators of the angiography system and the members of the cath lab team are operating at full capacity.</p>
Human resources (Cardiac disease treatment)	7 cardiologists, of which 2 are capable to conduct Electrophysiology (EP) (all of whom are capable of conducting PCI), 24 general physicians, 119 nurses, 5 radiologists, and 5 circulatory ECG technologists
Issues	<ul style="list-style-type: none"> ◆ 7 cardiologists are working and conducting a little less than 3,000 cases of catheter diagnoses/interventions per year. However, insufficient number of catheter diagnoses/interventions is being conducted in comparison with the number of patients because this hospital is receiving many patients referred by other hospitals, encountering concentration of patients, and because only one angiography system is de facto in operation, causing patients to wait for one year before receiving examinations. ◆ Although 2 cardiologists specializing in electrophysiological treatment are assigned, there is not a sufficient number of equipment necessary to conduct electrophysiological treatment, such as biplane angiography systems and 3D mapping systems. ◆ The hospital requested a new laboratory complex building in their premise, detached from the outpatient unit building in where the existing laboratories are located dispersedly and operated in tight space.

3-1-4 Sirimavo Bandaranayake Specialized Children Hospital (Central Province)

Outline	A general hospital for children located approximately in the centre of Peradeniya; a relatively new hospital that has 292 beds in total and started providing outpatient care in 2010. This hospital covers mostly the entire Sri Lanka except for the Southern and Western Provinces. The hospital has a function of catheter diagnoses/interventions in place.
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Cardiac care service	This hospital procured an angiography system with the national budget and started to provide catheter interventions in 2015 (there is a cath lab.). Although the backup from the cardiothoracic surgery unit is required for congenital cardiac diseases of children, this hospital doesn't have cardiothoracic surgery unit. Therefore, seriously ill patients are conveyed to Lady Ridgeway Hospital for Children in Colombo, which has a child cardiovascular surgery department.
Number of beds in cardiology	16 beds in general ward
Equipment usage status	This hospital was provided with one single-plane angiography system in 2015 and started to provide catheter interventions to child patients in 2016.
Human resources (Cardiac disease treatment)	2 cardiologists, 7 general physicians, 12 nurses, and 2 cath lab technologists
Issues	<ul style="list-style-type: none"> Although this hospital has no choice but to provide catheter diagnoses/interventions under unstable conditions without backup from cardiovascular surgeons, the treatment needs for child patients are being met.

3-1-5 Kurunegala Teaching Hospital (North Western Province)

Outline	A general hospital located approximately 1 km south of downtown Kurunegala and having 2,302 beds in total; the second largest tertiary healthcare institution in Sri Lanka along with Kandy Teaching Hospital. This hospital, receiving a total of more than 1.2 million patients per year, is a core hospital that covers not only the whole District of Kurunegala but also receives referred patients from Anuradhapura, Polonnaruwa, Trincomalee, and Matale when needed. The angiography system used for catheter diagnoses/interventions in the cardiology department went out of order and is being renewed with the MOH budget.
Cardiac care service	<p>Though there is a cath lab in the hospital, no diagnosis/interventions that need catheters can be conducted since October 2016 when the angiography system (second-hand product installed in 2009) went out of order.</p> <p>At present, outpatients and inpatients who need various examinations are provided with such examinations as stress electrocardiography, Holter electrocardiography, CT scanner, and ultrasonic diagnostic equipment and treatment/nursing through pacemaker implantation and medication.</p>
Number of beds in cardiology	56 beds in general ward (28 for men and 28 for women), 8 beds in CCU, and 8 beds in ICCU
Equipment usage status	<p>The existing out-of-order angiography system is past its service life and cannot be repaired, so it is being renewed.</p> <p>In the period from January to September 2016, 999 cases of angiography and 249 cases of PCI were performed.</p>
Human resources (Cardiac disease treatment)	3 cardiologists, 17 general physicians, 117 nurses, 5 ECG technologists, 1 radiologist
Issues	<ul style="list-style-type: none"> One set of used angiography was installed in 2009 and services related to catheter diagnoses/interventions were provided at the cath lab until 2015 but are no longer provided due to recent malfunction of the machine. Expansion of facilities for catheter diagnoses/interventions is urgently required for the tertiary healthcare institution. Since cath lab team staff was assigned to other departments at the same time when stopping the operation of cath lab, it was necessary to organize the team again. Therefore close coordination between cath lab team to be established and existing departments in the hospital will be required in terms of re-allocation of staff and works as it will almost be the first time for most of the new staff to operate the cath lab. Another issue in the hospital is that there is no proper system of collecting and recording basic information on outpatients and those referred to other hospitals.

3-1-6 Anuradhapura Teaching Hospital (North Central Province)

Outline	A teaching hospital located 4 km southeast of downtown Anuradhapura and having 1,950 beds in total; the fourth largest tertiary healthcare institution in Sri Lanka. It covers the North Central Province (approx. population of 1.1 million) and the adjacent Northern and Western Provinces with an approximate population of half a million. The angiography system used for catheter diagnoses/interventions in the cardiology department went out of order and is being renewed with the MOH budget.
Cardiac care service	There is a cath lab in the hospital. But the angiography system went out of order in October 2016 and is currently in the process of removal and replacement. Temporary pacemaker placement is conducted not in a cath lab but in an operating theatre.
Number of beds in cardiology	26 beds in general ward (14 for men and 12 for women), 4 beds in CCU, and 8 beds in ICCU
Equipment usage status	From April to December 2015, the angiography system was used to conduct 159 cases of treatment such as PCI.
Human resources (Cardiac disease treatment)	3 cardiologists, 10 general physicians (9 for adults and 1 for children), 18 nurses, and other ECG staff
Issues	<ul style="list-style-type: none"> ◆ One set of angiography was installed in 2002 but was removed in 2016 due to malfunction. Therefore no services related to catheter diagnoses/interventions can be provided. Only medical treatment such as medication is provided in the cardiology unit. ◆ In addition to an angiography system of single-plane type which is under process of procurement by MOH budget, the introduction of a biplane angiography system is expected to enable examinations and treatments using small amounts of contrast media. In addition, the assignment of cardiology specialist who can provide electrophysiological treatment is expected to enable electrophysiological examinations and treatments in the future. ◆ Despite its position as a teaching hospital, no cardiovascular surgery department that provides backup to the catheter interventions in the cardiovascular surgery has been established. The introduction of operation-related facilities for the cardiovascular surgery is vital to establish a backup organisation and make the hospital an institution that can handle difficult cases. ◆ Since cath lab team staff was assigned to other departments at the same time when stopping the operation of cath lab, it was necessary to organize the team again. Therefore close coordination between cath lab team to be established and existing departments in the hospital will be required in terms of re-allocation of staff and works as it will almost be the first time for most of the new staff to operate the cath lab. Another issue in the hospital is that there is no proper system of collecting and recording basic information on outpatients and those referred to other hospitals.

3-1-7 Polonnaruwa District General Hospital (North Central Province)

Outline	A general hospital located a little west of the centre of Polonnaruwa and having 895 beds in total. This hospital covers the entire Polonnaruwa Province (population approx. 430 thousand people) and approx. 600 thousand people in the surrounding provinces (Trincomalee, Batticaloa, Matale, Ampara, and Anuradhapura). Although the cath lab in the cardiology department has an angiography system, it is not yet operational and therefore no service of catheter diagnoses/interventions is provided.
Cardiac care service	An angiography system was installed in the cath lab (one unit) with the national budget in 2016. However, the cath lab is not yet operated because the X-ray protection work for the walls has not been completed and some basic equipment such as defibrillators and contrast media fillers still need to be procured. Patients receive medication according to their disease conditions and are nursed in CCU.
Number of beds in cardiology	40 beds in general ward, 4 beds in CCU, 4 beds in ICCU
Equipment usage status	As mentioned in the column of "Cardiac care service" above, the cath lab is not yet operated.
Human resources (Cardiac disease treatment)	2 cardiologists, 7 general physicians, 16 nurses, and 2 cath lab technologists

Issues	<ul style="list-style-type: none"> ◆ The completion of shielding work for the angiography system and the installation of the related equipment will enable diagnoses/interventions in the cath lab in the future. ◆ The Polonnaruwa District General Hospital is located at a distance of 1.5 to 2 hours' drive from the Anuradhapura Teaching Hospital. Therefore, the availability of one angiography system is sufficient to meet the need of nearby residents for cath lab diagnoses/interventions. ◆ Close coordination between cath lab team to be established and existing departments in the hospital will be required in terms of re-allocation of staff and works when starting operation of cath lab as it is the first time for most of the staff to operate the cath lab. Another issue in the hospital is that there is no proper system of collecting and recording basic information on outpatients and those referred to other hospitals.
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3-2 Medical Laboratory Technologist (MLT) Schools

Current situation	<p>There are three MLT Schools in Sri Lanka, which are fostering MLTs in a two-year course.</p> <p>The school curriculum was revised in 2014. Learning of examination methods required for diagnoses of congenital cardiac diseases has been introduced in addition to the basic examination items. However, the methods taught at the MLT Schools are mostly the manual basic skills and not the skills required for the automated laboratory equipment. Many students learn the operations of automatic analysers, etc. after they are assigned to hospitals.</p> <p>Each School is composed of 6 staff (One Principal, 1 senior lecturer, 4 lecturers). Prescribed number of students is 50 but the number sent to each MLT School by MOH defers every year. In 2016, each School was requested to accept 70 students and is currently managing their training with available equipment and staff.</p> <p>In the entire country, total number of the vacated positions for MLT is approx. 400, against the number of positions for which the budget has been approved.</p>
Issues	<ul style="list-style-type: none"> ◆ Insufficient kind, number and quality of equipment required for the training according to the current curriculum ◆ Automated equipment that has become popular in health care institutions has not been introduced in MLT Schools and therefore the trainees cannot receive trainings on how to use them while they are enrolled. ◆ In the future, the tertiary healthcare institutions will encounter an increase in the number of examinations such as sample testing, etc., which are expected to increase the workload of MLTs. Therefore, the fostering of MLT needs to be promoted to contribute to an increase in the quality and quantity of diagnoses/treatments related to cardiac diseases.

3-3 Bio-medical Engineering Services (BES)

Current situation	<p>The BES established on the premises of the MOH in Colombo has the workshop (The equipment maintenance room with soldering iron, multi-meter, tools and parts storage room, etc.) and five repair sections for (1) general medical equipment, (2) operating-theatre medical equipment, (3) clinical laboratory equipment, (4) electric and electronic equipment, and (5) radiographic image diagnostic equipment (each equipped with soldering irons, multi-meters, tools, repair parts cabinets, etc.), each dealing with medical equipment that cannot be repaired by the branch workshops at the hospitals under the administration of MOH. The branch workshops at the hospitals are repairing medical equipment with simple structures such as aspirators and anesthetic machines of the hospital departments using parts available in local markets or purchased from local agents. For the equipment of complicated structure, only an authorized technician can repair them under a long-term maintenance contract between the manufacturer of said equipment or local agent with MOH.</p> <p>BES consists of DDG as the leader and 14 bio-medical engineers (BMEs), 35 foremen, and 40 technicians, who are assigned to the BES head office and branch workshops as of March 2017. BMEs have qualifications as university graduates who specialized in electrical engineering and other such subjects. Foremen and technicians have diploma-level qualifications. BME is working for the management of the operating</p>
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	<p>condition of medical equipment. On the other hand, foremen and technicians are mainly responsible for the services of procurement of parts and repairing.⁴⁵</p> <p>As of January 2017, 1 BME and 1 foreman at Badulla PGH, 1 foreman and 2 technicians at Trincomalee DGH, 1 foreman and 2 technicians at Kandy TH and 1 foreman and 3 technicians at Anuradhapura TH are allocated. Although there is no such staff at Kurunegala TH, technicians at Kandy TH (one hour from Kurunegala by car) are also in charge there.</p> <p>For the medical equipment allocated to the hospitals, BES establishes tendering conditions and specifications from the stage of procurement including the maintenance and management contract on behalf of the hospitals since the survey stage and concludes maintenance contracts for the equipment with a successful tenderer (agent) in an effort to maintain the maintenance services.</p>
Issues	<ul style="list-style-type: none"> ◆ Hospitals do not keep master management ledgers for current equipment, so the equipment service life, repair history, and other areas of administration are not known. For that reason, it is difficult to schedule equipment renewal. ◆ BES is provided with a simple computer-recorded equipment management ledger (including years of purchase, manufacturers, models and places of installation). However, management of the equipment repair at the workshop branches of the hospitals is done by hand-written notes, thus hindering coordination with the BES in operation and maintenance of medical equipment. ◆ This results in the BES of MOH having no understanding of the operability of on-site equipment; this causes the equipment defects to become irreparable major malfunctions, resulting in problems such as the renewal of equipment being necessary. ◆ Preventive maintenance such as daily and periodical inspections is not properly and timely conducted due to insufficiency of maintenance tools. To improve the safety of the cardiovascular medical services, it is necessary to procure laboratory equipment and equipment for calibration and ensure implementation of preventive maintenance activities using them.

3-4 Provincial Training Centres

Current situation	<p>PHIs and PHMs serve as the core personnel for prevention and screening of NCDs.</p> <p>The Provincial Training Centres are intended to foster these personnel and provide in-service training to health and medical personnel who are currently working in the provinces according to the programmes made by MOH.</p>
Issues	<ul style="list-style-type: none"> ◆ The Provincial Training Centres in Kurunegala and Galle do not have sufficient space for fostering PHIs and PHMs, such as a lecture room or a large assembly hall. No in-service training for doctors and paramedics such as nurses in the provinces is provided, either, due to lack of space. The current situation of using vacant rooms of the Provincial Department of Health Services, which needs the adjustment on training schedule based upon the condition of vacant rooms, is posing problems in the scheduled implementation of the training curriculum.

⁴⁵ At the time of survey in April 2017, eight BMEs have been recruited and will be assigned to regional hospitals including the target hospitals in this Project after two-week training. Additionally, the recruiting of new foremen and technicians is also in progress.

Chapter 4 Scope of the Project

4-1 Position of the Project in National Policies

Cardiovascular diseases are the largest cause of death for the Sri Lankan people. The death rate in Sri Lanka is 159.4 per 100,000 population, which is higher than the international level of 117.0 per 100,000⁴⁶, leaving a lot to be improved in medical services for the patients. The largest obstacle to treatment of cardiovascular diseases is a limited access to medical institutions that can provide such treatment. For the public healthcare service, only six institutions (including the ones which is not currently functioning) in Sri Lanka can provide catheter interventions and they are situated in only six of the nine provinces in the country. For acute ischemic heart diseases, time is the decisive factor between life and death. Not a few patients are losing their life because there is no hospital near their residences. Furthermore, concentration of patients at a limited number of hospitals that can provide catheter diagnosis/interventions is prolonging the waiting time⁴⁷ until treatment. A delay in treatment worsens patients' conditions and has significant impact on their social rehabilitation after treatment. In Sri Lanka, men in their productive age have a high cardiac morbidity⁴⁸ and the maintenance of their productive activities is an important issue in the development of the national economy. Furthermore, the long waiting time until catheter diagnosis at public hospitals has been increasing and is causing many patients to use private hospitals on a chargeable basis. This trend is increasing the individual payment of healthcare expenses, which the Sri Lankan government considers as a financial risk for patients. Therefore, the government plans to guide the private institutions by setting maximum price of medical services in order to avoid extra financial burden of the patients.⁴⁹

Consequently, the Sri Lankan government is in the process of establishing healthcare policies that include strategies that focus on improvement of access to catheter interventions and strengthening of relevant human resources. This Project is positioned as a means to support national strategies for cardiovascular diseases by creating facilities that can provide catheter interventions mainly in the provinces where they are not available at present, expanding the capacity of the existing hospitals with concentration of patients, and contributing to fostering health personnel concerned for the services. (see Figure 4-1, "Position of the Project in Healthcare Policies").

4-2 Project Purposes

Through the analysis of the request and the health conditions in Sri Lanka, the objectives to be pursued in this ODA Loan Project are summarized as follows:

⁴⁶ "Global Health Estimate (GHE) 2012", WHO

⁴⁷ Waiting time at National Hospital of Sri Lanka is several months and Kandy TH is one year, according to the findings by JICA Survey Team

⁴⁸ Proportion of ischemic heart disease patient by sex: men 55.5% and women 44.6% , according to "Annual Health Bulletin 2014", MOH (2016)

⁴⁹ "National Health Policy 2016-2025", MOH (2016). The Private Health Service Regulatory Council established by MOH in 2007 is analyzing the unit costs of various services to set the reasonable cost, and plans to regulate such costs to be applied to the private sector.

4-2-1 Overall Goal

To contribute to the reduction in premature mortality from cardiovascular disease

4-2-2 Purpose of the Project

To improve the diagnosis and treatment service for cardiac diseases by constructing medical facilities and procuring equipment in tertiary healthcare institutions and training institutions for medical staff, as well as strengthening the medical equipment maintenance capability.

4-2-3 Project Output

- (1) Equitable access to catheter diagnosis/ treatment will be improved by developing the medical facilities and equipment in tertiary healthcare institutions
- (2) Diagnostic function for cardiac disease care will be strengthened by improving the medical equipment in MLT Schools
- (3) Maintenance function at the tertiary healthcare institutions will be enhanced by improving the repair tools and equipment in BES

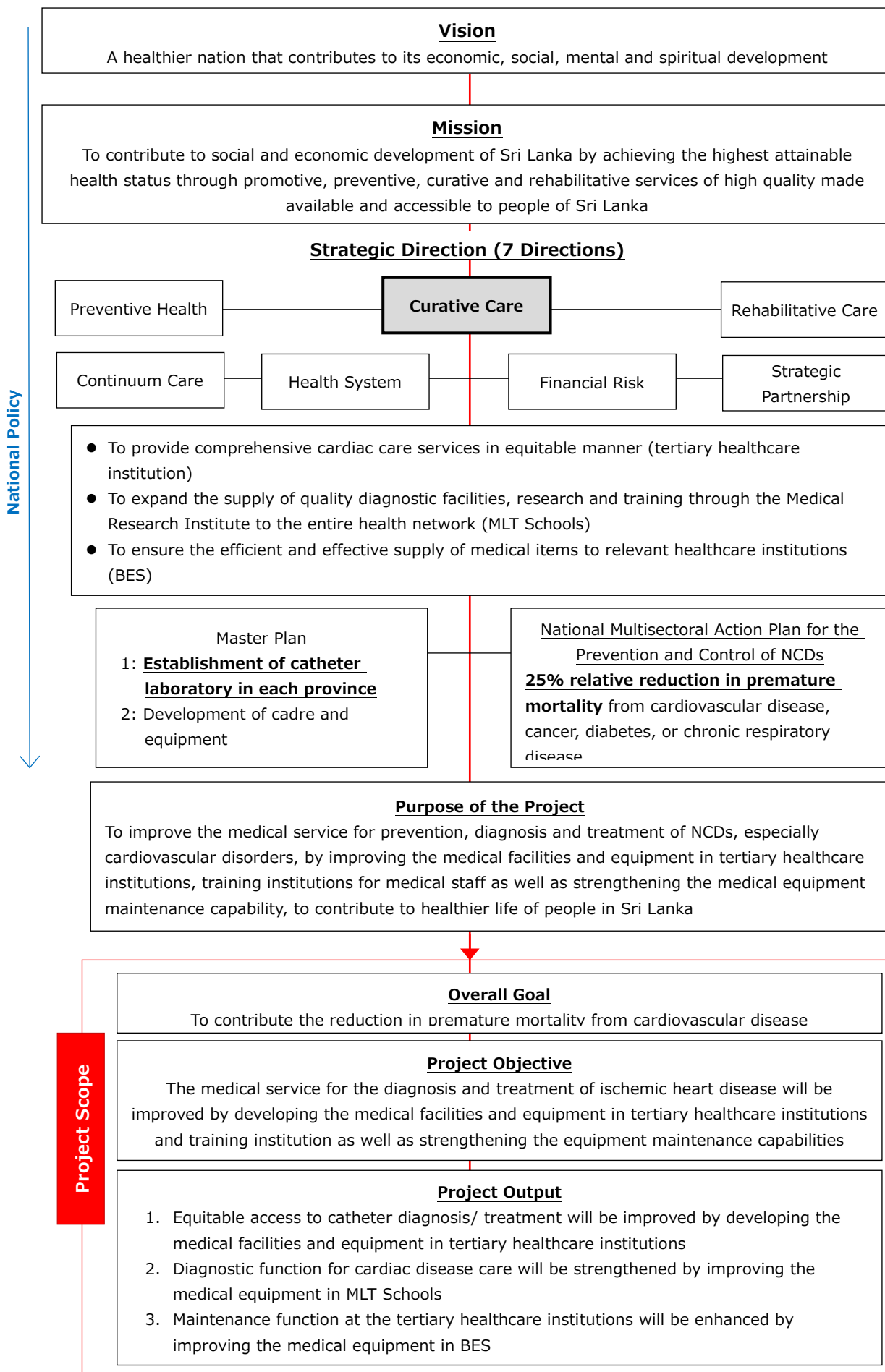


Figure 4-1 Position of the Project in National Policies

4-3 Priority Order of Target Facilities

4-3-1 Priority evaluation method

The priority order of target facilities was determined by specifying the minimum qualification requirements and prioritization evaluation criteria and evaluating each of these facilities according to them.

(1) Minimum qualification criteria

The minimum qualification criteria refer to minimum requirements for being a target of this ODA Loan Project. The facilities are evaluated according to the minimum qualification requirements listed in the table below and categorized into three levels: “Consistent,” “Weak Consistency,” and “Not Consistent.” Any facility and component that are “Not Consistent” were not included in the scope of the Project.

Table 4-1 Minimum Qualification Requirements

Criteria	Content
1. Consistency with Project Purposes	<ul style="list-style-type: none"> ✓ To improve the diagnosis and treatment service for cardiac diseases by improving the medical facilities and equipment in tertiary healthcare institutions, training institutions for medical staff as well as strengthening the medical equipment maintenance capability
2. Consistency with Current and Future Demand	<p><u>[Hospitals]</u></p> <ul style="list-style-type: none"> ✓ The consistency is evaluated with the future demand for catheter diagnoses/interventions calculated by the Survey Team. <p><u>[MLT Schools]</u></p> <ul style="list-style-type: none"> ✓ Whether there is a demand for training or not. (The demand for research, accommodation and means of transportation is not included.) <p><u>[Provincial Training Centres]</u></p> <ul style="list-style-type: none"> ✓ Whether there is a demand for training or not. (The demand for research, accommodation and means of transportation is not included.) <p><u>[BES]</u></p> <ul style="list-style-type: none"> ✓ Whether there is a demand for maintenance of medical equipment of the hospitals.
3. Consistency with Systems in Sri Lanka and Master Plan	<p>The consistency is evaluated with the following strategies as indicated in the “National Strategic Framework for Development of Health Services 2016-2025” issued in 2016:</p> <p><u>[Hospitals]</u></p> <ul style="list-style-type: none"> ✓ Alleviating the congestion at hospitals by building up the capacity of the secondary and tertiary level hospitals ✓ Improving the services for the patients of ischemic heart diseases by construction of a new cath lab considering the population density and the accesses to the hospitals <p><u>[MLT Schools]</u></p> <ul style="list-style-type: none"> ✓ Enhancing the capability of laboratory technology <p><u>[Provincial Training Centres]</u></p> <ul style="list-style-type: none"> ✓ Strengthening the training organisations for healthcare human resources <p><u>[BES]</u></p> <ul style="list-style-type: none"> ✓ Strengthening the capacity of inventory control and maintenance of medical care equipment

Source : Prepared by the Survey Team (2017)

(2) Priority Evaluation

According to the priority evaluation criteria shown in the table on the next page, the status of a target facility was evaluated in three levels: “Satisfactory,” “Partially satisfactory,” and “Not satisfactory.”

Table 4-2 Priority Evaluation Criteria

Criteria	Description
1. There is consistency in content and schedule between the project to be implemented by the Sri Lankan side and the ODA Loan Project.	If the buildings are constructed with any other budget and the equipment is procured with ODA Loan, there is a risk of inconsistency of the project schedule for equipment procurement and the schedule for building construction. In this case, the evaluation is low.
2. There is no duplication with any other project or existing facility or equipment.	If there is any other project similar to this Project, or if the equipment to be procured in the Project is duplicated with existing equipment, the evaluation is low.
3. The construction site or equipment installation space has been acquired.	If the construction site or equipment installation space is not acquired, the evaluation is low.
4. The personnel in charge of maintenance and operation or the improvement plan are available.	[Hospitals] ✓ Is the medical staff team for a cath lab headed by cardiology consultant organized? If not, is the staffing plan available? [MLT Schools] ✓ Is there at least one lecturer per each subject? If not, is the staffing plan available? [Provincial Training Centres] ✓ Is there at least one lecturer per each course? If not, is the staffing plan available?
5. The equipment maintenance system is existing, or the creation plan is available.	[Hospitals] ✓ Is the equipment maintenance system, including the inventory control, regular inspection, inspection recording and follow-up service of the equipment existing? If not, is the improvement plan available? [MLT Schools and Provincial Training Centres] ✓ Is the equipment inventory control done?
6. No negative impacts on the society and environment are predicted.	Is there any possibility of negative impact on the society and environment?

Source : Prepared by the Survey Team (2017)

(3) Overall Evaluation

The result of overall evaluation of the plans which are listed in the Table 1-1 and satisfied the Minimum Qualification as the first step and the Priority Evaluation as the second step is shown in the following grading system.

Table 4-3 Priority Order Grades for Overall Evaluation

Priority	Description
A	All of both minimum qualification requirements and priority criteria are met and considered to be included in the Project.
B	Though minimum qualification requirements are met, one of the priority criteria is “unsatisfactory” at present. If the satisfaction of the criterion is confirmed, it will be considered to be included in the Project.
C	A part of the minimum qualification requirements is not satisfied and thus the priority of inclusion in the Project is low.
X	The minimum qualification requirements are not satisfied and thus will not be included in the Project.

Source : Prepared by the Survey Team (2017)

4-3-2 Evaluation Results

The outline of the evaluation results is shown in the table below. As a result of evaluation, it was deemed appropriate to include Badulla Provincial General Hospital, Trincomalee District General

Hospital, Kandy Teaching Hospital, Kurunegala Teaching Hospital, and Anuradhapura Teaching Hospital in the target of ODA Loan Project but to exclude Sirimavo Bandaranayake Specialized Children Hospital and Polonnaruwa District General Hospital from the Project. Both the MLT Schools and BES were evaluated as grade A and thus should be included in the target of the Project. On the other hand, the Provincial Training Centres were evaluated as grade C because of weak consistency with the objectives of the Project. The survey team and MOH confirmed after discussions that the Provincial Training Centres will not be included in the Project.

Table 4-4 Priority Order Evaluation Result for Target Facilities

Target facilities	Overall Evaluation	Reason/remarks
<Tertiary healthcare institutions>		
Badulla PGH	B	Although the minimum qualification criteria are satisfied, since the Sri Lankan government will construct a cardiology ward (and the ODA Loan Project will procure equipment), it is a prerequisite to secure the construction budget by the Government of Sri Lanka.
Trincomalee DGH	A	This hospital has a high priority order as a result of the overall evaluation. The installation of a cath lab in the Eastern Province is highly necessary.
Kandy TH	A	This hospital has a high priority order as a result of the overall evaluation. It is required to provide higher quality services as Sri Lanka's second largest core teaching hospital in cardiac care services.
Sirimavo Bandaranayake SCH	X	Among the minimum qualification criteria, this hospital does not qualify in terms of future demand. Angiography system originally requested to this Project has been already procured by MOH and therefore the hospital can respond to the demand of children.
Kurunegala TH	A	This hospital has a high priority order as a result of the overall evaluation. The installation of a cath lab in the North Western Province is highly necessary.
Anuradhapura TH	A	This hospital has a high priority order as a result of the overall evaluation. The installation of a cath lab in the North Central Province is highly necessary.
Polonnaruwa DGH	X	Among the minimum qualification criteria, this hospital is not qualified in terms of future demand as the Sri Lankan government is already constructing a cath lab.
<MLT Schools>		
Colombo	A	There are high needs for fostering MLTs training to fulfill the needs of MLTs who have been approved.
Peradeniya	A	Ditto
Kalutara	A	Ditto
<Bio-medical Engineering Services (BES)>	A	High in priority rankings. The functional strengthening of BES is important in ensuring continuous production of effects of this Project.
<Provincial Training Centres>*	C	At present, the Provincial Training Centres do not have arrangements for training on prevention/treatment of ischemic heart diseases at the tertiary healthcare institutions and therefore are not consistent with the objectives of the Project.

* Five Centres in Uva, Eastern, Central, North Western, North Central, and Southern Provinces

Source : Prepared by the Survey Team (2017)

4-4 Forecast of the Number of Cases of Catheter Diagnoses/Interventions and Capable Cases of Diagnoses/Treatments per Hospital in 2025

Based on the recent trends in ischemic heart disease, the number of ischemic heart disease patients in 2025 (2years after completion of the Project) at the health facilities in the country including the target facilities was forecast. With this forecast estimate, the comparison was made with the number of cases of catheter diagnosis and treatment that can be handled at the 5 target health facilities to identify what the 5 target facilities will be able to handle against the future demand. The result is as shown below.

4-4-1 Forecast of Numbers of Catheter Diagnoses/Interventions by Hospital in 2025

The Table below shows the actual number of cases of catheter diagnoses/interventions in 2014 and expected (estimated) number in 2025 for each hospital. The forecast demand of the cases for the five hospitals totals 19,051. This number is the total sum of patients who are visiting the National Hospital of Sri Lanka, Colombo and Jaffna Teaching Hospital and start to visit the target hospitals, and the increased number of patients at each area.

Table 4-5 Forecast of Number of Cases of Catheter Diagnoses/Interventions per Year by Hospital in 2025

Hospital	Province	Catchment area ⁵⁰	As of 2014 ⁵¹	Expected in 2025
Public Hospitals				
⊙ National Hospital of Sri Lanka	Western Province Sabaragamuwa Province	Colombo, Gampaha, Kalutara Ratnapura, Kegalle	6,972	* 5,301
⊙ Kandy Teaching Hospital	Central Province Nuwara Eliya Eastern Province (part)	Kandy, Matale Nuwara Eliya Ampara	2,982	6,901
○ Anuradhapura Teaching Hospital	North Central Province, Northern Province (part)	Anuradhapura Vavuniya, Mannar	956	2,415
⊙ Karapitiya Teaching Hospital	Southern Province	Galle, Matara, Hambantota	1,217	* 1,698
⊙ Jaffna Teaching Hospital	Northern Province (part)	Jaffna, Kilinochi, Mullaitivu	2,213	1,703
○ Kurunegala Teaching Hospital	North Western Province	Kurunegala, Puttalam	1,368	5,075
△ Badulla Provincial General Hospital	Uva Province	Badulla, Monaragala	0	2,722
△ Trincomalee District General Hospital	Eastern Province (part)	Batticaloa, Trincomalee	0	1,938
▲ Polonnaruwa District General Hospital	North Central Province	Polonnaruwa	0	868
(Private and 3rd sector hospitals)	Concentrated in Colombo			* 14,842
Nationwide			30,550	43,463
Total for 5 target hospitals			5,306	19,051

⁵⁰ Catchment areas were identified in the interview survey by the Study Team.

⁵¹ Finding in the interview survey by the Study Team.

Note 1: ◎ Currently operating, ○ Operation stopped, △ To be newly procured under the Project,
▲ To be procured with Sri Lankan budget

Note 2: The National Hospital of Sri Lanka and Karapitiya Teaching Hospital share catchment areas with private and 3rd sector hospitals. In this forecast, it was assumed the number of cases to be handled by private and 3rd sector hospitals in 2025 will remain approximately the same as that of 2014 (14,842). The demand forecast was calculated by deducting the 14,842 cases from the total number of possible cases obtained based on the population of catchment areas of the National Hospital of Sri Lanka and Karapitiya TH and dividing the result proportionately using the population rates of the catchment areas of the two hospitals.

Source : Prepared by the Survey Team (2017)

4-4-2 Forecast of Number of Capable Cases of Diagnoses/Interventions by Hospital

The result of forecast of possible diagnosis and intervention by cath labs at the target 5 hospitals in the years from 2023 to 2025 is as shown in the table below.

Table 4-6 Forecast Capable Cases of Diagnosis and Treatment in 5 Hospitals (2023~25)

Unit: Cases per year

Hospital	Total number of capable catheter diagnosis and treatment cases predicted to be handled			(B) Demand forecast at the five target hospitals in 2025 (ref. Table 4-5)	Difference between (A) and (B) in 2025 (A – B)
	2023	2024	(A) 2025		
Kandy Teaching Hospital	6,000	5,760	5,538	6,901	▲ 1,363
(interventions)	(1,200)	(1,728)	(2,215)		
(examinations)	(4,800)	(4,032)	(3,323)		
Anuradhapura Teaching Hospital	3,328	3,442	3,442	2,415	1,027
(interventions)	(666)	(1,033)	(1,377)		
(examinations)	(2,662)	(2,410)	(2,065)		
Kurunegala Teaching Hospital	3,328	3,630	3,994	5,075	▲ 1,081
(interventions)	(666)	(726)	(799)		
(examinations)	(2,662)	(2,904)	(3,195)		
Badulla Provincial General Hospital	1,248	1,427	1,664	2,722	▲ 1,058
(interventions)	(250)	(285)	(333)		
(examinations)	(998)	(1,142)	(1,331)		
Trincomalee District General Hospital	1,248	1,427	1,664	1,938	▲ 274
(interventions)	(250)	(285)	(333)		
(examinations)	(998)	(1,142)	(1,331)		
Total	15,152	15,686	16,302	19,051	▲ 2,749

Note: ▲: Number of capable cases which do not satisfy the forecasted demand

Source: Estimated by the Survey Team

The forecast number of possible cases handled in 2025, which was calculated based on the number of cath lab teams which can be formed at each hospital as shown in Table 2-9, is 16,302 and the number of demand forecast cases at the five target hospitals in 2025 is 19,051. Therefore, it is found that there will be an excess demand of 2,749 cases. Only Anuradhapura Teaching Hospital has the

capacity to handle such forecast demand, with the forecast number of possible cases handled exceeding the forecast demand by 1,027 cases. The remaining 4 hospitals' capacities fall short. Forecast capacities of Kandy Teaching Hospital, Kurunegala Teaching Hospital and Badulla Provincial General Hospital are over 1,000 cases behind the forecast demand values, and for Trincomalee District General Hospital the deficit is 274 cases. The shortage for Kandy Teaching Hospital is the largest, estimated at 1,363 cases. However, the number of cases handled in this hospital is expected to decrease because in the future up to 3 cath lab teams will be placed in this hospital to focus on cases with higher difficulty. Therefore, it is necessary to consider a possibility of referring the patients that cannot be treated at Kandy TH, to other institutions, such as the National Hospital of Sri Lanka in Colombo. Most of the excess demand at Kurunegala Teaching Hospital and all of that of Trincomalee District General Hospital can be covered by Anuradhapura Teaching Hospital, which is relatively close geographically and has excess capacity.

The other approach to cope with the increasing demand for diagnosis/intervention, is to consider increasing the number of cath lab teams. If one extra team is placed at both Kurunegala Teaching Hospital and Badulla Provincial General Hospital, thus increasing the number of teams to 3 at Kurunegala TH and 2 at Badulla PGH, the number of possible cases handled will increase to around 6,000 and 3,000 cases, respectively; and this will allow the resolution of the excess demand.

To increase the number of cath lab teams, education and employment of medical staff to form the team. 50 cardiologists are currently studying abroad, mainly in the U.K. and the education of cardiologist are being implemented.⁵² As the result, possibility of assignment of additional cardiologist to the 5 target hospitals is high. Furthermore, if the number of nurses and MLTs are increased by the plan of MOH with the existing training institutions, availability of these medical staff including the cardiologist will make it possible to increase the number of cath lab team. If the number of cath lab team is not increased and the target hospitals will not be able to satisfy the increased demand, it will be possible for them to refer the patients to the National Hospital of Sri Lanka or Jaffna Teaching Hospital, which would have room to accept them as the Project will enable the target hospitals to provide the services for cardiovascular diseases.

4-5 Basic Policies for Improvement of Facilities and Equipment

4-5-1 Relation between Service Flow for Cardiac Diseases and Policy for Improvement of Facilities and Equipment

As described in section 2-3-2 (2) on "Referral System for Patients with Cardiovascular Diseases," a cardiology ward must provide comprehensive treatments for various disorders included in cardiovascular diseases, such as ischemic heart diseases (acute myocardial infarction, etc.), arrhythmia, heart failures, valvular heart diseases and aortic diseases. Regarding this matter, this Project will adopt a basic policy for constructing necessary facilities and procuring equipment with a focus on diagnoses/interventions for ischemic heart diseases, which are the most important in decreasing the death rate due to cardiac diseases (ischemic heart diseases, arrhythmia, heart failure).

⁵² Additionally 10 more cardiologists will be dispatched to UK to study for two years according to MOH.

Figure 4-2 shows a comprehensive schematic diagram of service flow for cardiac diseases and relationship between necessary equipment and facilities. Interventions for ischemic heart diseases are provided by cath labs. Before and after them, the emergency room function and the basic function of ward and outpatient follow-up are necessary. Cath lab, which is the core part of medical treatment for ischemic heart disease, equips itself with the emergency unit in front and the ward/outpatient observation unit in back (referred to as “Function 1”). A function of arrhythmia treatment (referred to as “Function 2”), a function of cardiac valvular heart disease treatment (referred to as “Function 3”) and a function of early detection of ischemic heart disease (referred to as “Function 4,” can be confirmed normally in hospitals of primary and secondary level) exist in this service flow. It’s possible to provide favorable treatment services by completing all of these functions in a hospital.

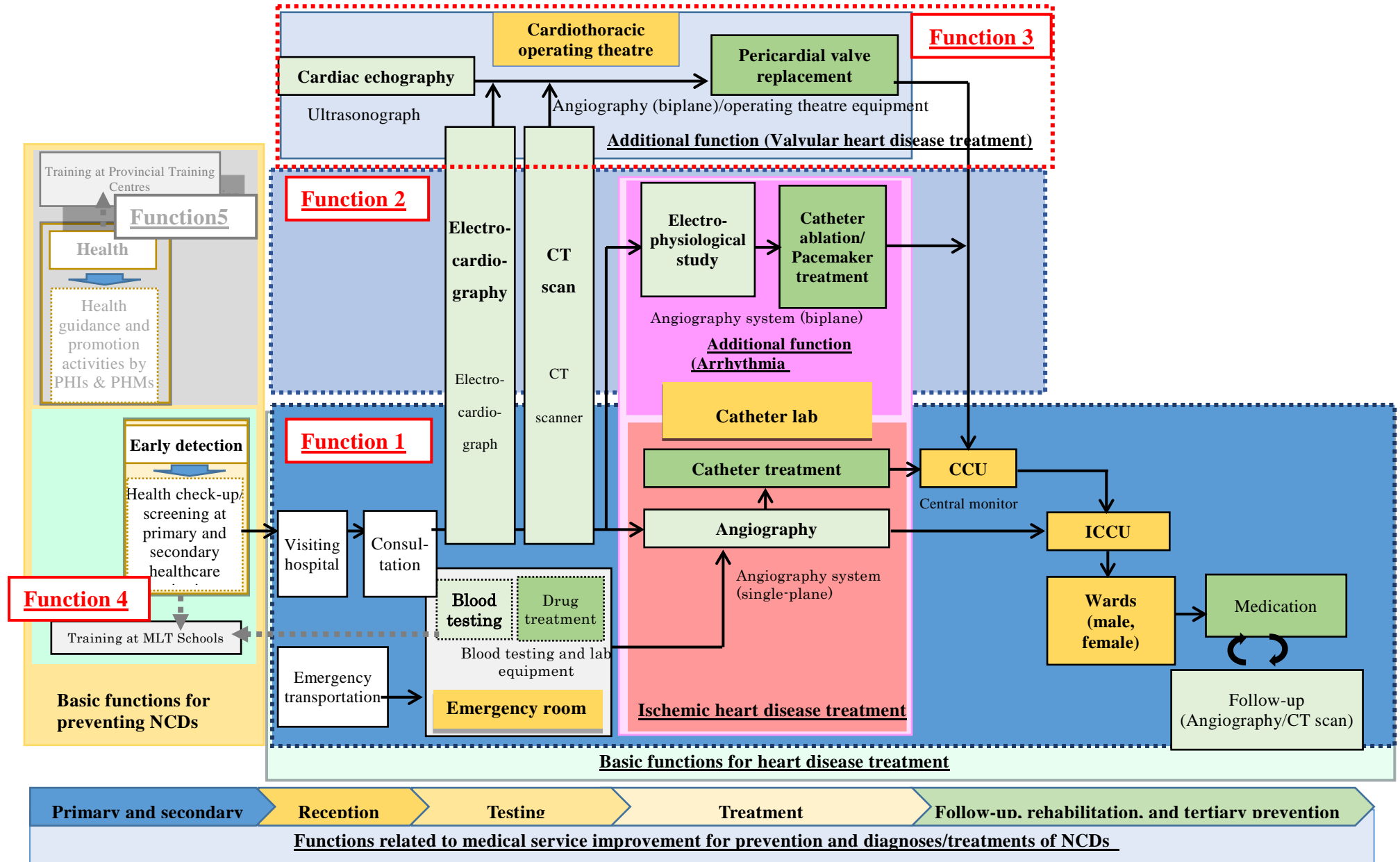
Regarding the improvement plan for facilities and equipment, the contents of the requests from the target institutes are different from each other because the sufficiency levels on the existing facility and equipment are different from each. Concretely, Badulla Provincial General Hospital and Trincomalee District General Hospital are currently focused on the cath lab with an angiography system of single-plane type (Function 1) in their request because both hospitals are currently not equipped with cath lab.

In case of Kandy Teaching Hospital which has been providing the services of catheter examination and treatment (Function 1) by an angiography system of single-plane type (de facto only one system is in operation out of two angiography systems), they submitted a request including not only procurement of an angiography system (biplane type) which can provide the services of electrophysiology treatment (Function 2) but also resolution of shortage of ICU for cardiothoracic surgery theatre (Function 3). In addition, their request includes construction of a new laboratory building which can release the existing laboratories from the tight and narrow space in the existing outpatient department building.

As to Kurunegala Teaching Hospital which has been providing the services of catheter examination and treatment by an angiography system of single-plane type (for which MOH is currently proceeding the procedure of renewal because of its breakdown), their request includes the installation of one more cath-lab with an angiography system of single-plane type (Function 1) in their existing cardiology department building. In addition, their request includes construction of a new radiology building which will be equipped with an MRI, a CT scanner and an ultrasonography apparatus which had been requested repeatedly by the hospital to MOH with no clear prospects for budgeting.

In case of Anuradhapura Teaching Hospital which has been providing the services of catheter examination and treatment by a angiography system of single-plane type (for which MOH is currently proceeding the procedure of tender for renewal because of its breakdown) (Function 1), their request paper covers not only procurement of a angiography system of biplane type which can provide the services of electrophysiology treatment (Function 2) but also installation of cardiothoracic surgery related facility and equipment (Function 3).

It was confirmed in the field survey that the justifications on the requests from each target institution were acceptable. Therefore, the survey team adopted a policy to formulate the improvement plans (for facility and equipment) in conformity with the requests from each target institution.



Source: Prepared by the Survey Team

Figure 4-2 Service Flow for Cardiac Disease Treatment and Necessary Equipment and Facilities

4-5-2 Outline of Improvement Plan for Target Facilities

Improvement plan proposed by each target facility are shown in the table below, using the concept of these functions (Functions 1 to 4) in Figure 4-2.

Table 4-7 Outline of Improvement Plan for Target Facilities

Target institution	Function 1 (Catheter interventions)	Function 2 (Arrhythmia treatment)	Function 3 (Valvular heart disease treatment)	Function 4 (Function of prevention)
<Tertiary healthcare institutions>				
Badulla Provincial General Hospital	✓			
Trincomalee District General Hospital	✓			
Kandy Teaching Hospital	✓	✓	✓	
Kurunegala Teaching Hospital	✓			
Anuradhapura Teaching Hospital	✓	✓	✓	
<MLT Schools>				✓

Source : Prepared by the Survey Team (2017)

4-5-3 Basic Policies for Architectural Planning

As for architectural planning, the draft plans consider the architectural criteria and the operation practices of facilities, smooth flow lines of users and staff, and accommodation and operation of planned equipment. As for structure and construction planning, they consider adopting the structures and architectural materials and specifications that are commonly adopted in the hospitals and training facilities in Sri Lanka.

The table below shows the items that need particular attention in terms of hospital planning in general and architectural facility planning.

Table 4-8 Precautions in Architectural Facility Planning of Hospitals

Item	Content																												
Outline of structures and specifications, etc.	<p>(1) Principal structure: Reinforced concrete (RC) structure; Strip footing + Pile foundation (3 stories or more) are assumed. Party walls (partitions) are assumed to be brickwork. Table: Rough dimensions of columns, beams and slabs (unit: m)</p> <table border="1"> <thead> <tr> <th>Floor</th> <th>Columns</th> <th>Beams</th> <th>Slabs</th> </tr> </thead> <tbody> <tr> <td>8F</td> <td>0.4×0.4</td> <td>0.3×0.6</td> <td>0.125</td> </tr> <tr> <td>5~7F</td> <td>0.4×0.4</td> <td>0.3×0.6</td> <td>0.125</td> </tr> <tr> <td>2~4F</td> <td>0.4×0.5</td> <td>0.4×0.6</td> <td>0.125</td> </tr> <tr> <td>1F</td> <td>0.4×0.6</td> <td>0.4×0.6</td> <td>0.125</td> </tr> <tr> <td>GF</td> <td>0.4×0.6</td> <td>0.4×0.6</td> <td>0.125</td> </tr> <tr> <td>Foundation</td> <td>0.4×0.6</td> <td>0.5×1.40</td> <td></td> </tr> </tbody> </table> <p>(2) Principal finish: In general, the following finish types are assumed. Exterior walls: Mortar coating, paint finish Partition walls: Mortar coating, tiling/paint finish Floor finish: Tiling Ceiling: Aluminum lattice ceiling foundation/cement board and acoustic board Opening: Aluminum sash</p>	Floor	Columns	Beams	Slabs	8F	0.4×0.4	0.3×0.6	0.125	5~7F	0.4×0.4	0.3×0.6	0.125	2~4F	0.4×0.5	0.4×0.6	0.125	1F	0.4×0.6	0.4×0.6	0.125	GF	0.4×0.6	0.4×0.6	0.125	Foundation	0.4×0.6	0.5×1.40	
Floor	Columns	Beams	Slabs																										
8F	0.4×0.4	0.3×0.6	0.125																										
5~7F	0.4×0.4	0.3×0.6	0.125																										
2~4F	0.4×0.5	0.4×0.6	0.125																										
1F	0.4×0.6	0.4×0.6	0.125																										
GF	0.4×0.6	0.4×0.6	0.125																										
Foundation	0.4×0.6	0.5×1.40																											

Item	Content
	(3) Architectural equipment, etc. Electricity, air conditioning (individual/central control system), ventilation, plumbing and sanitary facilities, lifts, etc.
Plan in general	<ul style="list-style-type: none"> • Any new facility, including a cath lab, shall be constructed at a target hospital based on the number of patients assumed in the future demand forecast according to the principles listed below. <ol style="list-style-type: none"> (1) There shall be a CCU and an ICCU which have respectively at least 6 beds each for one cath lab or 8 beds each for two cath labs. (2) The general cardiology sickrooms shall have 40 beds for one cath lab (20 each for men and women including 2 in the isolation ward) or 60 beds for two cath labs (30 each for men and women including 3 in the isolation ward). (3) There shall be a rehabilitation room (a shared room is acceptable) for cardiology department. (4) There shall be a CSSD, outpatient consultation and examination rooms (such as ultrasonography rooms). (5) There shall be extra space for installing a CT in the future. • If a request for a target hospital does not meet all of the above principles, it should be enhanced in a draft proposal and corrected so that it meets the principles (→ Applied to a CCU, ICCU, and general sickrooms of the new cardiovascular medicine building in Trincomalee).
Architectural equipment	<ul style="list-style-type: none"> • As for the air-conditioning method, the use of a central-control air-conditioning system is assumed for a zone including a cath lab and operating rooms. The use of individual-type air-conditioners is assumed for other zones. • The four new facilities to be constructed at the target hospitals shall have an emergency power supply (200 KVA). The backup power supply for emergency shall be supplied in principle to elevators, a cath lab, CCU, ICCU, electrophysiological lab and CCU, cardiovascular surgery operating room, recovery room, ICU, MRI room, and CT room. • Medical gases (oxygen, compressed air, and vacuum) shall be supplied to a cath lab, CCU, ICCU, electrophysiological lab and CCU, cardiovascular surgery operating room, ICU, and recovery room in a central pipe system.
Other	<ul style="list-style-type: none"> • If a large effluent treatment plant of a target hospital is found to have an operation problem, individual-type effluent treatment equipment shall be planned for the planned facility (applied to the Trincomalee District General Hospital, Kurunegala Teaching Hospital, and Anuradhapura Teaching Hospital).

Source : Prepared by the Survey Team (2017)

4-5-4 Basic Policies for Equipment Plan

(1) Tertiary healthcare institutions: Equipment Selection Criteria for Hospitals

- The cath lab equipment that directly contributes to “improving the cardiovascular medical service,” which is an objective of the project, equipment of CCUs, and ancillary equipment for functions such as sterilization that are needed in connection with cath labs shall be given high priorities in this plan.
- The equipment shall be at a quality level that allows healthcare workers, end users, to use it after receiving the initial operation guidance, etc.
- The cost of maintenance required for operation of the equipment (consumables of medical equipment, drugs, and medical materials such as catheters) shall be in a range that the budget allocation by the MOH may be possible.
- For the equipment that needs constant maintenance service, there shall be a local agent affiliated with the manufacturer, its engineers shall provide training on the operation and maintenance of the equipment and maintenance service shall be available such as installation, initial operation guidance, periodical inspection, and troubleshooting.

- The medical equipment shall be products that meet the international criteria, *i.e.*, those compliant with the international standards such as FDA (Food & Drug Administration) and CE marking ⁵³ or manufactured at factories compliant with the medical device quality management system based on ISO 13485.

(2) Equipment Selection Criteria for MLT Schools

- Equipment indispensable for accurate implementation of the 2014 revised MLT training curriculum currently in use shall be procured with priority. Furthermore, equipment that contributes to improving the diagnosis accuracy level of the laboratory testing of cardiovascular patients shall be given high priority in this plan.
- The equipment shall be at a quality level that allows healthcare workers, end users, to use it after receiving the initial operation guidance.
- The cost of maintenance required for operation of the equipment (such as reagents and consumables of equipment) shall be in a range that the budget allocation by MOH may be possible.
- For the equipment that needs constant maintenance service, there shall be a local agent affiliated with the manufacturer, its engineers shall provide training on the use and maintenance of the equipment and maintenance service shall be available such as installation, initial operation guidance, periodical inspection, and troubleshooting.

(3) Equipment Selection Criteria for BES of MOH

- PC with necessary software for networking system to control the equipment master ledger shall be procured.
- Checking and measuring instruments required for safe use of equipment at the tertiary healthcare institutions shall be procured.
- Repair instruments and tools with which the current scope of repair is to be expanded at the workshop branches shall be procured with priority.
- Maintenance in Sri Lanka shall be possible for the planned repair instruments and tools.

4-6 Assistance Activities of Japan and International Organizations in Health Sector

4-6-1 Assistance of Japan in Health Sector

The Japanese Government has been extending assistance in line with the Country Assistance Policy to Sri Lanka issued in June 2012. Among the target facilities for the Project, grant aid was extended to Anuradhapura Teaching Hospital, through the “Project for Improvement of Anuradhapura Teaching Hospital”, that supplied medical equipment for the outpatient, obstetrics and gynaecology,

⁵³ The CE mark is a proof that it meets safety standard requirements when exporting products to EU member countries. CE comes from French notation of European Community (Communauté Européenne) which is a forerunner of EU.

and paediatrics departments. The grant aid project was however intended to improve the maternal and child healthcare services.

Assistance regarding NCDs has continued to be extended from the “Project on Health Promotion & Preventive Care Measures of Chronic NCDs 2008 to 2013 (Technical Cooperation Project)” to the “Project on Enhancement of Measures against NCDs 2014 to 2018 (Technical Cooperation Project).” The first project created the service models for preventing NCDs and guidelines, manuals, etc. for providing the services. Furthermore, it verified the models for preventing NCDs and determined the establishment of HLCs in all the districts. The second project is assisting the operations at HLCs, i.e., screening of blood pressure, blood-sugar levels, etc., health education on NCDs, and collection of data on NCDs.

This screening, preventive activities, and data on NCDs will have synergetic effects when they are connected to the treatment of NCDs at the tertiary level hospitals. However, such data for preventive services is collected by the NCD division established under the Deputy DG of Public Health Services, MOH, and there is no coordination between the said NCD division and Medical Services I (Tertiary Care).⁵⁴ The information on the result of screening service by HLCs and their preventive service activities are reported to NCD division and not shared with the Medical Service I, according to the Survey Team interview. In the future, it is expected that improved coordination between NCD division and the Medical Services department will cause the information on NCDs to be shared by them and thus promote a consistent system from prevention to treatment of cardiac diseases.

4-6-2 Assistance by International Agencies in Health Sector

Among the international agencies, the United Nations Children’s Fund (UNICEF) is assisting in the fields of child nutrition and water and sanitation, and the United Nations Population Fund (UNFPA) is providing support in prevention of sexually-transmitted diseases and reproductive health.

In connection with the NCDs, World Health Organization (WHO) and the World Bank (WB) are providing assistance focusing on preventive service. But the international agencies including WHO and WB are not extending the assistance for treatment of NCDs at tertiary healthcare institutions. The assistance for NCDs prevention by WHO and WB however could be effectively linked with the Project to produce the synergistic effect, such as the development of intervention policy in the tertiary healthcare institutions based on the result of screening services, if the coordination is done between NCD division under Public Health department and the Medical Services I department.

(1) World Bank (WB)

WB implemented the Health Sector Development Project since 2004 to 2010, and the Second Phase. They are currently discussing the third phase with MOH. The First Phase provided the support for improvement of District level health administration, strengthening administrative capacity of MOH, program support for vaccination, capacity building addressing NCDs, hospital management and programs, Tsunami emergency recovery, avian influenza. The Second Phase has two project

⁵⁴ Finding in the interview survey by the Study Team

components: (1) Support to priority areas under the National Health Development Plan (NHDP), and (2) Innovation, results monitoring and capacity-building under the framework of NHDP. The support to priority areas is focusing on 3 thematic areas of Addressing maternal and child health and nutrition, Improving the prevention and control of non-communicable diseases, and Health system improvement. In the area of improvement of NCDs, 24-hour emergency treatment units at all levels, HLCs in each of Medical Officer of Health areas, and comprehensive rehabilitation units in every province will be established depending on the achievement of Disbursement Linked Indicators' goals, in addition to the support for awareness creation activities related to the risk of chronic and acute NCDs, development of standard guidelines for emergency treatment unit.

(2) World Health Organization (WHO)

WHO has been assisting in the areas of health system development, essential medicine, human resource development, administration of communicable diseases, NCDs, mental health, maternal, new-born, child, adolescent and reproductive health, and emergency and humanitarian action. They supported the MOH in the development of “National Multisectoral Action Plan for the Prevention and Control of NCDs 2016-2020”, as an assistance in the area of NCD.

(3) ADB

Asian Development Bank (ADB) has been actively assisting in the areas of economic development and poverty reduction. ADB has announced their Country Partnership Strategy for 2018-2022 in 2017 which focuses on the two strategic pillars of support for diversification of economic activities and improvement of quality for development. Improvement of public services of education and health is included in the strategy of quality improvement for the development. According to the MOH, ADB is showing their interests in health sector lately.

4-6-3 Assistance by Bi-lateral Donors in Health Sector

Recently, China, Australia, Netherland, Korea, German, etc. are extending bi-lateral cooperation in health sector. Contents of their assistance are maternal and child health (China, Netherland, Korea), hospital renovation/construction (China, Netherland, India, Korea, Germany) , provision of medical equipment (China, India), improvement of pharmaceutical facility (China), etc. None of their assistance is related to the medical services for the cardiovascular diseases at tertiary healthcare institutions. Their assistance in NCD-related area in the target hospitals of the Project are as follow:

- ◆ China is assisting the construction of a six-storey Renal Unit building in the premises of Trincomalee DGH and a kidney hospital at a location near Polonnaruwa DGH.
- ◆ Australia is assisting an initiative for an Environment and Occupational Health Unit of MOH for the installation of Metamizers. This is equipment that sterilises infectious waste using steam under pressure (autoclaving) at > 134°C for four minutes or more, at six healthcare institutions, including Badulla PGH and Trincomalee DGH and Polonnaruwa DGH.

4-7 Consideration of Application of Japanese Technology/Know-how in Hardware Elements

4-7-1 Recommended Japanese Medical Equipment

As stated in Chapter 4 Scope of the project, major components of the Project are: (1) improvement of the facilities and equipment for tertiary healthcare institutions, (2) improvement of the laboratory equipment for MLT Schools and (3) improvement of maintenance equipment for BES.

(1) Medical equipment for tertiary healthcare institutions

Equipment to be procured under the Project for tertiary healthcare institutions includes controlled medical device by function such as angiography system, MRI, and CT scanner, and specially controlled medical device by function such as artificial heart-lung machine and ME devices. Such equipment produced by Japanese manufacturers are incorporating top-class technologies in the world and therefore they have high advantage. For example, PC processing capability of image diagnostic software attached to Japanese MRI and CT scanners is very high, and there is an advantage that clear image analysis of contrast can be performed quickly.

Radiation equipment such as angiography system has realized a reduction in exposure dose that is comparable to that of competitor products from third countries

In addition, Japanese products are also advantageous with their lightweight, compact size, and energy-saving design. Especially for large volume equipment such as MRI, CT scanner, angiography system planned to be procured with this Project, restrictions on infrastructure such as securing installation space, load capacity of floor and ceiling, securing of loading route, transportation cost, etc. are reduced, and reduce cost burden on Sri Lankan side.

Further, compared with CT scanners with equivalent functions produced by manufacturers of other countries, Japanese products are designed to have more than 30% lower power consumption. Thus electricity charges during use of the equipment are lowered. In addition, since the capacity of the Auto Voltage Regulator (AVR) and the Uninterrupted Power Supply (UPS) for securing the stable power supply can be covered by the low capacity model, the procurement cost and the operation cost are reduced.

ME devices such as defibrillators, patient monitors and infusion pumps are equipped with Japanese advanced technologies and are highly evaluated internationally in terms of accuracy control.

(2) Equipment for MLT Schools

For laboratory equipment in MLT Schools such as microscope and autoclave, Japanese products are superior in quality and performance. In the case of a microscope, there are features such as less lens aberration and wide field of view. As for the sterilizer, the power consumption is low and not required 3-phase power supply. It is possible to use the equipment by single-phase power supply which distributed at existing class rooms. The Japanese equipment are highly cost-effective as they also have international competitiveness in terms of price.

In MLT Schools, Japanese products such as microscope and autoclave are already widely used, the lecturers are accustomed to using Japanese equipment, and smooth curriculum implementation shall be expected by their usability. Even in the medical facilities, these Japanese products such as patient monitor and infusion pumps are popular, and there is also advantage for MLT School graduates that examination with familiar equipment would be continued.

Japanese products such as angiography, MRI are well-regarded in terms of its high durability and good operability by medical staff in Sri Lanka

As for procurement plan for consumables and supply systems of repair parts for the planned equipment, Japanese manufacturers' agents are in place and they have no obvious problems in terms of maintenance and maintenance system.

4-8 Issues on equipment import

An Import License (I/L) must be acquired to import medical equipment that has never been imported to the Sri Lankan market before. The acquisition of an I/L for medical equipment is under the jurisdiction of the National Medicine Regulatory Authority (NMRA). After a technical specification and an application are submitted to the above department, an I/L will be granted after examination for about six months. An I/L for a model is effective for five years after it is granted unless a new function is added to the equipment.

Chapter 5 Project Plan

The Project consists of the plans for (1) facility construction/renovation and equipment procurement for the hospitals, (2) equipment procurement for MLT Schools, and (3) equipment procurement for BES, and in addition to the above, provides the technical assistance to hospitals and BES for enhancing the project implementation capacity. The outline of the plans is shown in the table below and the details are described in the subsequent sections.

Table 5-1 Outlines of the Project Plan

Target institutions	Facility construction/ renovation plan	Equipment procurement plan
Badulla Provincial General Hospital	No plan under the Project (There is a plan to construct an emergency complex building (10 stories) including a cath lab by government budget by 2020)	<ul style="list-style-type: none"> ◆ Equipment for a cath lab including an angiography system with single-plane type ◆ Equipment for investigation room, CCU, ICCU, the general cardiology ward, cardiologic rehabilitation and sterilization department.
Trincomalee District General Hospital	<ul style="list-style-type: none"> ◆ Construction of a new cardiology unit building (8 stories/approx. 5,220 m²) including a cath lab, CT examination room, electrocardiography room and CCU as well as general patient rooms 	<ul style="list-style-type: none"> ◆ Equipment for a cath lab including an angiography system with single-plane type ◆ Equipment for the outpatient clinic, investigation room, CCU, ICCU as well as the general cardiology ward and cardiologic rehabilitation and sterilization department.
Kandy Teaching Hospital	<ul style="list-style-type: none"> ◆ Construction of a new laboratory complex building (10 stories/8,060 m²) including two cath labs ◆ Repairing existing facility to install the cardiothoracic surgery ICU (6 beds, approx. 210 m²). 	<ul style="list-style-type: none"> ◆ Equipment for cath lab including angiography system with biplane type. ◆ Equipment for cardiovascular surgery ICU, cardiovascular surgery operation room, and CCU.
Kurunegala Teaching Hospital	<ul style="list-style-type: none"> ◆ Renovation of existing cardiology department ward (approx. 169 m²) to install a cath lab. ◆ Construction of a new radiology unit building (2 stories/480 m²) 	<ul style="list-style-type: none"> ◆ Equipment for cath lab including an angiography system with single-plane type. ◆ A cardiology CT scanner and MRI for the new radiology unit building.
Anuradhapura Teaching Hospital	<ul style="list-style-type: none"> ◆ Construction of a new complex building for cardiology and cardiothoracic unit (9 stories/7,668 m²) including two cath labs. 	<ul style="list-style-type: none"> ◆ Equipment for cath lab including an angiography system with biplane function. ◆ CT scanner and the equipment related to the cardiothoracic surgery operation room and the cardiology CCU.
MLT School in Colombo	/	<ul style="list-style-type: none"> ◆ Microscopes, safety cabinets for microbiology department, PCR-related equipment, ELISA equipment and electrophoresis apparatus.
MLT School in Peradeniya	/	<ul style="list-style-type: none"> ◆ Equipment and materials related to safety cabinets
MLT School in Kalutara	/	<ul style="list-style-type: none"> ◆ Equipment and materials related to microscopic inspection and safety cabinets.
BES (MOH and 5hospitals)	/	<ul style="list-style-type: none"> ◆ Tools including defibrillation checkers, electrocardiogram checkers, blood pressure checkers, multi-meters and hammers ◆ Computer-related equipment and materials
5 hospitals above and BES	Technical assistance for enhancement of project implementing capacity	
	<p>The Consultant to be hired by the Project will provide following technical assistance to enhance the project implementation capacity of the staff concerned.</p> <ul style="list-style-type: none"> ◆ Technical assistance for equipment operation and maintenance ◆ Assistance in operational coordination inside hospital necessary for operation of cath lab (including assistance in preparation of SOP - Standard Operation Procedure) ◆ Assistance in data management in hospitals 	

Source : Prepared by the Survey Team (2017)

5-1 Plan for Facilities Construction/Renovation and Equipment Procurement

Based upon the service flow for ischemic heart diseases and the policy for improvement of facilities and equipment which is mentioned in Section 4-5-1, this chapter provides draft plan of facilities and equipment on each target facility.

5-1-1 Tertiary healthcare institutions

The outline of facility plan in the 5 target hospitals are as follow. It is noted the emergency complex building of Badulla Provincial General Hospital will be constructed using the budget of the Government of Sri Lanka.

Table 5-2 Outline of Facility Plan in the 5 Target Hospitals

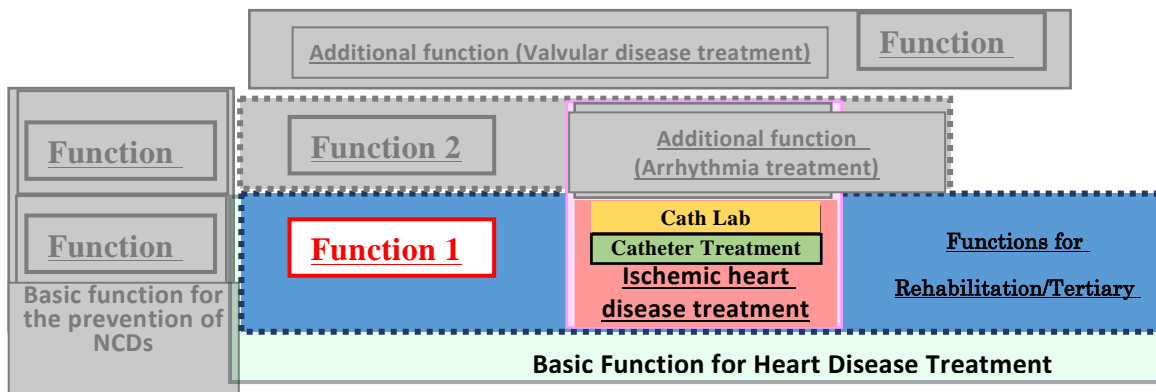
Hospital	Facility Plan		
Badulla PGH <i>GOSL plans to construct this building by 2020.</i> Outline of Emergency Complex Building	Floor	Facility name	Area (m ²)
	9F	Neurology, general ward (male, 54 beds; female, 40 beds) and Hyper Acute Stroke Unit (HASU) (4 beds)	
	8F	Neurology	
	7F	Neurosurgery, general ward	
	6F	Neurosurgery (operating room, ICU)	
	5F	Cardiology department, general ward (female, 50 beds; children, 20 beds)	
	4F	Cardiology general ward (male, 60 beds)	
	3F	Cath lab, ICU (10 beds), ultrasound lab, ECG lab, exercise testing lab	
	2F/1F GF	Emergency Room	
Total floor area			No data
Trincomalee DGH Outline of New Cardiology Unit Building	Floor	Facility name	Area (m ²)
	7F	Grand hall (230 seats), library, storage, etc.	683.75
	6F	Rehabilitation clinic, lifestyle habit improvement seminar room, etc.	683.75
	5F	General patients' rooms, women (24 beds + 2 beds in isolation ward), storage, etc.	683.75
	4F	General patients' rooms, men (24 beds + 2 beds in isolation ward), storage, etc.	683.75
	3F	Cath laboratory, etc.	683.75
	2F	CCU (6 beds), ICCU (6 beds), Radiology (CT) lab, etc.	683.75
	1F	Consultation area (including ECG lab, exercise testing lab, ultrasound lab, pharmacy), etc.	683.75
	GF	Parking, entrance, machine room, outdoor unit/medical gas storage	683.75
Total floor area			5,219.75
Kandy Teaching Hospital Outline of New Laboratory Complex Building	Floor	Facility name	Area (m ²)
	8F	Telemedicine centre, library, auditorium (370 seats), etc.	774.00
	7F	Bacteriology lab	774.00
	6F	Histopathology lab	774.00
	5F	Haematology lab	774.00
	4F	Clinical pathology lab	774.00
	3F	Cath lab 1, cath lab 2, etc.	774.00
	2F	Postoperative observation room (Interventional cardiac ward), High Dependency Unit (HDU), rehabilitation department, etc.	774.00
	1F	Outpatient reception for electrophysiological test (EP), EP-CCU (4 beds), EP general sickrooms (8 beds for men and 7 beds for women), etc.	955.00
	GF	Parking, specimen reception for labs, etc.	1,015.00
GF lower part	Parking, machine room, outdoor unit/medical gas storage	672.00	
Total floor area			8,060.00

Hospital	Facility Plan		
Outline of Existing Facility Renovation	Floor	Facility name	Area (m ²)
	Existing 4F	The existing cath lab on 4F of the “cardiology and cardiothoracic surgery complex” of the hospital shall be refurbished to establish a cardiothoracic surgery ICU (6 beds).	210.18
	Total floor area		210.18
<u>Kurunegala Teaching Hospital</u> Outline of Existing Facility Renovation	Floor	Facility name	Area (m ²)
	Existing GF	The existing CCU on GF of the “cardiology ward” of the teaching hospital shall be refurbished to establish a new cath lab.	168.50
	Total floor area		168.50
Outline of New Radiology Unit Building	Floor	Facility name	Area (m ²)
	1F	Doctor/technician waiting room and etc.	240.00
	GF	MRI, CT, and sonography rooms	240.00
	Total floor area		480.00
Note: The private room ward in the southwest of the neurology medicine building (one-storey) of this hospital shall be dismantled by the budget of the Sri Lankan side for construction of the new radiology unit building.			
<u>Anuradhapura Teaching Hospital</u> Outline of New Complex Building for Cardiology and Cardiothoracic Unit	Floor	Facility name	Area (m ²)
	8F	Auditorium (144 seats) and rehabilitation room for cardiology	846.00
	7F	Cardiothoracic surgery general sickroom (26 beds for men, 2 isolation beds for men, 18 beds for women, 2 isolation beds for women)	846.00
	6F	Cardiology general sickroom (40 beds for women and 2 isolated beds for women), 20 children beds (10 each for boys and girls)	846.00
	5F	Cardiology general sickroom (54 beds for men and 2 isolated beds for men)	846.00
	4F	Cardiothoracic surgery ICU (12 beds), cardiovascular surgery HDU (12 beds), etc.	846.00
	3F	Cardiothoracic surgery operating room, cath laboratories (two), cardiology CCU (12 beds), etc.	846.00
	2F	Chest pain examination room, cardiology ICCU (12 beds), etc.	846.00
	1F	Outpatient consultation room, diagnosis-related rooms (CT room, exercise electrocardiography room, and sonography room), etc.	846.00
	GF	Parking, entrance, machine room, outdoor unit/medical gas storage	900.00
	Total floor area		7,668.00

Source : Prepared by the Survey Team (2017)

(1) Badulla Provincial General Hospital (Uva Province)

There is no angiography system in Badulla Provincial General Hospital. Therefore, it was planned to install a basic function of ischemic heart disease diagnosis and treatment, focusing on the cath lab with an angiography system of single-plane type (Function 1 in the diagram below), including the related intensive care units, cardiac general ward and rehabilitation facilities (refer to Section 4-5-1, Figure 4-2 and Table 4-7).



For this hospital, the budgetary measures from the Government of Sri Lanka include plans for the construction of an emergency complex building (10 stories) by the year 2020, including an emergency room, cath lab, cardiology and neurology/neurosurgery. As this Project includes plans for the procurement of equipment for investigation room, cath lab, CCU, ICCU, general cardiology ward, cardiologic rehabilitation and sterilization department, securing the budget for the construction and appropriate implementation of the plans is a prerequisite for this Project.

1) Facility plan (refer to table 5-2)

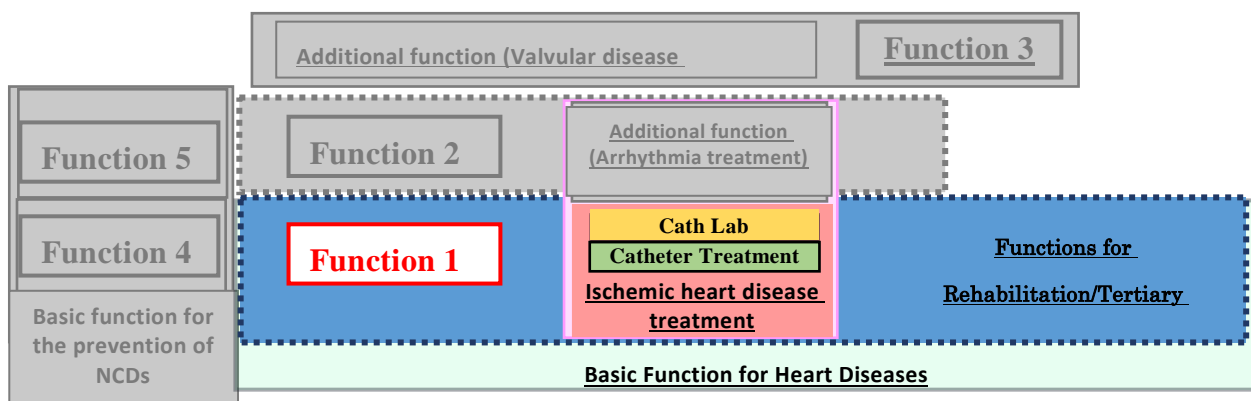
As described above, the construction of the facility is not covered by this ODA Loan Project. Total number of bed planned for the cardiac general ward seems to be too large, compared with the estimated inpatients number in 2025. Therefore, it is recommended to make adjustment between the building plan by Sri Lankan side and the equipment plan in the Project during the detail design stage in the coming implementation period of the Project.

2) Equipment Plan

Procurement of relevant equipment and materials will be conducted for the investigation room, cath lab, CCU, ICCU, general cardiology ward, cardiologic rehabilitation and sterilization department, which are to be constructed on the 3rd, 4th and 5th floors of the emergency complex building. Equipment for the cath lab includes an angiography system for single-plane type.

(2) Trincomalee District General Hospital (Eastern Province)

There is no angiography system in Trincomalee District General Hospital. Therefore, it was planned to install a basic function of ischemic heart disease diagnosis and treatment, focusing on the cath lab with an angiography system of single-plane type (Function 1 in the diagram below), including the related intensive care units, cardiac general ward and rehabilitation facilities (refer to Section 4-5-1, Figure 4-2 and Table 4-7).



1) Facility plan

A new cardiology unit building will be constructed (8 stories/approx. 5,220 m²). This facility will include a cath lab, CT examination room, electrocardiography room and Coronary Care Unit (CCU) as well as general patient rooms (see the table below.)

For the Intensive Care Unit (ICU), the original request made by the hospital showed only 8 step-down beds for the Intensive Coronary Care Unit (ICCU); this was changed to 6 beds for CCU and 6 beds for ICCU. As for general patient beds in the cardiology department, it was made clear that 24 beds (12 for men and 12 for women) as requested by the hospital were insufficient. This was changed to 48 beds (24 for men and 24 for women), and isolation rooms (2 beds each for men and women) were added. Due to the above-mentioned adjustment from planning viewpoints, the planned building is shown as an 8-storey one as shown below although a 6-storey building was originally requested by this hospital.

Table 5-3 Outline of New Cardiology Unit Building in Trincomalee District General Hospital

Floor	Facility name	Total floor area (Unit: m ²)
7F	Grand hall (230 seats), library, storage, etc.	683.75
6F	Rehabilitation clinic, lifestyle habit improvement seminar room, etc.	683.75
5F	General patients' rooms, women (24 beds + 2 beds in isolation ward), storage, etc.	683.75
4F	General patients' rooms, men (24 beds + 2 beds in isolation ward), storage, etc.	683.75
3F	Cath laboratory, etc.	683.75
2F	CCU (6 beds), ICCU (6 beds), Radiology (CT) lab, etc.	683.75
1F	Consultation area (including ECG lab, exercise testing lab, ultrasound lab, pharmacy), etc.	683.75
GF	Parking, entrance, machine room, outdoor unit/medical gas storage	683.75
Total floor area		5,219.75

Source : Prepared by the Survey Team (2017)

Note 1: The use of a central-control air-conditioning system is for a zone including a cath lab. The use of individual-type air-conditioners is assumed for other zones.

Note 2: An emergency power supply (200 KVA) shall be installed. The backup power is assumed to be supplied to elevators, a cath lab, CCU, ICCU, X-ray (CT) room.

Note 3: Medical gases (central pipe system) are assumed to be supplied to cath laboratories, CCU, and ICCU.

- Note 4: Since an effluent treatment plant of this hospital was found to not work currently, individual-type effluent treatment equipment shall be planned for the planned facility (planned capacity for 200 persons).
- Note 5: It's ideal that a catheter lab and a CCU are located jointly on the same floor. On the other hand, CCU and ICCU are tentatively planned on the lower floor of cath-lab floor in the draft floor plan in this report, considering the effective use of floor space. Therefore, it's recommended to reconfirm the facility plan during the detail design stage in the coming period of implementation stage of the Project.
- Note 6: It's ideal that the rehabilitation related rooms are located on the ground floor or near the ground floor. In the draft floor plan in this report, the rehabilitation related rooms are tentatively planned on the 6th floor, considering the original request from the hospital. Therefore, it's recommended to reconfirm the facility plan during the detail design stage in the coming period of implementation stage of the Project.

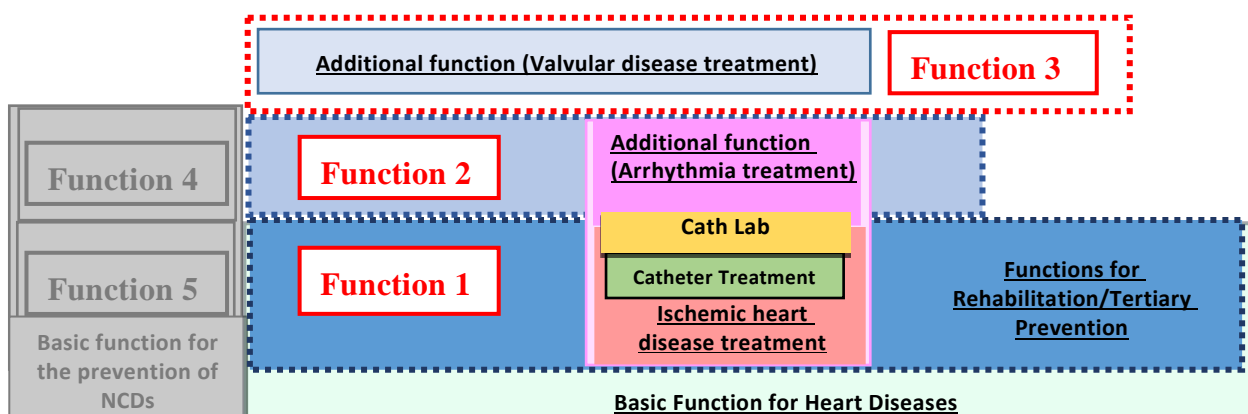
2) Equipment Plan

Equipment and materials shall be procured that are required by the outpatient clinic, investigation room, cath lab, CCU, ICCU as well as the general cardiology ward and cardiologic rehabilitation and sterilization department in the cardiology department ward scheduled for construction.

Equipment for the cath lab includes an angiography system for single-plane type. The CT scanner for circulatory organs as requested by the hospital is not included in this plan because the existing model is sufficient (although this is not dedicated to circulatory organs, it is capable of acquiring images for cardiologic patients). The equipment and materials for the main auditorium, library and other facilities which are not directly related to clinical activities were excluded from this Project.

(3) Kandy Teaching Hospital (Central Province)

Kandy Teaching Hospital has been providing the services of catheter examination and treatment (Function 1 in the diagram below) by an angiography system of single-plane type. The improvement plan covers not only procurement of an angiography system (biplane type) which can provide the services of electrophysiology treatment (Function 2 in the diagram below) but also resolution of shortage of ICU for cardiothoracic surgery theatre (Function 3 in the diagram below). In addition, the improvement plan includes new laboratories (Refer to Section 4-5-1, Figure 4-2 and Table 4-7).



1) Facility plan

A new laboratory complex building (10 stories/8,060 m²) as shown in table below will be constructed. In addition, repairs shall be carried out on the existing facility (cardiology/cardiothoracic surgery ward) in order to install the cardiothoracic surgery ICU (6 beds).

Table 5-4 Outline of New Laboratory Complex Building in Kandy Teaching Hospital(Unit: m²)

Floor	Facility name	Total floor area
8F	Telemedicine centre, library, auditorium (370 seats), etc.	774.00
7F	Bacteriology lab	774.00
6F	Histopathology lab	774.00
5F	Haematology lab	774.00
4F	Clinical pathology lab	774.00
3F	Cath lab 1, cath lab 2, etc.	774.00
2F	Postoperative observation room (Interventional cardiac ward), HDU, rehabilitation department, etc.	774.00
1F	Outpatient reception for electrophysiological test (EP), EP-CCU (4 beds), EP general sickrooms (8 beds for men and 7 beds for women), etc.	955.00
GF	Parking, specimen reception for labs, etc.	1,015.00
GF lower part	Parking, machine room, outdoor unit/medical gas storage	672.00
Total floor area		8,060.00

Note 1: The use of a central-control air-conditioning system is for a zone including a cath lab. The use of individual-type air-conditioners is assumed for other zones.

Note 2: An emergency power supply (200 KVA) shall be installed. The backup power is assumed to be supplied to elevators, a cath lab, CCU, ICCU, electrophysiology lab and CCU, and X-ray (CT) room.

Note 3: Medical gases (central pipe system) are assumed to be supplied to a cath laboratory, CCU, ICCU, and electrophysiology lab and CCU.

Note 4: CCU, ICCU and general ward for cath-lab patients are not included in the planned complex building. It's planned by the hospital to utilize the existing CCU/ICCU and general ward in the cardiology and cardiothoracic unit building. In case of the existing cardiac general ward, it's supposedly necessary for hospital side to increase the bed number by themselves because of expected shortage of its capacity in 2025.

Note 5: It's ideal that the rehabilitation related rooms are located on the ground floor or near the ground floor. On the other hand, a physiotherapy unit room is tentatively planned on the 2nd floor in the draft floor plan in this report, considering the original request from the hospital. Therefore, it's recommended to reconfirm the facility plan during the detail design stage in the coming period of implementation stage of the Project.

Note 6: As to the laboratory floors from the 4th floor to the 7th floor, one floor is basically given to one unit of laboratory in the draft floor plan in this report. However, it's recommended to reconfirm the facility plan during the detail design stage in the coming period of implementation stage of the Project, considering efficient use of planned building.

Source : Prepared by the Survey Team (2017)

Table 5-5 Details of Existing Facility Renovation in Kandy Teaching Hospital(Unit: m²)

Floor	Content	Total floor area
Existing 4F	The existing cath lab on 4F of the "cardiology and cardiothoracic surgery complex" of the hospital shall be refurbished to establish a cardiothoracic surgery ICU (6 beds).	210.18
Total floor area		210.18

Note: The cardiothoracic surgery ICU is assumed to be supplied with the emergency backup power as well as medical gases (central pipe system).

Source : Prepared by the Survey Team (2017)

2) Equipment plan

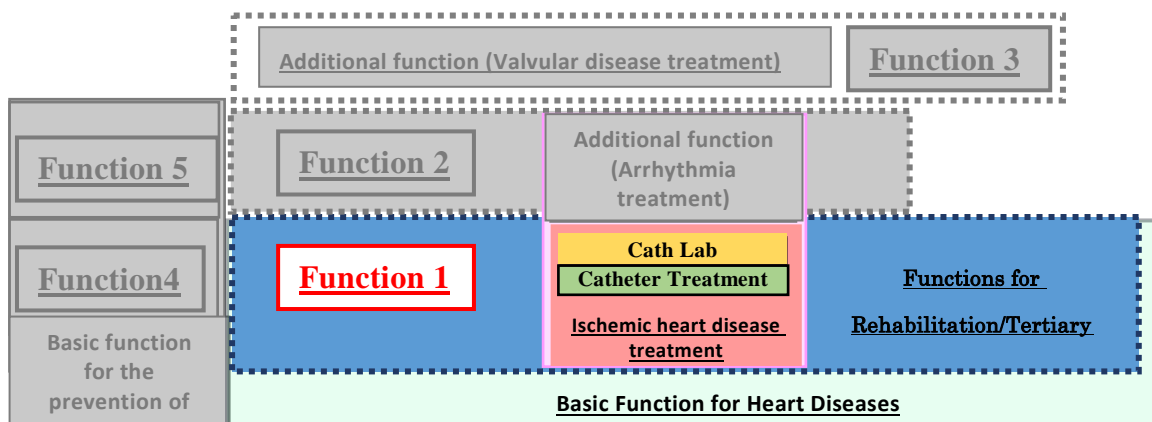
Catheterization-related equipment and materials shall be procured including angiography system with biplane function in the cath lab in the newly constructed general examinations ward. However, there is no plan to procure new medical laboratory equipment for the 4th to 7th floors in the general examinations ward because such equipment can duly be replaced with the existing equipment that will be relocated to those floors.

Equipment and materials related to the cardiovascular surgery ICU, the cardiovascular surgery operation room, and the CCU will be procured in the existing cardiology department ward.

For the free space left after the existing equipment is relocated to the general examinations ward of the medical laboratory department, a request was made to procure the equipment required in order to use such free space as the neurosurgery operation room and ICU. However, it was decided to exclude the procurement of such equipment from this Project because more than 70% of the activities of the neurosurgery department are cases of excision of brain and spinal tumours, which have little connection to cardiovascular disease-related medical care services, which are the objective of this Project.

(4) Kurunegala Teaching Hospital (North Western Province)

As to Kurunegala Teaching Hospital which has been providing the services of catheter examination and treatment by an angiography system of single-plane type, it is planned to install one more cath-lab with an angiography system of single-plane type (Function 1 in the diagram below) in their existing cardiology department building for countermeasures for the increasing demand of catheter examination and treatment. In addition, the improvement plan includes the construction of a new radiology building which will be equipped with an MRI, a CT scanner and an ultrasonography apparatus in order to strengthen the examination function for ischemic heart disease (Refer to Section 4-5-1, Figure 4-2 and Table 4-7).



1) Facility plan

The existing cardiology department ward will be renovated (168.5 m²) to install a cath lab. The existing neurology department ward will be dismantled and a new radiology unit building (2 stories/480 m²) will be built at the site.

Table 5-6 Details of Existing Facility Renovation for the Cardiology Department Ward in Kurunegala Teaching Hospital

(Unit: m²)

Floor	Content	Total floor area
Existing GF	The existing CCU on GF of the “cardiology ward” of the teaching hospital shall be refurbished to establish a new cath laboratory.	168.50
Total floor area		168.50

Note 1: The new cath laboratory shall be supplied with the emergency power (installed in the radiology department building) as well as medical gases (central pipe system).

Note 2: Kurunegala Teaching Hospital intends to firstly procure inpatients beds for CCU in the existing cardiology unit building by their budget because they will demolish the existing CCU in order to create a new (2nd) cath lab in the building. In addition, they will ensure enough number of bed for the cardiology general ward by their budget because the capacity of the existing general ward supposedly won't be enough for the future inpatients in 2025 after the second Cath. Lab is installed in the Project.

Source : Prepared by the Survey Team (2017)

Table 5-7 Outline of New Radiology Unit Building in Kurunegala Teaching Hospital

(Unit: m²)

Floor	Content	Total floor area
1F	Doctor/technician waiting room and etc.	240.00
GF	MRI, CT, and sonography rooms	240.00
Total floor area		480.00

Note 1: An emergency power supply (200 KVA) shall be installed. The backup power shall be supplied to the MRI and CT room as well as the above new cath lab.

Note 2: Since an effluent treatment plant of this hospital was found to not work currently, individual-type effluent treatment equipment shall be planned for the planned facility (planned capacity for 50 persons).

Note 3: The private room ward in the southwest of the neurology medicine building (one-storey) of this hospital shall be dismantled by the budget of the Sri Lankan side for construction of the new radiology unit building.

Source : Prepared by the Survey Team (2017)

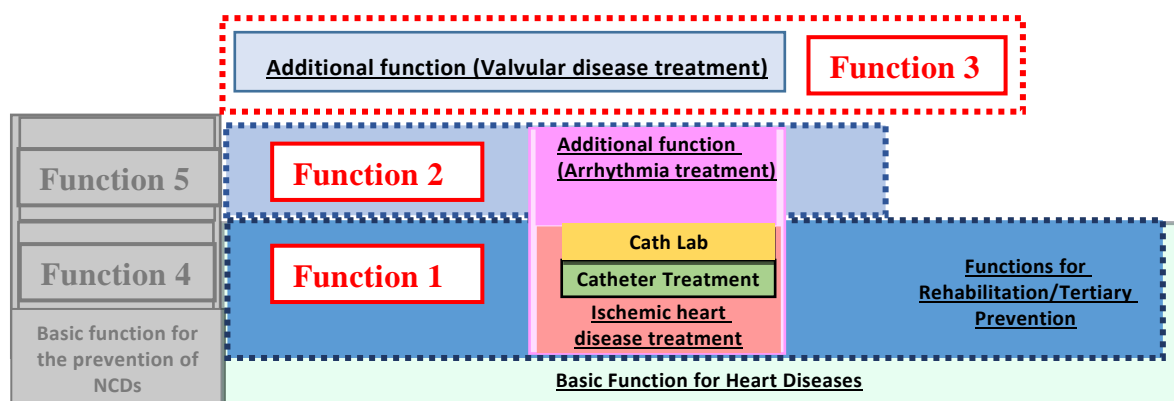
2) Equipment plan

An angiography system (single plane type) and other related equipment and materials shall be procured in the cath lab scheduled for construction in the existing cardiology department ward. A proposal has also been made to enable the provision of speedy and accurate diagnostics by equipping the newly-built radiology department with a cardiology CT scanner and MRI, which are effective for cardiovascular disease diagnosis. This recommendation is based on the judgment that there are many neurologic patients and stroke patients in this Hospital and that the MRI is highly necessary for making appropriate inspections of the effects of thrombolytic agent medications.

(5) Anuradhapura Teaching Hospital (North Central Province)

Anuradhapura Teaching Hospital has been providing the services of catheter examination and treatment by an angiography system of single-plane type (Function 1 in the diagram below). The existing angiography system are currently under replacement as it cannot be repaired. The improvement plan covers not only procurement of a angiography system of biplane type which can provide the services of electrophysiology treatment (Function 2 in the diagram below) in order to confront arrhythmia, that is currently treated at National Hospital of Sri Lanka etc. in Colombo, but also installation of cardiothoracic surgery related facility and equipment (Function 3 in the diagram

below) in order to confront valvular heart disease which hasn't been treated by hospitals in and around North Central Province (Refer to Section 4-5-1, Figure 4-2 and Table 4-7).



1) Facility plan

A new complex building for cardiology and cardiothoracic unit (9 stories/7,668 m²) including two cath labs will be built. Although 5 storeyed building was requested by this hospital, the planned building is shown as a 9 storeyed one in this report, corresponding to the tight spatial condition of the site proposed by the hospital.

Table 5-8 Outline of New Complex Building for Cardiology and Cardiothoracic Unit in Anuradhapura Teaching Hospital

(Unit: m²)

Floor	Facility name	Total floor area
8F	Auditorium (144 seats) and rehabilitation room for cardiology	846.00
7F	Cardiothoracic surgery general sickroom (26 beds for men, 2 isolation beds for men, 18 beds for women, 2 isolation beds for women)	846.00
6F	Cardiology general sickroom (40 beds for women and 2 isolated beds for women), 20 children beds (10 each for boys and girls)	846.00
5F	Cardiology general sickroom (54 beds for men and 2 isolated beds for men)	846.00
4F	Cardiothoracic surgery ICU (12 beds), cardiovascular surgery HDU (12 beds), etc.	846.00
3F	Cardiothoracic surgery operating room, cath laboratories (two), cardiology CCU (12 beds), etc.	846.00
2F	Chest pain examination room, cardiology ICCU (12 beds), etc.	846.00
1F	Outpatient consultation room, diagnosis-related rooms (CT room, exercise electrocardiography room, and sonography room), etc.	846.00
GF	Parking, entrance, machine room, outdoor unit/medical gas storage	900.00
Total floor area		7,668.00

Note 1: The use of a central-control air-conditioning system is assumed for a zone including cath lab and operating rooms. The use of individual-type air-conditioners is assumed for other zones.

Note 2: An emergency power supply (200 KVA) shall be installed. The backup power is assumed to be supplied to elevators, a cath lab, CCU, ICCU, cardiothoracic surgery operating room and recovery room, ICU, and CT room.

Note 3: Medical gases (central pipe system) are assumed to be supplied to cath lab, CCU, ICCU, cardiothoracic surgery operating room and recovery room, and ICU.

Note 4: Since waste water treatment plant of this hospital was found to not working currently, individual-type waste water treatment equipment shall be planned for the planned facility (planned capacity for 300 persons).

Note 5: It's better that a cardiothoracic surgery theatre and a ICU are located jointly on the same floor. On the other hand, ICU/HDU are tentatively planned on the upper floor of cardiothoracic surgery theatre floor in the draft floor plan in this report, considering the effective use of floor space. Therefore, it's recommended to reconfirm the facility plan during the detail design stage in the coming period of implementation stage of the Project.

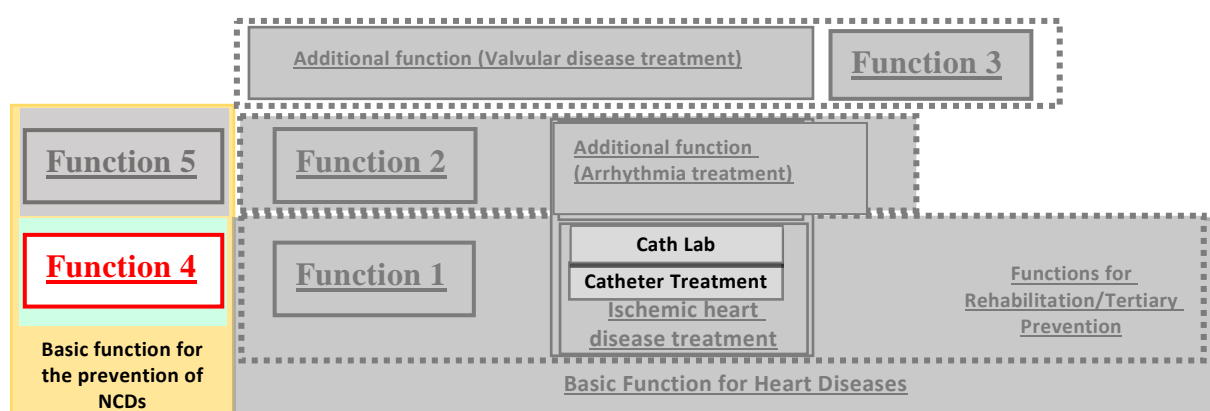
Source : Prepared by the Survey Team (2017)

2) Equipment plan

In one of the two cath labs scheduled for construction, there is a plan to install an angiography system with biplane type to enable electrophysiology treatment. It is expected that a single-plane type angiography system to be procured by the Government of Sri Lanka will be relocated and installed in the other cath lab under the responsibility of Sri Lanka. The procurement of the CT scanner and the equipment related to the cardiothoracic surgery operation room and the cardiology CCU will also be covered by this Project.

5-1-2 Medical Laboratory Technologist (MLT) Schools

Function of early detection (Function 4) as basic functions in the prevention of NCDs in MLT Schools will be improved (Refer to Section 4-5-1, Figure 4-2 and Table 4-7).



The requested items in this Project for three of the target MLT Schools were: (1) procurement of microscopes; (2) procurement of safety cabinets for microbiology department; (3) installation of a skill laboratory fully equipped with PCR-related equipment and materials, ELISA equipment and electrophoresis apparatus; and (4) procurement of a means of trainee transportation (pickup buses). Facility construction plan was not included in the request paper from three schools; only medical equipment shall be procured.

The equipment as itemized in (1) and (2) above is necessary for practical training and thus is included in this Project.

The equipment related to the skill laboratory (3) will be procured for the MLT School in Colombo located on the MRI premises because the students in the MLT Schools in Kalutara and in Peradeniya will receive lectures and practical training in the MLT School in Colombo for a certain period during the second year, and because the teaching staff of MRI provide practical demonstration training for equipment for which instruction is comparatively difficult, including ELISA systems.

Pickup buses (4) have little connection to the objectives of this Project and they are excluded from this Project because it is expected that the buses can be procured by Sri Lanka before the Project is completed after 2020. The MLT School in Peradeniya requested microscopes but they are excluded

from the Project because there are about 60 units of microscopes with workable condition in the school.

Table 5-9 Procurement of Equipment Items for MLT Schools

Classification	Function	Colombo	Peradeniya	Kalutara
Haematology and general laboratory testing	(1) Microscope	○		○
Microbiology	(2) Safety Cabinets, etc.	○	○	○
Biochemistry, pathology, general laboratory testing	(3) Skills Lab, etc.	○		

Source : Prepared by the Survey Team (2017)

(1) MLT School in MRI (Colombo)

The skill laboratory will be fully equipped with microscopes, safety cabinets for microbiology department, PCR-related equipment, ELISA equipment and electrophoresis apparatus by the Project. It is justified because the poor focus adjustment occurs in the aged microscopes available in the school and there is no safety cabinet and PCR-related equipment, which have affected school operation.

(2) MLT School in Peradeniya

The 60 sets of microscopes are currently available and in usable condition, so no microscope purchase will be included in the Project. The safety cabinets are essential for the training based on the current curriculum and included in the Project. The skill laboratory equipment (such as ELISA equipment) is not included in the Project for MLT School in Peradeniya, as it will be included in the Project for the MLT School in the MRI in Colombo.

(3) MLT School in Kalutara

The microscopes are malfunctioning in focal axis adjustment due to aging and no safety cabinet is available (The School is using ones owned by other institutions). It has affected school operation. The plan is to procure (1) equipment for microscopic inspection and (2) safety cabinets that are indispensable to the implementation of curricula. The skill laboratory equipment is not included in the Project, as in the case for MLT School Peradeniya.

5-1-3 Bio Medical Service Units (BES)

There is a plan to procure a set of tools including defibrillation checkers, electrocardiogram checkers, blood pressure checkers, multi-meters and hammers to reinforce preventive maintenance including daily and regular inspections of medical apparatuses installed in hospitals.

In addition, there is a plan to procure a set of computer-related equipment and materials (including PCs, servers, routers, printers and digital cameras) in order to network the BES workshop in MOH with the workshop branches of the 5 target hospitals under this Project and to configure the management system for centralized control of the status of operation and maintenance and the repair history of the procured equipment and materials.

Table 5-10 Equipment Procurement Items for BES

Classification	Equipment for Procurement	Place of Installation
Equipment necessary for preventive maintenance	Repair tools, various types of operation checker, etc.	Workshop branches in target hospitals and BES workshop under the MOH
Equipment necessary for building a maintenance network	Personal computers, printers, and various types of equipment required for networking	Workshop branches in target hospitals and BES workshop under the MOH

Source : Prepared by the Survey Team (2017)

5-2 Operation and Maintenance Plans

5-2-1 Operation plan

(1) Operation Plan

1) Operation of Cath Lab

Diagnoses and interventions in the cath lab will be provided by teams, and the number and assignment of teams will be determined by the hospital according to the number of cath labs and the working hours.

The standard cath lab team consists of six specialists including one cardiologist, one general doctor, two nurses (one direct assistant and one supporter), one radiologist and one electrocardiograph (ECG) technologist. If the diagnosis and inspection cases increase, the personnel should be increased by assigning one general doctor and two nurses who will take auxiliary parts.

The cath lab team assignment plan in the target hospitals in the Project is shown in Table 5-11 below.

Table 5-11 Cath Lab Teams Assignment Plan in Target Hospitals (2025)

	No. of teams	Points for Increase of Personnel
Badulla Provincial General Hospital	1	A cath lab will be installed in the hospital for the first time and it is necessary not only to assign a cardiologist experienced in team medical care but also for the nurses and radiologists to get familiar with team medical care.
Trincomalee District General Hospital	1	A cath lab will be installed in the hospital for the first time and it is necessary not only to assign a cardiologist experienced in team medical care but also for the nurses and radiologists to get familiar with team medical care.
Kandy Teaching Hospital	3	This hospital has sufficient personnel necessary for team medical care. The cardiology team also includes an assigned electro-physiologist; thus, if the necessary equipment is procured, it is possible to make full use of existing personnel.
Kurunegala Teaching Hospital	2	It is possible to organize the system to make effective and stable use of two cath labs by increasing the number of cardiologists and radiologists.
Anuradhapura Teaching Hospital	2	In order to expand the treatable range of diseases and respond to hard-to-treat cases, the EP cardiologists and cardiothoracic surgeons who can treat Electro-physiology (EP) will be assigned.

Source : Prepared by the Survey Team (2017)

2) Operation of other functions provided for each hospital in the Project

In case of construction of complex building for the hospitals and/or other functional facilities, the equipment to be procured is planned either for replacement or those which can be managed by the existing staff or additional staff planned to be employed. Therefore there will not be any operational problem. However, the hospitals which will newly operate the cath lab will need to identify the flow of patients and various work orders, such as preparation of necessary equipment, materials and tools, for services in cath lab and other clinical department, clarify the responsibilities of each department, and to optimize the allocation of staff and hospital activities. The Anuradhapura Teaching Hospital plans to employ a cardiothoracic surgeon to start the cardiothoracic surgery, anaesthesiologist and scrub nurses, clinical engineers and other necessary personnel can be secured from the existing personnel.

It should be noted, however, that hospitals that are about to start operating new cath labs need to perform clarification of responsibilities and optimisation of personnel assignment plans pertaining to cath labs and related departments, as well as coordination of assignment of said responsibilities and personnel within the hospitals by sorting out the routes and directions of patient flow and medical orders.

3) MLT School

The equipment procured for the MLT Schools is required for the schools to conduct the training in compliance with their curriculum, and there should not be any operational problem in providing the training with use of the equipment procured as the schools have been using the equipment owned by other facilities. However, in recent years the number of trainees has been on the increase; in case this trend continues, strengthening of the systems needs to be considered.

4) BES

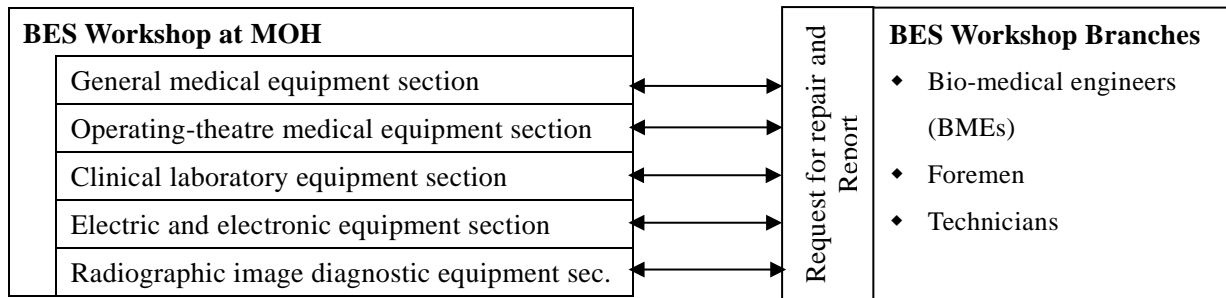
The equipment procured for the BES are required for them to provide the preventive maintenance and repair services for the medical equipment at the hospitals. As the new medical equipment will be procured for the hospitals in the Project, BES is expected to start the preventive maintenance service, which they have not conducted, and respond to the needs of repair, which is deemed to increase depending on the increased number of medical equipment. As of March 2017, BES at HQ and branches has the total of 14 biomedical engineers, 35 foremen and 40 technicians, and has started the process of recruitment of additional staff (4, 43, and 40, respectively).

(2) Operation and maintenance of equipment and facilities

1) Management of equipment and facilities in tertiary healthcare institutions

Regarding the maintenance and maintenance management of equipment, nurses belonging to each clinical department are mainly conducting day-to-day inspections before the use of equipment. If abnormality is found in daily inspection, contact the hospital maintenance department or hospital workshop and repair equipment with simple structure that can be repaired in the hospital workshop. In case internal repair is impossible, a request for repair is submitted to BES of MOH from the hospital workshop. Repair is conducted at respective sections of BES (MOH) depending on the

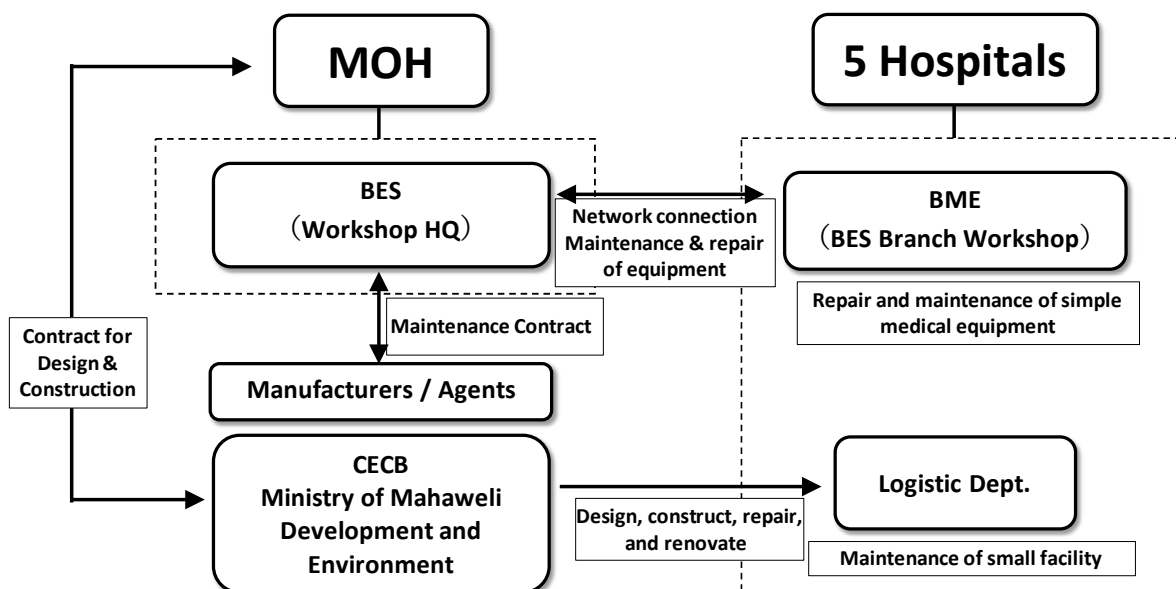
type of equipment. The system of cooperation between BES of MOH and workshops of the hospitals is shown below.



Medical equipment which is relatively simple and can be repaired within the hospital is dealt with internally by BES staff in the hospital. For the equipment of complicated structure which can only be repaired by an authorized technician as per Product Liability (PL) law MOH has a maintenance system in place, where a long-term maintenance contract is concluded between MOH and the manufacturer of said equipment or its local representative.

Operation and maintenance of hospital facilities, namely construction of new facilities as well as extension and repair of the existing ones, is conducted by Central Engineering Consultancy Bureau (CECB⁵⁵) under Ministry of Mahaweli Development and Environment based on a contract concluded between CECB and MOH.

System for operation and maintenance of hospital equipment is summarised in the figure below.



Source : Prepared by the Survey Team (2017)

Figure 5-1 Operation and Maintenance System of Hospital Facility and Equipment

⁵⁵ While CECB is controlled by Ministry of Mahaweli Development and Environment, it has a long-term contract with MOH regarding design, construction, extension and repair of facilities for institutions managed by MOH.

2) Budget for operation and maintenance

Tertiary healthcare institutions to install cath labs under this Project are supervised by MOH via a member from the MOH's Department of Tertiary Healthcare Institutions dispatched to their respective management committees. Therefore, when it comes to the budget for facility operation and maintenance, the budget request is prepared by the hospital and forwarded to the Department of Tertiary Healthcare Institutions; after that the request is forwarded to Deputy Director General of Medical Service 1, then to Director General of Medical Services and then submitted to Ministry of Finance. MLT Schools are under the administration of Deputy Director General of Education, Training and Research, and together with BES are managed by MOH. The operational budget request prepared by MLT School and BES is submitted to Deputy Director General respectively and to Director General and to Chief Accountant for approval.

5-2-2 Operation and Maintenance Costs

(1) Tertiary Healthcare Institutions

All target facilities already have the necessary personnel for operating a cath lab and, as was shown in Table 5-11 above, will have one to three cath lab teams in place (depending on the scope of the institution). Only one team per institution will be placed at the hospitals that are to start operation of cath lab for the first time, however as it is expected that the number of patients is going to be limited in the beginning, no problems are assumed in operating the lab under the current personnel assignment.

When the services of diagnosis and intervention with the cath lab with the equipment procured in the Project are started, MOH must secure the budget for operation and maintenance costs shown in Table 5-12. The estimated operation and maintenance costs were calculated with the same criteria as were set for forecasting the number of annual catheterization cases to be handled (2023 to 2025), as described in the Table 4-6, "Forecast Capable Cases of Diagnosis and Treatment in 5 Target Hospital (2023-25), where the calculations used same number of possible cases, operating hours, and diagnosis/intervention expenses in the items of (1) consumables for medical equipment such as electrocardiograph recording paper, electrode plate, etc., (2) equipment maintenance including maintenance contract amount, (3) medical materials such as stent, catheter, etc., (4) pharmaceuticals such as thrombus solvent, and (5) operation for cardiothoracic surgery. Upon comparison with O&M costs for Kandy Teaching Hospital, the results were deemed reasonable.

This estimate of operation and maintenance (O & M) costs indicates the additionally required costs (addition), on top of the current activities in the hospital; in other words, the estimated costs do include the O&M costs for the equipment which is in use and will be relocated.

The estimation is made with the assumption that there will be a few cases immediately after the handover of cath labs planned for 2023, and because mastering of operating the cath lab requires time, it is assumed that after completion of construction the number of capable cases of diagnosis/treatment will increase gradually. The estimated number of the cases at target hospitals after completion of facilities construction is explained in section 4-4 of Chapter 4, Table 4-6. As to

the cardiothoracic surgery operation, it is assumed that the number of operations will start from 3.8 cases per week, which will increase to about 5 cases per week in 2026.

Table 5-12 below shows estimated annual O & M cost of medical equipment to be procured under the Project at 5 target hospitals as of 2023, soon after cath labs commence the operation. Note that the O&M costs for 2023 do not include the cost of maintenance services contract for the equipment for two years after the free warranty period and the cost of spare parts for two years after commencement of operation, that are included in the project cost.

Expenses for annual maintenance agreement and replacement of spare parts will be required after 2026. The total amount is shown in Table 5-12 below.

Table 5-12 Operation and Maintenance Costs Necessary for Hospitals in 2023 (Immediately after Handover) ⁵⁶

Institution	Estimated annual O&M Cost (million)	
	In 2023 (Immediately after Handover)	In 2026 (3 Years after Handover)
Badulla Provincial General Hospital	Rs.132.99 (¥99.48)	Rs.258.86 (¥193.63)
Trincomalee District General Hospital	Rs.132.74 (¥99.29)	Rs.257.32 (¥192.48)
Kandy Teaching Hospital	Rs.502.99 (¥376.24)	Rs. 589.02 (¥440.59)
Kurnegala Teaching Hospital	Rs.334.46 (¥250.17)	Rs.500.81 (¥374.61)
Anuradhapura Teaching Hospital	Rs.523.44 (¥391.53)	Rs.757.14 (¥566.34)
Total	Rs.1,626.62 (¥1,216.70)	Rs.2,363.15 (¥1,767.65)

Source : Prepared by the Survey Team (2017)

(2) Medical Laboratory Technologist (MLT) Schools

The maintenance costs for the project equipment in MLT Schools are shown in Table 5-13. These budgets should be explained to and approved by the Financial Division in MOH. The amounts necessary for the operation of each MLT School consist of: 1) expenses for consumables for equipment, and 2) equipment maintenance costs (maintenance service costs).

A multiple year maintenance agreement must be concluded when procuring equipment. MOH must take budgetary measures to budget for operation and maintenance costs that include the cost of procurement for consumables required for reagents and equipment and must also keep the maintenance agreement continuously after termination of the free warranty period.

⁵⁶ It is calculated based on that Stent cost is “Rs. 100,000”, based on the information of private hospitals and market prices (Gazette was issued on 4th August 2017 by MOH to effectuate the maximum price of Stent set at Rs. 105,000 and this price does not have big difference of the number used in the estimate of O & M Costs, and not give effect the calculation). The price of Rs. 100,000 is used in this Survey.

Table 5-13 Equipment Maintenance Costs in MLT Schools

Institution	Maintenance Cost (million/year)
MLT School, Colombo	Rs.40.30 (¥30.14)
MLT School, Peradeniya	Rs.0.81 (¥0.61)
MLT School, Kalutara	Rs.2.13 (¥1.60)
Total	Rs.43.24 (¥32.35)

Note: Figures in parentheses indicate JPY equivalent based on following exchange rate:
Rs.1.0=JPY0.748

Source : Prepared by the Survey Team (2017)

(3) Bio-medical Engineering Service (BES)

The BES in charge of the maintenance of medical equipment is established in the MOH. The BES workshop in MOH has 5 sections in charge of radiological equipment, operation-related equipment, general medical equipment, electronic medical equipment and clinical laboratory equipment. The workshop in each hospital (hereinafter “workshop branch”) accepts and repairs equipment among the medical equipment and devices which are out of order in the hospitals under the control of MOH.

While parts needed when making repairs are purchased in the general market or from any agent, relatively simple medical equipment using no electronic parts can be repaired in the workshop branches. Equipment with a complicated composition such as image diagnostic equipment and electronic medical equipment are generally repaired by agents.

For large-type image diagnostic equipment including angiographic equipment and CT scanners for the cath labs planned for procurement in this Project, BES and each manufacturer’s agent shall enter into a maintenance agreement including regular inspection. In Sri Lanka, in general, each BES receives an estimation for the total cost of equipment including the maintenance costs for 5 to 10 years in addition to the one- or two-year free warranty period at the discretion of MOH at the time of purchasing medical equipment, and the maintenance agreement is renewed based on the estimated amount agreed between BES and each of the agents for each year. It is required that MOH secures the budget for maintenance contract for the equipment to be procured in this Project.

5-3 Plan for Enhancement of Project Implementing Capacity

For enhancement of the Project implementing capacity and demonstration of the Project Effects, the Consultants hired by implementing organisations will provide the technical training and technical assistance for aspects of improvement of operation and equipment maintenance of equipment and materials in BES, operational coordination inside hospital necessary for operation of cath lab, and establishment of a hospital data management system, as described below.

5-3-1 Technical training for operation and maintenance of equipment

(1) Problems with operation and maintenance

MOH has several problems with the operation and maintenance of medical equipment and materials for use in the public healthcare institutions; the main ones are described below.

- Hospitals do not keep master management ledgers for current equipment, so the equipment service life, repair history, and other areas of administration are not known. For that reason, it is impossible to schedule equipment renewal.
- In many workshop branches at the hospitals, BME is not allocated, and in the Kurunegala Teaching Hospital, an even foreman is not allocated. In Kandy Teaching Hospital, an engineer functions as foreman to repair the equipment. The staff for maintenance and repair at many hospitals is not adequately allocated. Because of this situation, malfunctioning equipment is seen at some places left unused without being repaired.
- BES in MOH is provided with a simple computer-recorded equipment management ledger (including years of purchase, manufacturers, models and places of installation). For operation and maintenance of medical equipment, the repair sections are also provided for (1) General medical devices; (2) Medical equipment for operating theatres; (3) Equipment for clinical examination rooms; (4) Electrical and electronic equipment and (5) Diagnostic radiology equipment. However, management of the equipment repair at the workshop branches of the healthcare institutions is done by hand-written notes, thus hindering coordination with the BES in operation and maintenance of medical equipment. This results in the BES of MOH having no understanding of the operability of on-site equipment; this causes the equipment defects to become irreparable major malfunctions, resulting in problems such as the renewal of equipment being necessary.
- Medical treatment sites do not employ managers for each item of equipment, and there is no provision for basic management systems for equipment conservation and maintenance, including regular inspections, daily inspections, or communication systems in case of malfunction. For that reason, accidents may occur due to the use of poorly maintained equipment.

(2) Input for problem solution

Such problems not only hinder the proper operation and maintenance and appropriate use of the advanced medical equipment to be procured by the Project but, as more medical services are provided, also heighten the safety risk to patients and medical practitioners, such as electric shocks, radiation exposure, and exposure to magnetic fields. In order to solve these problems and provide the advanced medical services in a safe and stable manner, it is necessary to build a system which can centrally manage the information including the preparation of equipment master ledger with the information of operating status of equipment, repair history, service life and cost analysis in PC-based networking of the BES of MOH with the workshop branches of healthcare institutions. The equipment operation

and maintenance system can be operated in an appropriate and quick manner by reinforcing the procured equipment management system through training and guidance at the target hospitals and the centralized equipment management system built through PC networking of the centre with the branches.

MOH plans to allocate the BMEs, who will be newly employed, to the 5 target hospitals. With these workforce, the newly procured maintenance equipment, PC networking and the training to the BMEs, foremen and technicians of workshop branches will enable the centralized management of proper and scheduled maintenance of equipment.

The contents of technical training for equipment operation and maintenance are described below.

[Objective of O&M equipment training]

- To provide 5 target hospitals that are hubs for NCD diagnosis and treatment with systems for equipment care, operation and maintenance, and to promote effective use of the equipment to be procured by the Project.
- To promote better condition and longer life with safety for the supplied equipment by providing systems for equipment care, operation and maintenance.
- Strengthen the maintenance and management capability of BES through technology transfer of PC network construction and operation guidance.

[Effects of Training]

- Through the technical guidance on equipment maintenance system and preventive maintenance practice including daily and periodical inspection to the BES staff (Engineer, Foreman, Technician) in addition to the nurses, paramedical and other staff who may use the medical equipment in the hospital, and the utilization of centralized information of operation and maintenance of equipment at the hospitals by PC networking system, the coordination between BES and the BME, foreman, technician and other equipment maintenance staff at the hospitals will be improved. As a result, it is expected that the joint use of information among the persons and parties concerned in the equipment maintenance is promoted and the operation and maintenance system for medical equipment can be implemented in an appropriate and quick manner.

[Training implementation period]

- Implemented in conjunction with the supply of equipment in this Project

[Target training participants]

- Bio-medical Engineer in Colombo and Bio-medical Engineer, Foreman and Technician of target facilities
- Persons in charge of equipment operation such as para-medical and nurses at target facilities

[Details of training]

Name of course	Details	Training period	Training location
Technical Training for Equipment O&M (Theory/ Practice)	<p>First course: Training for preparation of equipment ledgers, building of a PC network, assignment of equipment manager and scope of responsibility, daily checking and regular inspection, lecture on characteristics of procured equipment, etc.</p> <p>Second course: Practical training of PC networking, guidance of basic knowledge of preventive maintenance, practical training for troubleshooting, etc.</p> <p>Third course: Lectures on electrical safety, preparation of inspection manuals and preventive maintenance manual, verification of effects of the newly constructed O&M system, review and adjustment of training items, etc.</p> <p>Fourth course: Checking of the operating status of PC network and the use conditions of equipment ledgers, and troubleshooting. Verification of implementation of the built operation and maintenance system, and verification of input effects by tests.</p> <p>[Lecturer] International Consultants and local maintenance engineers (the guidance starts 2 to 3 weeks prior to the delivery of equipment with the base established at Kandy TH and Anuradhapura TH and other institutions covered via lecture tours).</p>	12 months	BES (Colombo) and BES workshop branches under the Project

5-3-2 Assistance in operational coordination inside hospital necessary for operation of cath lab

It is important for the hospitals to provide the immediate services for diagnosis and intervention for the patients of acute ischemic heart diseases. On the other hand, smooth necessary service to the patients from the time a patient is hospitalized until he/she is released from the hospital is also likely to affect the conditions of patients after he/she is released. Therefore, it will become necessary to adjust and coordinate the operations inside the hospital when the cardiovascular service is started or expanded. For the diagnosis and intervention, a medical team, headed by cardiovascular consultant doctor, with general physician, nurses (1 direct support, 1 assistant), radiographer, electrocardiograph technician will be on duty, and provides the services for cath lab operation to the patients of various acute conditions. At the same time, providing all the necessary services to such patients, after the diagnosis/intervention in cath lab, requires the combination of various services in the hospital, and therefore coordination and adjustment in medical staff flow and allocation, budget allocation in between other departments and supporting sections is important and essential. The Consultants will support in optimization of hospital staff allocation, establishment of coordination plan of services relevant to cath lab and preparation of plan of emergency services.

[Objective of facilitation support]

- Necessary study as well as proposal of improvement will be conducted in order to provide the proper medical services to the patients of acute cardiac diseases and to provide other medical services without hindrance in the hospitals, which will newly introduce cath labs.

[Support implementation period]

- Before the facilities are completed.

[Content of facilitation support]

Type of assistance	Details	Training period	Training location
Assistance in operational coordination inside hospital necessary for operation of cath lab	<ul style="list-style-type: none"> • Sorting out the routes and directions of patient flow and medical orders in relation to operation of cath lab and other medical departments • Clarification of the duties and responsibilities of cath lab and relevant departments (preparation of Standard Operation Procedure) • Drafting staffing plan to optimize re-allocation of doctors and staff to diagnosis and intervention at cath lab • Drafting an emergency action plan (establishment of a safety administration system in serious cases such as patient's death) 	Total 4 months	Tricomalee DGH, Badulla PGH

5-3-3 Assistance in data management in hospitals

The target hospitals, except the Kandy Teaching Hospital and Badulla Provincial General Hospital, do not have units for data collection, recording and monitoring of the hospital services and of patients, even a patient's clinical record, except for items instructed by MOH. In the Survey, it was observed that, in some hospitals, number of outpatients and information of outpatients (name, address, name of disease, disease record) and information of referred patients such as name, name of disease and addresses were not recorded. In this situation of absence of patient's clinical record, the patient who cannot meet the same doctor that he/she has met before may be treated as the one who comes as the first time.

Data collection, recording and monitoring is an essential part of the service improvement at the hospitals, and for the evaluation of the Project outputs. Basic data of outpatients and data on patients referred to upper and lower level facilities, among others, are important. It is necessary to properly monitor and record such basic data in each hospital in order to measure the degree of contribution to "Reduction of mortality due to ischemic heart disease" as laid out as one of the policy objectives.

Therefore, for the target hospitals that do not have an appropriate internal data management system/structure in place, in the Consultants will provide guidance on basic methods of data collection, recording and monitoring.

[Objective of facilitation support]

- To establish the unit/officer in charge for information/data management and the necessary system for collection, recording and monitoring of basic data and other data on referred patients and mortality, etc.

[Support implementation period]

- To be started at the early stage of the Project.

[Content of facilitation support]

Name of assistance	Details	Training period	Training location
Assistance in data management in hospitals	<ul style="list-style-type: none">• Study on current situation of data collection and management in the hospital (unit/officer in charge, personnel, budget)• Identify the place of data collection and method for operation and effect indicator monitoring• Recommendation of data collection, recording and monitoring system for operation and effect indicators (Preparation of Monitoring Manual)	Total 4 months	Tricomalee DGH, Kurunegala TH, Anuradhapula TH

5-4 Consulting Services

The purpose of employment of Consultants is to provide the technical and administrative support to the MOH which is the executing agency.

The consulting services are outlined as follows:

[Design, bidding assistance and supervision of construction]

- 1) Basic and detail designs for the buildings to be constructed
- 2) Basic and detail designs for electricity, machinery, air-conditioning system and other facilities for the buildings
- 3) Basic and detail designs for the equipment to be procured
- 4) Preparation of tender documents and other relevant documents for bidding
- 5) Assistance in bidding and contracting
- 6) Supervision of construction and equipment installation
- 7) Supervision of delivery and commissioning of buildings and equipment

[Technical assistance for assuring the capacity enhancement in Project implementation]

- 1) Technical training for operation and maintenance of equipment
- 2) Assistance in operational coordination inside hospital necessary for operation of cath lab
- 3) Assistance for building a system for hospital data management

5-5 Project Implementation Arrangement

5-5-1 Project Implementation Arrangement

(1) Implementation Arrangement

In this Project, the Project Management Unit (PMU) to control and manage the entire Project will be set up in the MOH as the core for implementation of the Project, and the Project Implementation Unit (PIU) will be set up in each target hospital, MLT School and BES. In addition, the Steering Committee which will function as the highest decision making system for the Project will be set up. The Committee will be chaired by the Secretary of Health or an officer equivalent to the same level, and be composed of the member of representatives from PMU, PIU and other institutions concerned. It will hold the periodic meetings, with the report on project progress from the PMU, and make

necessary decisions on project implementing policy, budget and personnel allocation and other important issues.

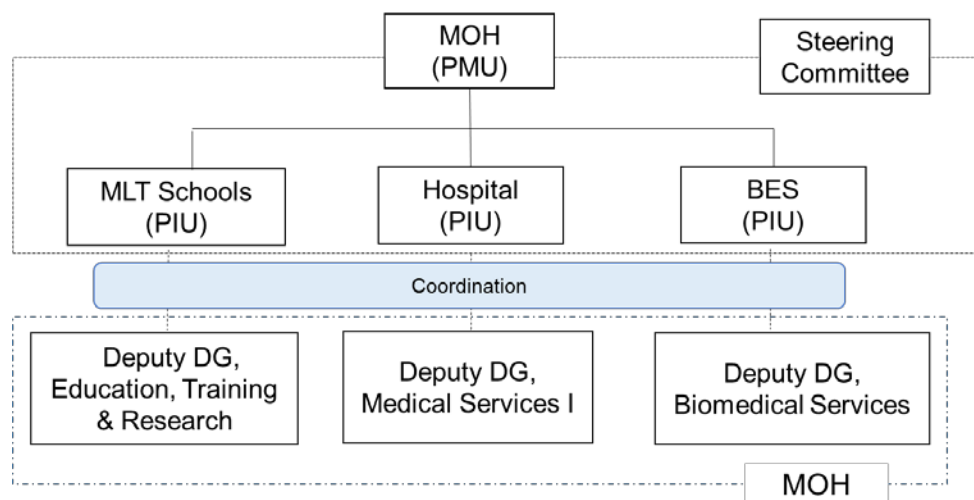
The function of PMU is as follows and PMU will be assisted by the Consultant for items (2) to (5).

- 1) Selection and employment of Consultants
- 2) Procurement of equipment supplier and building contractor (preparation of tender documents, contracting procedure, etc.)
- 3) Implementation and management of the Project through the communication and coordination with PIUs
- 4) Preparation of various manuals for implementation of the Project
- 5) Communication and coordination with other Ministries concerned and JICA
- 6) Administration of Project funds (including for the ODA Loan disbursement)
- 7) Opening the periodical meetings of Steering Committee

The function of PIU is as follows.

- 1) Implementation of the respective Project at each facility (study of technical specifications and tender documents, monitoring the construction and procurement progress, etc.)
- 2) Periodical reporting to PMU
- 3) Participation in the periodical meetings of Steering Committee

The entire organization of the system is shown in Fig. 5-2.

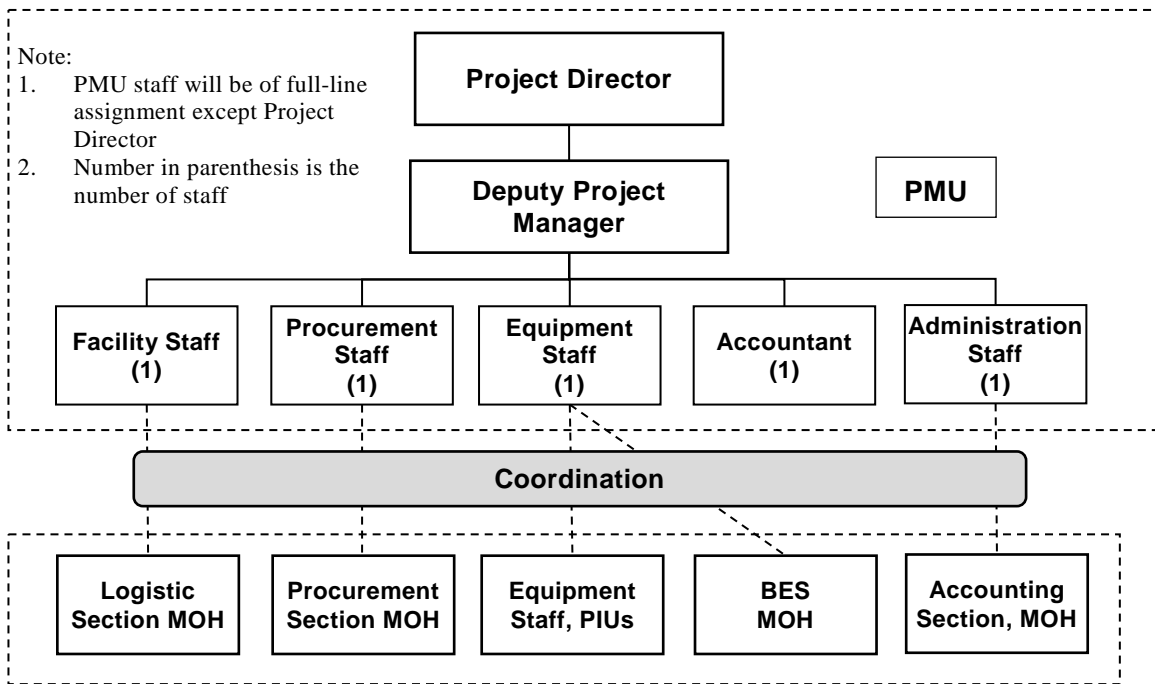


Source : Prepared by the Survey Team (2017)

Figure 5-2 Project Implementation System

(2) PMU

The organization of the PMU to be set up in the MOH is shown below. The PMU will coordinate with the existing departments and sections concerned in MOH and other PIUs.



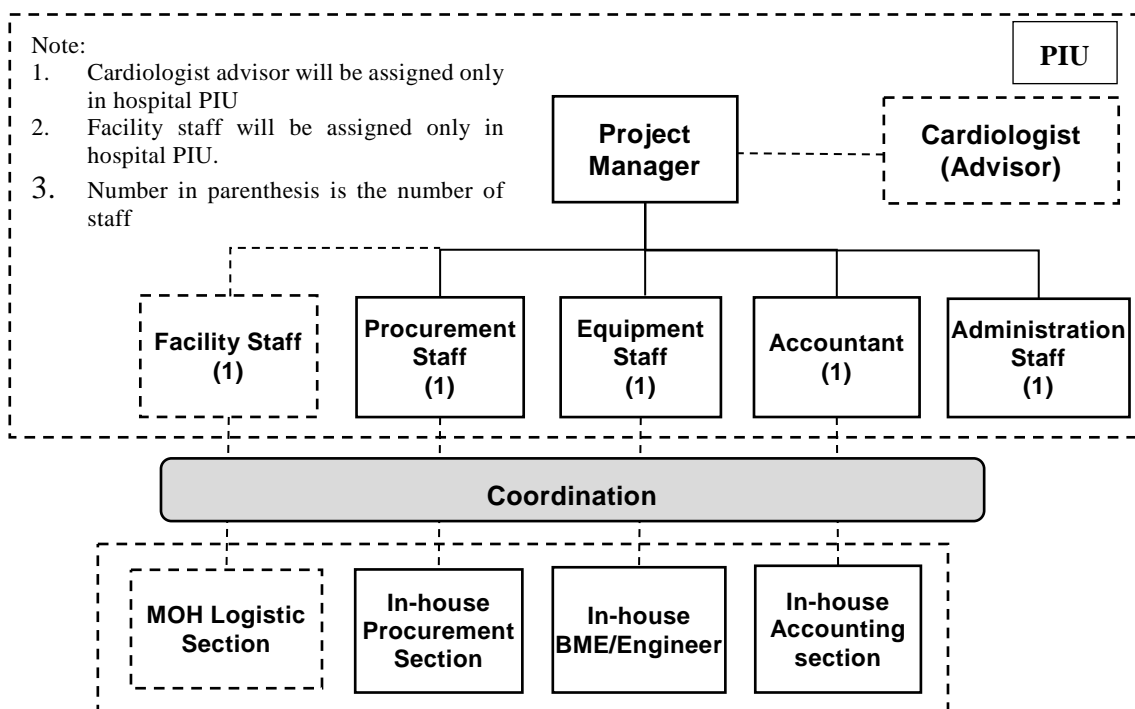
Source : Prepared by the Survey Team (2017)

Figure 5-3 Structure of PMU

(3) PIU

The organization of the PIU to be installed in each hospital, each MLT School and the BES is shown below. For the hospital PIUs, the hospital staff will be assigned. For the PIUs of MLT Schools and BES, the MLT School staff and MOH staff will be assigned respectively. It is recommended to assign a cardiologist of the hospital as an advisor to hospital PIU.

For monitoring the operation and effect of the Project, PIU, receiving the data from the person in charge in the facility, record and monitor the data, and report it to PMU periodically.



Source : Prepared by the Survey Team (2017)

Figure 5-4 Organisational Structure of PIU (Hospitals, MLT Schools or BES)

5-5-2 Project Implementation Schedule

In preparing the implementation schedule of this Project, the experiences of a similar project under implementation was taken into account.

The period of each stage of work was assumed based on the work items and the standard work periods in each stage and the experiences in the above mentioned on-going project. In assuming the work period of each stage based on the standard periods and the experiences, the total project period from the date of the Loan Agreement (L/A) to the completion of facility construction and equipment procurement was estimated as 5 years. The estimated periods by each stage is shown below.

Table 5-14 Estimated Periods Required for Work Stages

Work phase	Work description	Standard schedule (month)	Records of a similar project (months)	Estimated period (month)	Estimation basis
Selection of consultant	Consultants selection procedure	12	16	12	
Selection of contractors and suppliers	B/D, D/D, Preparation of PQ and Bid documents	6	16	7	
	PQ	3	4	3	
	Bidding	3	2	3	
	Bid evaluation	5	12	5	
	Contract negotiation and conclusion	4	6	4	
	Sub-total	21	56	22	
Construction works/equipment procurement	Construction/procurement	24-48	18	30	Construction period for a 9-storey building
Total period	(months)	45-69	75	64	
	(years)	3.8-5.8	6.25	5.3	

5-5-3 Risk Analysis and Countermeasures

(1) Risks related to Project implementation arrangement and capability

a. Possible delay due to the late establishment of PMU and PIU

PMU in MOH and PIUs of hospital, MLT Schools and BES should be established before the Project starts. The delay of establishment of PMU and PIUs could cause the delay of Project commencement. MOH should initiate the early establishment of implementation arrangement.

b. Possible trouble due to the shortage of capability of PMU and PIUs

At present, the “Project for Improvement of Basic Social Services Targeting Emerging Regions” financed by ODA Loan is being implemented and the PIU is established in the MOH. The staff to be allocated to the PMU and PIUs for the Project may not be familiar with the project of ODA Loan. The project sites are located throughout the country, and if any complicated trouble happens at multiple sites at the same time, the trouble shooting would be very hard. Upon commencement of the Project, PMU should prepare project implementation guidelines and share it with all stakeholders.

c. Possible trouble in budget allocation

Badulla PGH plans to construct the new building by the Governmental Budget and needs to secure the budget along with the construction plan. The necessary budget for the operation of PMU and PIUs must be secured at the timing of their establishment. It is necessary to confirm the budget allocation for the building construction and the operation of PMU and PIUs of the first year before conclusion of Loan Agreement and the MOH and PMU need to confirm the budget allocation every fiscal year and share the budget information with JICA and the Consultants.

d. Possible failure of commitment due to sudden retirement of high ranking officer of the Government and/or lack of information sharing on commitments/agreement

In order to cope up with the cases of personnel reallocation or retirement, and to expedite the information sharing, PMU with the assistance of Consultants will develop the coordination manual including way of compiling the minutes, list of distribution and so on. In accordance with the coordination manual, all important issues should be recorded and shared with the parties concerned with respective issue.

e. Possible delay due to the lengthy process of evaluation by the Government

In the similar project, the Technical Evaluation Committee (TEC, composed of MOH and others) of the Sri Lankan Government evaluated the documents to be used for the bidding, and the process of evaluation took some considerable time. PMU with the assistance of Consultants will give prior explanation on the Project and the content of bidding to eliminate the time for evaluation.

(2) Risks related to the construction work

a. Shortage of labour (skilled workers)/construction machinery

Currently, the development of infrastructure (including roads, ports, water service and electricity) and the construction of foreign-affiliated hotels, offices and housing complexes under international fund investments is proliferating in the capital city, in particular, and small-scale construction works (of hotels and shops) are underway even in regional cities.

For large-scale construction works, foreign skilled workers (from China, Bangladesh, India, etc.) are employed. Local constructors are also involved in these works, but the total number of skilled workers is insufficient in Sri Lanka, so the Government has taken the policy of accepting the employment of foreign skilled workers.

It is expected that construction of facilities under this Project will start in around 2021. If the construction boom continues at that time, considerations must be made for contingency costs to cope with the rise of construction costs.

The present construction boom has resulted in a lack of availability of construction machinery. In particular, it is difficult to acquire large diameter pile excavators (1 m or more). This problem can be solved by scheduling the incorporation of pile excavators with a pile diameter of 0.6 or 0.75 m, which are available in large numbers.

In addition to the above, it is worth considering to arrange construction packages in a relatively small size so that construction companies limited in their operation scale could apply to the bidding.

b. Impact of natural conditions

In Sri Lanka, the rainy season is long and it is necessary to assume a delay to work in this season to maintain the safety of work. In some planned sites, disasters due to tsunamis and earthquakes have occurred in the past. Therefore, work must be carried out in accordance with the respective local laws and regulations regarding dealing with such disasters.

c. Delay to be caused by Sri Lanka side work

Badulla Provincial General Hospital will construct the new building by the Governmental Budget, while the necessary equipment would be procured by the ODA Loan. If any delay happens in the construction stage, procurement process for the equipment may also be delayed. On the other hand, part of Kurunegala Teaching Hospital shall be demolished by themselves, and subsequently a new facility for radiology department would be constructed at the same site by the ODA Loan. If the construction work to be done by Sri Lankan side is delayed, it will cause a delay in the implementation of the Project. In consideration of the situations mentioned, the actors concerned (hospitals, consultant and contractor) should have close coordination/communication from the design stage to the construction stage in order to avoid possible critical delays.

d. Risk for safety by accident

In the period of construction work, consultants provide guidance and supervision regarding the following safety control, etc., and contractors implement countermeasures

- Collection of information on health and safety, and public awareness
Subcontractor should implement security management as follows, and the Consultant should give guidance and supervise subcontractor. Safety information will be collected to build a cooperation system between the Client and JICA in order to deal with the prevention of disasters including diseases, damage to health, and civil war/terrorism.
- Safety management during work period

It is important that local subcontractors will be provided with guidance for safety measures and safety inspections by contractor and safety patrols will be carried out in order to deal with the prevention of fatal accidents during the construction work period so that Consultants provide guidance for safety measures with the contractor/local subcontractor

5-6 Environmental and Social Consideration and Poverty Reduction Effect

5-6-1 Environmental and Social Considerations

(1) Environmental Impact Assessment (EIA/IEE)

In Sri Lanka, environmental impact assessment (EIA) was introduced for the first time in 1981 under the Coast Conservation Act. The EIA was formally brought into practice for prescribed projects since 1988 through legal provisions under the National Environmental Act (Amendment), No.56 of 1988. The Environmental Impact Assessment Unit in the Environmental Management and Assessment Division of CEA is in charge of processing, implementing and approving the EIA or IEE.

It is confirmed with the CEA that this project, namely: Health and Medical Service Improvement Project, is not included in the prescribed projects, and an IEE or EIA is not required.

(2) Results of the Environmental and Social Impact Evaluation

This project provides facilities and equipment for NCDs, particularly for cardiovascular diseases, some of which may generate infectious solid waste and waste water. It is very important to manage and treat clinical solid waste and waste water properly in order to avoid an adverse impact on the people and the environment.

Regarding medical waste, a proper management system has been established at all target healthcare institutions, with the strong initiative of MOH, and an adverse impact caused by the solid waste is not anticipated.

On the other hand, waste water treatment facilities at some of the healthcare institutions require actions as they are old and not working properly or have limited capacity (Kurunegala Teaching Hospital, Anuradhapura Teaching Hospital and Trincomalee District General Hospital). For these three hospitals, a dedicated wastewater treatment system is planned to be installed as a mitigation measure. In addition, it is necessary to establish a thorough Ministry-led wastewater and effluent

management programme, like that which is in place for solid waste management, at each healthcare institution, in order for all waste water, including effluent from laboratories, to be properly treated before being sent to the septic tanks or waste water treatment facility.

Using and maintaining some new equipment to be provided by the project could cause accidents if they do not have sufficient understanding of the use and maintenance of newly-introduced equipment. In order to prevent unexpected accidents, sufficient training is required for engineers, doctors and nurses who will use the equipment.

Other environmental impacts directly caused by the project are likely to be generated by construction activities, including air, water and soil pollution, generation of construction waste, noise, and labour safety issues. However, these impacts would be relatively small in scale, and most likely confined to existing premises of the healthcare institutions, with limited impacts.

(3) Monitoring

It is very important to make efforts to contain and minimize any negative impacts, however minor, that may be generated by the implementation of the project during both the construction and the operational phase, through periodic monitoring. The following institutional arrangement is suggested for environmental and social impact monitoring.

In the construction phase, the contractor is responsible for implementing the monitoring, based on the monitoring plan, and for reporting to the PIU. PIU will report to the PMU periodically as agreed.

In the operational phase, the Infection Control Unit (ICU) and/or the Public Health Inspector (PHI) of each hospital or institution implement(s) the monitoring, based on the monitoring plan. The result will be shared at the Solid Waste Management Committee meetings. The result will be reported to the Director of hospital, and to the Environment and Occupational Health Unit of the MOH, where all information is gathered and compiled. Thereafter, an aggregated monitoring report will be delivered to the Deputy Director General, Public Health Services. If serious issues are found, these issues are to be raised and discussed, to be solved by the National Committee for Clinical Waste Management.

5-6-2 Gender based needs and poverty reduction effect

(1) Gender based needs

1) Tertiary Healthcare institutions

System of Sri Lanka guarantees equitable access to medical services for all citizens, and this survey confirmed that there is no obstacle to the use of tertiary level medical institutions based on gender⁵⁷. Although there are no guidelines showing gender-based considerations at tertiary level medical institutions, separate male and female wards, toilets, and locker rooms for medical personnel are provided in all the Project target facilities, and the examination rooms are arranged so that patients cannot look in from outside during examinations. It was also confirmed that consideration is given

⁵⁷ Finding in the field interview survey by the Study Team.

to gender by medical personnel in that, for example, a female nurse is present when male doctors examine female patients, and Muslim women, in particular, are treated in female wards to the extent possible, and that other considerations are given in terms of facilities and management so that women, in particular, can receive medical services with peace of mind.

The facilities planned in this Project will enable services to be offered with consideration for gender in line with existing facilities (separate male and female wards, toilets and locker rooms for medical personnel and arrangement of the examination rooms to secure their privacy) and at cath lab related facility as well, for example, preparing separation between male and female patient at waiting room where patients wait with their examination wear. No particular consideration is given to gender in the provision of equipment because there is no difference in the equipment that can be handled by different genders in terms of both service providers and users.

2) MLT Schools/BES

No particular consideration is given to gender in the provision of equipment because training and practice is implemented with the same curriculum for men and women regardless of gender, and because there is no gender difference in the equipment used.

(2) Poverty reduction effect

The people of Sri Lanka can receive free medical services at public healthcare institutions, including examinations, diagnoses, curative care and medical prescriptions. However, in most cases, patients cover their own expenses when receiving treatment at private healthcare institutions.

Regions that do not have a cath lab, including Uva Province and Eastern Province, in particular, where the ratio of families living in poverty greatly exceeds the national average, will be provided with a cath lab in this Project, and the improvement in cardiac disease diagnosis and treatment services in addition to the free services offered at public facilities will have an enormously beneficial effect on poverty in these Provinces by, for example, reducing transport and accommodation costs that are required when using facilities in other Provinces.

Chapter 6 Evaluation of the Project

This Chapter describes operation and effect indicators to monitor and evaluate the operation of inputs and its effect to achieve the Project objective, and the economic analysis to evaluate the economic viability of the Project.

6-1 Operation and effect indicators

6-1-1 Basic approach to setting indicators

The following three outputs are planned to achieve the Project objective (refer to Chapter 4).

- Output 1: Access to catheter diagnosis/treatment will be improved by developing the medical facilities and equipment in tertiary healthcare institutions
- Output 2: Diagnostic function for cardiac disease care will be strengthened by improving the medical equipment in MLT Schools
- Output 3: Maintenance function at the tertiary healthcare institutions will be enhanced by improving the repair tools and equipment in BES

In this section, operation and effect indicators are established for each output in order to monitor the achievement of the Project goals. In establishing the indicators, the consideration was given to (1) definition of indicators should be clear and simple, and (2) indicators should be have affinity with the statistic information system of MOH considering that the evaluations will be continued in the future and a possibility of expanding the evaluation to the other hospitals in the country.

(1) Establishment of indicators for Output 1

The operation indicators for Output 1 are the “number of diagnosis with angiography” and the “number of catheter intervention” to identify operational situation of cath labs for ischemic heart disease patients in each hospital.

As an effect indicator, mortality rate of patients of cardiovascular diseases can be proposed as it is the overall goal of the Project. However, the mortality rate is changeable due to a variety of reasons, and it is not suitable as the indicator to evaluate the Project effect. Therefore, the mortality rate should be monitored but not used for evaluation.

(2) Establishment of indicators for Output 2

For the Output 2, although only the supplemental equipment for training is procured for MLT Schools, the operation should be monitored by the indicator of “the ‘number of students per microscope” and the “number of lessons using the safety cabinets” are set as the operation indicators.

(3) Establishment of indicators for Output 3

As for Output 3, the tools and network equipment required for equipment maintenance and repair by BES are procured, and the “number of equipment items (kinds) repairable by tools and equipment in BES” is set as the operation indicator.

6-1-2 Operation and effect indicators

A list of operation and effect indicators is shown in the table below.

Table 6-1 Operation and Effect Indicator

Output1	(1) Number of diagnosis with angiography (2) Number of catheter interventions
Output2	(1) Number of students per microscope used in the training (2) Number of lessons using the safety cabinet
Output3	(1) Number of equipment items (kinds) which can be repaired by tools and equipment in BES

Source : Prepared by the Survey Team (2017)

The definition of indicators and values of baseline and target are shown in the tables below. Baseline values are values achieved in 2016 and target values are for 2025 (2 years after Project completion).

Table 6-2 Baseline and Target of Operation and Effect Indicators for Output 1

Indicators	Badulla PGH		Trincomalee DGH		Kandy TH		Kurunegala TH		Anuradhapura TH	
	Baseline (2016)	Target (2025)	Baseline (2016)	Target (2025)	Baseline (2016)	Target (2025)	Baseline (2016)	Target (2025)	Baseline (2016)	Target (2025)
(1) No. of diagnosis with angiography	0	1,300	0	1,300	2,624	3,300	* 999	3,200	160	2,000
(2) No. of catheter intervention	0	300	0	300	603	2,200	* 243	800	3	1,400

*: Figures for 9 months (Angiography was operated only for 9 months in 2016 in Kurunegala TH due to malfunction).
Source : Prepared by the Survey Team (2017)

Table 6-3 Baseline and Target of Operation and Effect Indicators for Output 2

	MLT Schools					
	Colombo		Peradeniya		Kalutara	
	Baseline (2017)	Target (2025)	Baseline (2017)	Target (2025)	Baseline (2017)	Target (2025)
(1) No. of students per microscope	3.20	2.17	-	-	3.90	2.29
(2) No. of lessons using the safety cabinet	0	5(58)	0	5(58)	0	5(58)

Note: 1. Number of students in 2017 is 80 at Colombo and 78 at Kalutara.
2. Number of students in 2025 is estimated to be same as in 2017.
3. Number of microscope will increase from 25 sets in 2017 to 37 in 2025 in case of Colombo and from 20 to 34 in case of Kalutara.

Source : Prepared by the Survey Team (2017)

Table 6-4 Baseline and Target of Operation and Effect Indicator for Output 3

BES of MOH		
	Baseline (2017)	Target (2025)
No. of equipment items (kinds) which can be repaired by tools and equipment in BES	33	55

Note: There are 88 equipment items to be procured by the Project including those for replacement.
Source : Prepared by the Survey Team (2017)

6-1-3 Indicator monitoring method and implementation systems

In order to obtain and monitor the indicator values, each facility will designate a staff in charge of data collection and recording (except the Kandy Teaching Hospital and Badulla Provincial Hospital having the relevant units). The staff in charge will collect, record the data and report it to PIU in the facility periodically. PIU will make the periodical report to PMU.

However, the PIU may be dissolved when this Project is completed, so it is appropriate to continue monitoring under existing information managing unit in the hospital. (Note: If there is no such unit or staff in the facility, a new post should be created.)

In order to accurately obtain, monitor and standardize the indicators among all facilities, a monitoring manual is to be produced by PMU with the assistance of Consultants and distributed to all facilities in the initial stage of the Project, including details on data collection/recording methods, and data management, examination and reporting systems.

Considering the fact that the essential objective of monitoring is to improve medical services based on the change in the indicators, it is important to organize medical service improvement system based on the data, within the hospital. Furthermore, the reduction of mortality rates from ischemic heart disease is an important policy for MOH, and it is proposed that the indicator data from the target facilities is incorporated into MOH information management systems.

6-2 Economic Analysis

6-2-1 Basic Concept of Economic Analysis

Economic analysis is an evaluation method of the economic viability of a project by comparing economic benefit, which is calculated by comparing benefit using the ‘With and Without’ case, and economic cost. The Economic Internal Rate of Return (EIRR) of the whole project and the following five hospitals is calculated.

MLT Schools are not the target of economic analysis because of the following reasons. Since improvement of quality of trainings, which is assumed to be economic benefit, is difficult to be converted to monetary value such as increase of individual income, it is impossible to calculate economic benefit. Hospitals and MLT Schools of this project are managed by governmental funding. Although there is a beneficiary liability in some cases, there is no medical expense revenue from general patients; therefore, financial analysis is not implemented.

Target of Economic Analysis

- 1) Badulla Provincial General Hospital; 2) Trincomalee District General Hospital;
- 3) Kandy Teaching Hospital; 4) Kurunegala Teaching Hospital; 5) Anuradhapura Teaching Hospital

Economic Analysis is based on the following basic assumptions:

Table 6-5 Basic Assumptions of Economic Analysis

No.	Item	Assumptions	Source/ Reference
1	Price	All prices are expressed in constant price at 2017 level excluding inflation.	JICA (2002) “JICA Methodology of Economic Analysis”
2	Transfer Items	Transfer items, such as tax, interest rate and subsidy are not excluded from economic costs and benefits.	JICA (2002) “JICA Methodology of Economic Analysis”
3	Conversion Factor of Economic Cost	Standard Conversion Factor (SCF) of 0.9 is applied to convert financial value of local currency costs into economic costs based on past record of ADB, JICA.	ADB (2017) “Guidelines for the Economic Analysis of Projects”,

No.	Item	Assumptions	Source/ Reference
			ADB (2012) “Northern Road Connectivity Project - Additional Financing” ⁵⁸ , JICA (2010) “Sri Lanka Feasibility Report on the Moragahakanda Agricultural Development Project”
4	Opportunity Cost of Capital	Opportunity cost of 10%, which is social discount rate in Sri Lanka is applied.	ADB (2012) “Dry Zone Urban Water and Sanitation Project – Additional Financing”, JICA (2009) “Sri Lanka Feasibility Study for Expansion of Victoria Hydropower Station”
5	Period for Economic Evaluation	30 years (2023-2052)	Since useful life of facilities is 30 years, and that of equipment is 10 years (renewed twice), evaluation period is 30 years.
6	Base Year	2023	-
7	Residual Value	0	Since the final year of the project is the final year of useful life of facilities and equipment, residual value is zero.

Source : Prepared by the Survey Team (2017)

6-2-2 Economic Cost

The project costs of hospitals and O&M costs are calculated. Hospitals’ O&M costs, which was mentioned in Chapter 5 including the cost of medical equipment consumables, medical equipment maintenance, medical material and medicines, and renewal costs of equipment (every 10 years) are calculated.

6-2-3 Economic Benefit

(1) Basic Concept of Economic Benefit

The economic benefit of the project and concept of beneficiaries are shown in Table 6-6 and Figure 6-1.

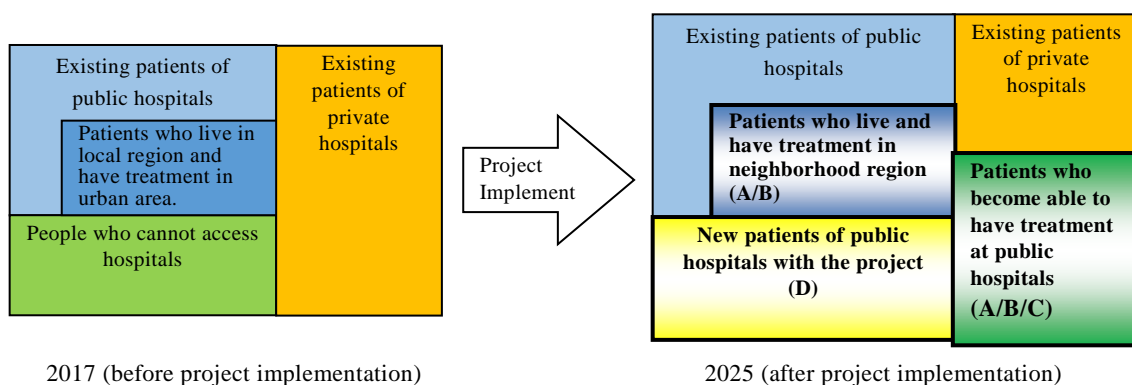
Table 6-6 Economic Benefit of the Project

Reduction of Opportunity Costs	<ul style="list-style-type: none"> • Patients can have treatment at local hospitals with the project. The following costs without the project are calculated as a benefit. • Since patients with cardiac disease do not need to be transferred from local hospitals to hospitals in Colombo and Kandy, the transfer costs are reduced (A). • Transportation and accommodation costs for families to accompany the in-patients are reduced (B). • Patients can have treatment with the project at public hospitals. Therefore, patients, who had treatment at private hospitals without project, do not have to pay for the difference between treatment fee at private hospitals and that at public hospitals with project (see note, C).
Expansion of Economic Activities by Decrease of Fatalities	<ul style="list-style-type: none"> • Patients, who cannot have treatment and who would otherwise die without the project, can have the treatment with the project and get back into society. The effects of a decrease in fatalities (decrease in death rate) on economic activities are calculated as an economic benefit. (D).

Note: These patients can be classed as A and B if they live in the local region.

Source : Prepared by the Survey Team (2017)

⁵⁸ <https://www.adb.org/sites/default/files/linked-documents/42254-014-sri-efa.pdf>



2017 (before project implementation)
 Note: Beneficiaries of the Project are shown in bold.
 Source : Prepared by the Survey Team (2017)

Figure 6-1 Concept of Beneficiaries of the Project

(2) Benefits of Opportunity Costs

- 1) Benefit of reducing transfer cost of patients with cardiac disease from local hospitals to Colombo and Kandy

The benefit of reducing the transfer cost of patients with cardiac disease from local hospitals to Colombo and Kandy is “A” in Table 6-6. The calculation method is as follows:

Economic benefit of reducing transfer costs of patients = Number of patients who are transferred to other hospitals without the project × Costs for transferring patients.

Table 6-7 Number of patients with cardiac disease who are transferred to other hospitals and transfer cost without project1

Hospital	Transferred to	Transfer cost (Rs.)	Number of patients who are transferred to other hospitals (people)					
			2025	2030	2035	2040	2045	2050
Badulla PGH	Kandy	15,000	2,083	2,096	2,109	2,122	2,135	2,133
Trincomalee DGH	Colombo	25,000	755	760	764	769	774	773
Kandy TH	Colombo	10,000	4	4	4	4	4	4
Kurunegala TH	Colombo	10,000	1,462	1,471	1,480	1,489	1,498	1,497
Anuradhapura TH	Kandy	20,000	1,912	1,923	1,935	1,947	1,959	1,957

¹ based on interviews and questionnaires from each hospital. Transfer costs include vehicle and staff costs.
 Note: Number of patients who are transferred to other hospitals after project start are calculated based on data (2014, 2015) from interviews and questionnaires from each hospital and population increase rate⁵⁹.
 Source : Prepared by the Survey Team (2017)

- 2) Benefit of reducing transportation and accommodation costs for in-patients’ families to accompany the in-patients to distant hospitals

⁵⁹ "World Population Ageing 1950-2050", United Nations (2002)

The benefit of reducing transportation and accommodation costs for in-patients' families to accompany the in-patients to distant hospitals is "B" in Table 6-6. The calculation method is as follows:

$$\text{Economic benefit of reducing transportation and accommodation costs for in-patients' families to accompany the in-patients} = \text{Number of patients who are transferred to other hospitals without the project} \times \left[\text{Number of family members} \times \text{Transportation costs} + \text{Accommodation costs} \right]$$

At least one family member accompanies the in-patients and they stay for 7 days. The following transportation and accommodation costs are used.

Table 6-8 Transportation and Accommodation Costs for In-patients' Families

Hospital	Transportation for In-patients' Families (Unit: Rs.)					Accommodation Costs for Families (Unit: Rs./night)
	Badulla PGH	Trincomalee DGH	Kandy TH	Kurunegala TH	Anuradhapura TH	
Colombo	-	1,224	604	484	-	6,000
Kandy	668	-	-	-	684	6,000

Source : Transportation costs = Sri Lanka Transport Board (2016); Accommodation costs = Questionnaire for hospitals

3) Reducing treatment costs (surgical costs and hospital charges) at private hospitals

The benefit of reducing treatment costs at private hospitals is "C" in Table 6-6. The calculation method is as follows:

$$\text{Reducing treatment costs at private hospitals} = \text{Number of catheter treatments at private hospitals} \times \text{Ratio of beneficiaries of five hospitals in whole country} \times \text{Package costs of treatment}^{60} \text{ at private hospitals excluding package costs of treatment at public hospitals}$$

Since Badulla Provincial General Hospital, Trincomalee District General Hospital and Anuradhapura Teaching Hospital are far from Colombo and Kandy, patients of these hospitals will not choose to have treatment at private hospitals if they can access public hospitals. Because Kandy Teaching Hospital and Kurunegala Teaching Hospital are relatively near to Colombo, 20% of high-income patients will not select public hospitals.

Although treatment costs at private hospitals are Rs. 320,000 (Rs. 170,000 including an overnight stay in the ICU plus Rs. 150,000 which is medical materials costs including stent costs) based on interview from private hospitals, medical material costs are required for treatment at public hospitals. Therefore, those are not included in the treatment costs reduced by this project. In addition, patients have to pay for honorarium for doctors. Since information of amount details of it could not be available, it is not included in the treatment costs at private hospitals.

⁶⁰ Package costs of treatment = Surgical costs + Hospitalization costs

Regarding treatment costs reduced by this project, the package costs at public hospitals are assumed to be less than 40% of those at private hospitals based on the following information. Although package costs of treatment at public hospitals are not available, the average of gross profit margin of 4 private hospitals was around 60%⁶¹. Therefore, treatment costs reduced by this project are 60% of package costs of treatment at private hospitals. In addition, since stent costs are required for treatment at public hospitals, those are not included in the treatment costs reduced by this project.

Table 6-9 Number of Annual Catheter Treatments at Private Hospitals (2015)

Nawaloka Hospital	Durdens Hospital	Central Hospital	Lanka Hospital	Total
4,200	3,132	2,500	2,400	12,232

Source : Prepared by the Survey Team (2017)

Table 6-10 Number of Beneficiaries of Hospitals and Rate in the Whole Country

Hospital	Rate (%)	Beneficiaries (people)					
		2025	2030	2035	2040	2045	2050
Badulla PGH	6.3	2,722	2,739	2,756	2,773	2,790	2,787
Trincomalee DGH	4.5	1,938	1,950	1,962	1,974	1,986	1,984
Kandy TH	15.9	6,901	6,943	6,986	7,029	7,073	7,065
Kurunegala TH	11.7	5,075	5,106	5,138	5,169	5,201	5,196
Anuradhapura TH	5.6	2,415	2,430	2,445	2,460	2,475	2,473
Total of 5 Hospitals	44.0	19,051	19,168	19,287	19,405	19,525	19,505
The Whole Country	100.0	43,463	43,725	43,995	44,266	44,538	44,494

Source : Prepared by the Survey Team (2017)

(3) Benefits of enhancement of economic activities by decrease in fatalities

The benefit of enhancement of economic activities by a decrease in fatalities is “D” in Table 6-6 and it is calculated as per capita GDP from the diseased age to 65 years old of patients who die without the project. The calculation method is as follows:

Benefits of enhancement of economic activities by decrease in fatalities = New patients of public hospitals with the project × Decrease in death rate of cardiac disease with the project × Loss of Per capita GDP caused by the disease⁶²

Decrease in death rate of cardiac disease with the project is 1.7%⁶³. In the following table, the rate of cardiac disease from age 45 to 54 years is 2.19%, which is higher than the average rate 1.61%.

⁶¹ The Lanka Hospitals Corporation PLC (2015) “Annual Report 2015”, Durdens Hospital (2015) “Annual Report 2014/2015”, Nawaloka Hospitals PLC (2015) “Annual Report 2014/2015”, Asiri Surgical Hospital PLC (2014) “Annual Report 2013/2014”

⁶² Loss of per capita GDP caused by the disease is that from 45 years (the rate of cardiac disease from 45 years is higher than the average rate of that of the total population) to 65 years.

⁶³ 6.9% (Estimated death rate from cardiac disease in 2025) - 5.2% (25% decrease in death rate from cardiac disease with the project). Reference : “Annual Health Bulletin 2014”, MOH (2016)

The possibility of an increase in the disease rate is from age 45 years and older. Therefore, per capita GDP from 45 to 65 years (Average lifetime of female in Sri Lanka is 78.6 years, and that of male is 72 years⁶⁴, so people conduct economic activities at least until age of 65 years) is used for calculating economic benefits.

Table 6-11 Rate of Cardiac Disease by Age Group (Unit: %)

Age group	< 17	18 - 24	25 - 34	35 - 44	45 - 54	55 - 64	> 65	Total
Male	0.19	0.16	0.30	0.87	2.66	5.19	7.00	1.74
Female	0.22	0.13	0.23	1.08	1.77	4.14	5.37	1.49
Total	0.20	0.15	0.26	0.98	2.19	4.63	6.09	1.61

Source : "National Survey on Self-reported Health in Sri Lanka 2014", Department of Census and Statistics, Ministry of National Policies and Economic Affairs (2016)

Table 6-12 Per Capita GDP in Sri Lanka (Unit : Rs.)

2025	2030	2035	2040	2045	2050
957,714	1,032,587	1,107,460	1,182,332	1,257,205	1,332,078

Source : "International Comparison Program database", World Bank (2017) ; "Overview of Sri Lanka", The World Bank (2016); and "The World in 2050", HSBC

Source : "World Economic Outlook", IMF (2016)

6-2-4 Results of Economic Analysis

Results of the economic analysis of the entire five hospitals' project and each hospital are shown in the following table. Each indicator is calculated based on the following method:

Economic IRR = (Discount rate which makes economic value 0)

Cost Benefit Ratio CBR (B/C) = (Net Present Value of Project Benefits) ÷ (Net Present Value of Project Costs)

Economic Net Present Value (ENPV) = (Net Present Value of Project Benefits) – (Net Present Value of Project Costs)

As a result of the economic analysis demonstrate, the EIRR of the entire five hospitals' project is found to be higher than the social discount rate, the CBR is higher than 1.0, and the ENPV is higher than 0. Therefore, the project is economically feasible.

Table 6-13 Results of Economic Analysis of Entire Five Hospitals' Project

Indicators	Result	Conditions of Economically Viable Project
EIRR	11.4%	It is higher than social discount rate (10%)
CBR	1.05	1.0 and more
ENPV	Rs. 1,407 million	0 and more

Source : Prepared by the Survey Team (2017)

As results of the economic analysis of each hospital demonstrate, the EIRR of Badulla Provincial General Hospital, Kandy Teaching Hospital and Kurunegala Teaching Hospital is higher than the social discount rate, the CBR is higher than 1.0, and the ENPV is higher than 0. Therefore, the above

⁶⁴ "Calculating the Life Expectancy for Sri Lankan Population", Department of Census and Statistics (2016)

three hospitals are economically feasible. The benefits of these hospitals are obtained enough compared with O&M costs.

On the other hand, the EIRR of Trincomalee District General Hospital (DGH) and Anuradhapura Teaching Hospital (TH) is lower than the social discount rate, the CBR is lower than 1.0 and the ENPV is lower than 0. Therefore, the hospital is not economically feasible. In detail, because O&M costs of Anuradhapura TH includes costs regarding cardiovascular bypass surgery (equipment are procured by this project), those are more expensive than those of other hospitals, and economic benefit is not enough for the O&M costs. Thus, net cash flow from the 1st year to 14th year (excluding 3rd year) is minus. Moreover, since beneficiaries of Trincomalee DGH are the fewest in 5 hospitals, economic benefit is not for O&M costs during whole operating period. In particular, the expensive renewal costs result in a net minus cash-flow in a large way in the 10th and 20th year and it makes the EIRR less than 10%. In this regard, the entire five hospitals' project is economically feasible.

6-3 Overall evaluation including social impacts

The results of the aforementioned economic analysis show that this Project will produce economic benefit that exceeds the investment cost. In addition to the economic effects, this Project will improve the quality of life of cardiac disease patients and their families, and will have social effects in the Project target regions, which cannot be overlooked. It is difficult to quantitatively measure such benefits, but roughly the following social effects can be expected.

(1) Reduction of poverty reduction and regional disparity

This Project will contribute to improved access to public medical services among those in poverty by offering medical services for cardiac disease patients and by reducing congestion and waiting times for medical examinations in urban areas. In the poverty-stricken Eastern Province, in particular, it is expected that the provision of medical services for cardiac disease patients in nearby regions will have the effect of halting the serious poverty situation by ensuring that breadwinners among those in poverty, who have limited access to diagnosis, can receive medical care. Such effects will improve the level of public medical services in regions, and will also reduce the regional disparity and contribute to the balanced development of the country.

(2) Improved quality of life for patients and their families

Many cardiac disease patients are working male adults responsible for the family finances, while patient care lies on the women in the family. By receiving a diagnosis and treatment at a cath lab in a nearby area, as well as possible opportunity of early identification of disease and intervention, the burden placed on women in the family shall be reduced and the quality of life shall be improved.

(3) Strengthening of referral systems and effective use of medical service resources in urban areas

In Provinces, secondary healthcare institutions will be able to refer cardiac disease patients to tertiary healthcare institutions in the same region, which will strengthen regional referral systems between upper and lower facilities, including the follow-up service to the patients sent by upper facility to

lower facility. Also, the improvement of medical services in the region will contribute to the relief of congestion in urban hospitals while also enabling the effective use of medical service resources at tertiary level medical institutions in the city, which have a leading role within Sri Lanka.

In this way, not only will this Project contribute to the macro-economy of Sri Lanka but from the societal point of view also it will contribute to local citizens, particularly to those in poverty, as well as lead to a sense of security among regional inhabitants. In view of such economic and social contributions, the implementation of this Project is deemed to have a major significance.

Chapter 7 Proposed Technical Cooperation Project for Mid-Term Implementation

As one of the means to cope up with the issues of NCDs, including the ischemic heart diseases, improvement of technical level and quality of hospital laboratory service can be addressed. With the objective of improving the technical level and quality of laboratory service in the hospital as the basis to identify the cause of disease and seriousness, the “Project for strengthening the quality management of hospital laboratory service” is proposed as a mid-term technical cooperation.

[Overview of the Project]

In order to develop an appropriate treatment policy by identifying the cause of the disease from the patient’s condition, it is most important to collect samples from the patient, examine them and obtain accurate results. Inadequate examinations and inappropriate examination methods will generate erroneous results. Erroneous diagnosis results and inaccurate results may lead to the development of an erroneous treatment policy. Accurate results by the laboratory examination are required also to identify the cause of NCDs or seriousness of diseases.

Currently, most of the healthcare institutions do not abide by the prescribed standards with respect to the examination methods and accuracy management, such as collection of samples, dispensing, management of blood and reagents, calibration of examination instruments, examinations and handling of examination results.

For these reasons, the Survey Team proposes to implement technical cooperation aimed at the improvement of examination operations to derive highly accurate results in a safe method that places little burden on patients, targeting the MLTs. The content of technical cooperation includes method of patient and sample identification from the time of sample collection, dispensation up to obtaining the test result, test data administration. While the improvement of clinical laboratory service is required at many healthcare institutions nationwide, it would be effective to establish a model system of clinical laboratory service, targeting a specific hospital.