AFRICA REGION

DATA COLLECTION SURVEY ON INFECTIOUS DISEASE CONTROL IN THE AFRICAN REGION

FINAL REPORT

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JAPAN INTERNATIONAL COOPERATION AGENCY（JICA）

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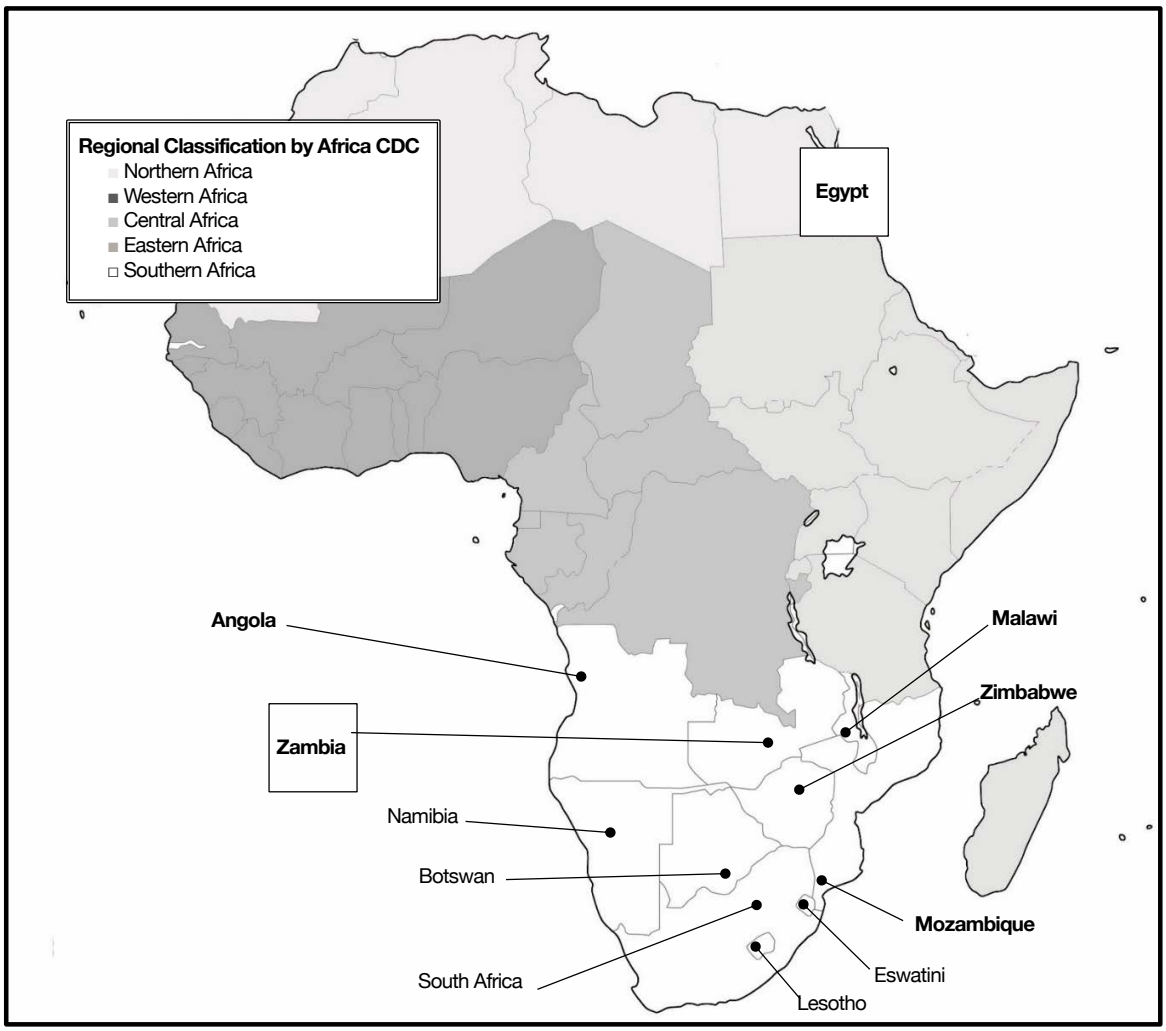

Map of surveyed countries

(**Circled text: countries of the Third Country Training Program**; fine print: literature review only)

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Abbreviation

Abbreviation	English (French)
ACEEZD	African Centre of Excellence for Emerging and Zoonotic diseases (Zambia)
Africa CDC	Africa Centres for Diseases Control and Prevention
AFR EDPLN	Emerging and Dangerous Pathogens Laboratory Network in the African Region
AMR	Antimicrobial Resistance
APHLN	African Public Health Laboratory Network
ASLM	African Society for Laboratory Medicine
AST	Antibiotic Susceptibility Test
AU	African Union
CIDCA	China International Development Cooperation Agency
COVID-19	Coronavirus Disease 2019
CRD	Center for Research and Development
CVL	Central Veterinary Laboratory
DALY	Disability Adjusted Life Years
DFID	Department for International Development (UK)
DRM	Disaster Risk Management
EDPLN	Emerging and Dangerous Pathogens Laboratory Network
FAO	Food and Agriculture Organization of the United Nations
FELTP	Field Epidemiology Laboratory Training Program
FETP	Field Epidemiology Training Program
FOM/SCU	Faculty of Medicine, the Suez Canal University
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GI	General Information
GLASS	Global Antimicrobial Resistance Surveillance System
HIV	Human Immunodeficiency Virus
IDSR	Integrated Disease Surveillance and Response
IHR	International Health Regulations
INCLEN-Africa	African Regional Network of the International Clinical Epidemiology Network
INRB	National Institute of Biomedical Research (Democratic Republic of Congo)
JIMTEF	Japan International Medical Technology Foundation
LIMS	Laboratory Information Management System
MRI	Medical Research Institute, the Alexandris University (Egypt)
NAMRU-3	U.S. Naval Medical Research Unit-3
NPHI	National Public Health Institute
NTD	Neglected Tropical Diseases
OIE	World Organisation for Animal Heath（L'Organisation Mondiale de la Santé Animale）
PHEIC	Public Health Emergency of International Concern
PHEOC	Public Health Emergency Operation Center
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PREPARE	Partnership for Building Resilience against Public Health Emergencies through Advanced Research and Education
RBF	Results-based financing
RCC	Regional Collaborating Centre
RISLNET	Regional Integrated Surveillance and Laboratory Network
RIT/JATA	Research Institute of Tuberculosis, Japan Anti-Tuberculosis Association
SADC	Southern African Development Community
SATREPS	Science and Technology Research Partnership for Sustainable Development
SLIPTA	Stepwise Laboratory Quality Improvement Process towards Accreditation
SLIMTA	Strengthening Laboratory Management Toward Accreditation
SOP	Standard Operating Procedures
SVM-UNZA	School of Veterinary Medicine, the University of Zambia
TCTP	Third Country Training Program
TICAD	Tokyo International Conference on African Development
UHC	Universal Health Coverage
USAID	U.S. Agency for International Development
U.S. CDC	U.S. Centers for Disease Control and Prevention
UTH	University Teaching Hospital,
WHE	WHO Health Emergencies Programme
WHO	World Health Organization
WHO/AFRO	World Health Organization Africa Regional Office
ZFETP	Zambia Field Epidemiology Training Program
ZNPHI	Zambia National Public Health Institute

Definition of Terms

Terms	Definition
Biosafety	Laboratory biosafety describes the containment principles, technologies and practices that are implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release.
Biosecurity	Laboratory biosecurity describes the protection, control and accountability for valuable biological materials within laboratories as well as information related to these materials and dual-use research[1], to prevent their unauthorized access, loss, theft, misuse, diversion or intentional release.
Case	A person who has the particular disease, health disorder or condition that meets the case definitions for surveillance and outbreak investigation purposes. The definition of a case for surveillance and outbreak investigation purpose is not necessarily the same as the ordinary clinical definition.
Case definition	A set of diagnostic criteria that must be fulfilled for an individual to be regarded as a case of a particular disease for surveillance and outbreak investigation purposes. Case definitions can be based on clinical criteria, laboratory criteria or a combination of the two with the elements of time, place and person.
Cluster	An aggregation of relatively uncommon events or diseases in space and/or time in amounts that are believed or perceived to be greater than that expected by chance.
Communicable disease (infectious disease)	An illness due to a specific infectious agent or its toxic products that arises through transmission of that agent or its products from an infected person, animal or reservoir to a susceptible host, either directly or indirectly through an intermediate plant or animal host, vector or the inanimate environment.
Competent authority	An authority responsible for the implementation and application of health measures under the IHR.
Designated laboratories	These are laboratories designated to perform specific laboratory services by national, WHO, or other authorities because of their proven capacities and capabilities, such as AMR testing.
Disease	An illness or medical condition, irrespective of origin or source that presents or could present significant harm to humans.
Early warning system	A specific procedure in disease surveillance to detect any abnormal occurrence, or departure from the usual or normally observed frequency of phenomena (such as one case of Ebola fever), as early as possible. An early warning system is only useful if it is linked to mechanisms for early response.
Epidemic	The occurrence in a community or region of cases of an illness, specific health-related behaviours, or other health-related events clearly over average expectancy. The community or region and the period in which the cases occur are specified precisely. The number of cases indicating an epidemic's presence varies according to the agent, size and type of population exposed, previous experience or lack of exposure to the disease, and time and place of occurrence.
Event	A manifestation of a disease or an occurrence that creates a potential for disease.
Event-based surveillance	The organized and rapid capture of information about events that are a potential risk to public health. This information can be rumours and other ad hoc reports transmitted through formal channels (i.e., established routine reporting systems) and informal channels (i.e., the media, health workers, and information from nongovernmental organizations), including events related to the occurrence of disease in humans and events related to potential human exposure.
Feedback	The normal process of sending analyses and reports about surveillance data back through all levels of the surveillance system so that all participants can be informed of trends and performance.
Field Epidemiology Training Program (FETP)	FETP Basic Level Training is for local health staff. It consists of limited classroom hours interspersed throughout as a three-to-five month on-the-job field assignment to build capacity in conducting timely outbreak detection, public health response, and public health surveillance. FETP Intermediate Level Training is for district/region/state-level epidemiologists and consists of limited classroom hours interspersed throughout as a six-to-nine month on-the-job mentored field assignment to build capacity in conducting outbreak investigations, planned epidemiologic studies, and public health surveillance analyses and evaluations. FETP Advanced Level Training is for advanced epidemiologists and consists of limited classroom hours interspersed throughout the 24 months of mentored field assignments to build capacity in outbreak investigations, planned epidemiologic studies, public health surveillance analyses and evaluations, scientific communication, and evidence-based decision making for the development of effective public health programming with a national focus. Animal health professionals can be engaged in these FETP training.
Health care worker	Any employee in a health care facility who has close contact with patients, patient-care areas or patient-care items; also referred to as “health care personnel.”
Health event	Any event relating to the health of an individual, such as the occurrence of a case of a specific disease or syndrome, the administration of a vaccine or a hospital admission.
Health measure	A procedure applied to prevent the spread of disease or contamination; does not include law enforcement or security measures
Incidence	The number of instances of illness commencing or persons falling ill, during a given period in a specified

[1] According to WHO, dual use research of concern is life sciences research that is intended for benefit, but which might easily be misapplied to do harm. The possibility that dual use research might result in misuse, either intentionally or accidentally, is a long-standing concern of science. The issues are broad and encompass not only research and public health, but also security, scientific publishing and public communications, biotechnology and ethics and wider societal issues. (WHO Dual Use Research of Concern (DURC) https://www.who.int/csr/durc/en/ (accessed on February 17, 2021)

Terms	Definition
	population.
Indicator-based surveillance	The routine reporting of disease cases, including from notifiable diseases surveillance, sentinel surveillance, and laboratory-based surveillance. This routine reporting is commonly health care facility based with reporting done on a weekly or monthly basis.
Infection	The entry and development or multiplication of an infectious agent in humans and animals body may constitute a public health risk.
International Health Regulations (2005) (IHR)	This is a legally-binding instrument of international law that has its origin in the International Sanitary Conventions of 1851. It concluded in response to increasing concern about the links between international trade and the spread of diseases (cross-border health risks).
Legislation	The range of legal, administrative or other governmental instruments available for States Parties to implement the IHR. This includes legally binding instruments, such as state constitutions, laws, acts, decrees, orders, regulations, and ordinances; legally non-binding instruments, such as guidelines, standards, operating rules, administrative procedures or rules; and other types of instruments, such as protocols, resolutions and inter-sectoral or inter-ministerial agreements. This encompasses legislation in all sectors, such as health, agriculture, transportation, environment, ports and airports, and applicable governmental levels (national, intermediate, local, and other).
Logistics	Pharmaceuticals, medical and surgical supplies, medical devices and equipment, and other products needed to support healthcare providers
Multisectoral	A holistic approach involving the efforts of multiple organizations, institutes and agencies. It encourages interdisciplinary participation, collaboration, and coordination of people of concern and resources from these key organizations to promote health security and achieve a specific goal.
Notifiable disease	By statutory/legal requirements, a disease must be reported to public health or other competent authority in the relevant jurisdiction when the diagnosis is made.
Notification	The processes by which cases or outbreaks are brought to the knowledge of the health authorities. In the context of the IHR, notification is the official communication of a disease/health event to the WHO by the health administration of the Member State affected by the disease/health event.
One Health	Defined by WHO as an approach to designing and implementing programmes, policies, legislation, and research in which multiple sectors communicate and work together to achieve better public health outcomes. In the context of the WHO IHR monitoring and evaluation framework, taking a One Health approach means including, from all relevant sectors, national information, expertise, perspectives, and experience necessary to conduct assessments, evaluations, and reporting to implement the IHR.
Outbreak	An epidemic limited to localized increase in the incidence of a disease, such as in a village, town or closed institution.
Point of entry	A passage for international entry or exit of travellers, baggage, cargo, containers, conveyances, goods and postal parcels, and the agencies and areas providing services to them upon entry or exit.
Public health emergency of international concern	An extraordinary event (as provided in the IHR) that: (i) constitutes a public health risk to other states through the international spread of disease; and (ii) potentially requires a coordinated international response.
Public health risk	The likelihood of an event that may adversely affect the health of human populations, with an emphasis on whether it may spread internationally or present a serious and direct danger.
Rapid response team	A group of trained individuals that is ready to respond quickly to an event. The concerned country determines the composition and terms of reference.
Readiness	It is the ability to quickly and appropriately respond when required to any emergencies.
Relevant sectors	Private and public sectors: such as all levels of the health care system (national, subnational, and community/primary public health); NGOs; ministries of agriculture (zoonosis, veterinary laboratory), transport (transport policy, civil aviation, ports, and maritime transport), trade and or industry (food safety and quality control), foreign trade (consumer protection, control of compulsory standard enforcement), communication, defence, treasury or finance (customs), environment, interior, health, tourism; the home office; media; and regulatory bodies.
Risk communication	Public health emergencies include the range of communication capacities required through the preparedness, response, and recovery phases of a serious public health event to encourage informed decision making, positive behaviour change, and the maintenance of trust.
Surveillance	The systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response, as necessary.
Syndrome	A symptom complex in which the symptoms and or signs coexist more frequently than would be expected by chance independently.
Vector	An insect or other animal that typically transports an infectious agent that constitutes a public health risk.
Zoonotic diseases (or zoonoses)	Any infection or infectious disease that is naturally transmissible from vertebrate animals to humans.
Zoonotic event	A manifestation of a disease in animals that creates a potential for a disease in humans as a result of human exposure to the animal source.

(Source) WHO (2019) WHO Benchmarks for International Health Regulations (IHR) Capacities

CHAPTER 1.
BACKGROUND, PURPOSE, AND METHODOLOGY OF THE SURVEY

1-1. Background of the survey

Many people worldwide are dying from infectious diseases, and epidemics of emerging and re-emerging infectious diseases pose a threat to human security. Particularly in recent years, with the Ebola virus epidemic in 2014-2016 and the global spread of coronavirus disease 2019 (hereinafter referred to as "COVID-19") since the end of 2019, these sudden infectious disease outbreaks, many of which are zoonotic, are widely recognized as threats not only to health care but also as having a significant impact on the economy and society. There is an increasing need to strengthen preparedness for and response to public health crises on the African continent and worldwide.

To respond to these health crises, the international community aims to comply with the International Health Regulations (hereinafter referred to as "IHR"). The Japanese government is also promoting global efforts to respond to health crises. In February 2016, the Japanese government decided on "the Basic Policy on Strengthening Countermeasures for Infectious Diseases that Pose a Threat to Global Society." It announced its intention to promote integrated international and domestic efforts and strengthen cooperation for countries and regions at risk of infectious disease outbreaks.

In response to these trends, JICA has launched the "Partnership for Building Resilience against Public Health Emergencies through Advanced Research and Education" (hereinafter referred to as "PREPARE"), which aims to (1) strengthen the functions of national core laboratories for infectious disease control, (2) develop human resources for infectious disease control, and (3) contribute to a regional and global partnership. The Africa Centres for Diseases Control and Prevention (hereinafter referred to as "Africa CDC") also established regional bases in Africa to promote infectious disease control. JICA has signed a Letter of Intent to cooperate with L'Organisation Mondiale de la Santé Animale (French), World Organisation for Animal Health (English) (hereinafter referred to as "OIE"), which specializes in zoonotic disease control and antimicrobial resistance (hereinafter referred to as "AMR"), which account for most infectious diseases and have a large economic impact not only on humans but also on livestock.

As for the development of human resources for infectious disease control in PREPARE, Noguchi Memorial Institute for Medical Research of Ghana and Kenya Medical Research Institute, which both have a long track record of cooperation in Africa, conduct the Third Country Training Program (hereinafter referred to as "TCTP"). In addition, Egypt conducts the TCTP for infectious disease clinical laboratory personnel and public health officers from neighboring countries as a base for technical cooperation with neighboring countries. Also, during this survey, Zambia, which Japan has been cooperating with for a long time, considers implementing a similar training program.

In developing the PREPARE and improving existing TCTP courses, and formulating a new TCTP course, this survey was conducted to analyze the current situation, issues, and cooperation needs.

1-2. Purpose of the survey

The purpose of this survey is to confirm, analyze, and summarize the current status and issues, cooperation needs, and trends in cooperation by the development partners concerning infectious disease control, including zoonoses, mainly in the national core laboratories for infectious disease control in the African region (mainly in Southern Africa). In addition, based on the results of the analysis, recommendations for the TCTP that are currently being implemented, or are planned to be implemented in this area, will also be discussed and

summarized.

1-3. Methodology of the survey

This survey consists of two parts: a scoping review, mainly based on a literature review, and online interviews and questionnaire survey

1-3-1. Scoping review

In the scoping review, the survey team conducted a literature review of existing related materials on infectious disease control and health crisis responses in the African region (mainly in Southern Africa) and the countries targeted in this survey, as well as on JICA's TCTP, to identify the current situation and issues, cooperation needs, and trends in cooperation by development partners. Simultaneously, the survey team organized the materials, information, and data necessary for the following " online interviews and questionnaire survey."

In the scoping review, the target countries for the literature review on infectious disease control and health crisis response are ten countries in the Southern African region as defined by the Africa CDC: Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. As for the JICA TCTP, the survey team focused on Egypt and Zambia.

1-3-2. Online interviews and questionnaire survey

Based on the results of the scoping review, the survey team conducted online interviews with stakeholders (e.g., Ministry of Health, Ministry of Agriculture, laboratories, and development partners) to collect additional information and data on the current situation and issues related to infectious disease control and health crisis response. Field survey coordinators also conducted visits to the national core laboratories in each country. The survey team selected Angola, Malawi, Mozambique, and Zimbabwe as the countries surveyed based on the scoping review results.

The survey team conducted online interviews with training institutions in Egypt and Zambia and their prospective cooperating training institutions. The questionnaire survey was also conducted on the TCTP ex-participants and lecturers in Egypt. The survey team collected additional information and data through online interviews with eight ex-participants of the TCTP in Egypt who responded to the questionnaire.

1-3-3. Analysis

The survey team analyzed the information and data collected from the scoping review, the online interviews, and questionnaire survey to identify issues and cooperation needs. Based on this analysis, the survey team proposed recommendations for the TCTP's content.

1-3-4. Schedule and interviewees

The survey schedule and a list of online interviewee names are attached in Appendix 1 and 2.

1-4. Limitation of the survey

The survey team experienced the following limitations in its implementation:

1) The relevant organizations in each country, covered by the online interviews and questionnaire survey, are also critical organizations actively working in infectious disease control and health crisis response. Due to the spread of COVID-19, it wasn't easy to coordinate survey times. As a result, the survey time was limited, affecting the amount of information and data collected.
2) The underdevelopment of internet infrastructure in certain areas decreased the quality of communication conditions for online interviews, which also reduced the amount of information and data collected.
3) Because some of the JICA offices in the four target countries of the online interviews and questionnaire survey did not have any relationships with organizations working in infectious disease control and health crisis response, it took time to collect contact information. As a result, the survey time was limited, affecting the amount of information and data collected.

CHAPTER 2.
GLOBAL TRENDS & SITUATION OF HEALTH CRISIS RESPONSES IN AFRICA

2-1. Overview and issues of infectious diseases in the world and Africa

2-1-1. Overview of infectious diseases in the world and Africa

Today, infectious disease deaths worldwide account for about a quarter of all deaths, and it is estimated that about 10 million people die each year from infectious diseases. It is also estimated that in the Disability Adjusted Life Years (hereinafter referred to as "DALY"), about a quarter of the DALYs lost in the world are due to infectious diseases. As shown in Fig. 2-1 and Fig. 2-2, the number of deaths due to infectious diseases and DALYs decreases, but they still account for a large proportion. In the African region, the same is true, but the difference from the global situation is that more than half of the deaths and DALYs are due to infectious diseases, which are considered to have a significant impact on health systems and socio-economics.[1,2]

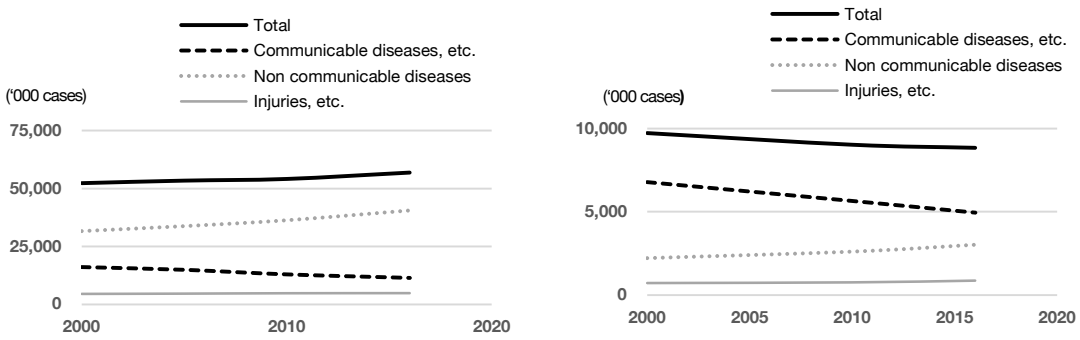

Fig. 2-1. Number of deaths worldwide (left) and Africa (right)
(Source) WHO Disease burden and mortality estimates- Cause-specific mortality 2000-2016

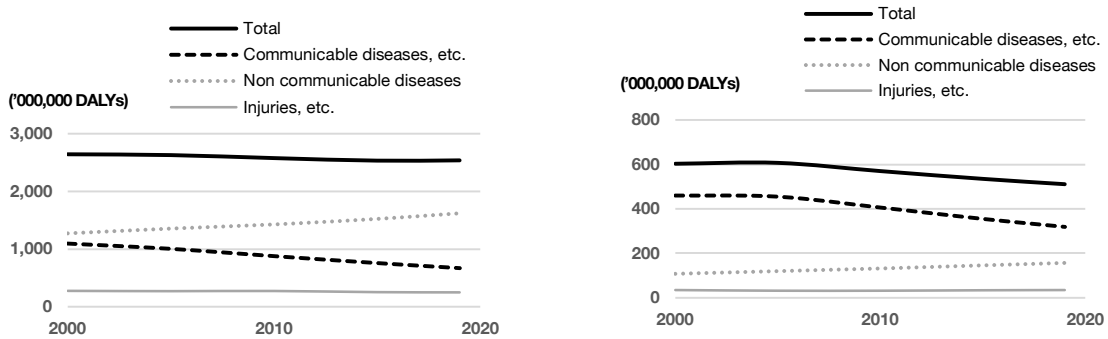

Fig. 2-2. Changes over the years of DALYs worldwide (left) and Sub-Saharan Africa (right)
(Source) IHME GBD Results Tool http://ghdx.healthdata.org/gbd-results-tool

Therefore, it can be said that the world and the African region are currently not in a state where infectious diseases are sufficiently controlled. In 1967, the U.S. Public Health Commissioner said, "It's time to close the book on infectious diseases."[3] It was also said that the 21st century was the golden age of global health,[4] when efforts for HIV/AIDS, tuberculosis, and malaria made dramatic progress. However, as demonstrated by the outbreak of Ebola virus disease in the West African region in 2014 and the spread

[1] Dye C. After 2015: infectious diseases in a new era of health and development. Philos Trans R Soc Lond B Biol Sci. 2014 May 12;369(1645):20130426.
[2] Fenollar F, Mediannikov O. (2018) Emerging infectious diseases in Africa in the 21st century. New Microbes New Infect. Sep 21;26:S10-S18.
[3] Spellberg, B., & Taylor-Blake, B. (2013). On the exoneration of Dr. William H. Stewart: debunking an urban legend. Infectious diseases of poverty, 2(1), 3.
[4] Chiori Kodama, Hiroki Nakatani (2017) WHO's new approach toward strengthening global management of emergencies. Modern Media Vol. 63, No. 11 (in Japanese)

of COVID-19 that has occurred worldwide since the end of 2019, the spread of infectious diseases remains a threat in Africa and around the world. Especially in the African region, outbreaks of various infectious diseases are reported every year, as shown in Table 2-1.

About 75% of these human infectious diseases are of animal origin. It is believed that infectious diseases of animal origin are becoming a problem for human society against the background of today's changing social environment and diversification of human behavior.[5] There are more than 200 zoonotic diseases confirmed by the World Health Organization (hereinafter referred to as "WHO") alone. Many of them are highly contagious and tend to cause serious illnesses, some of which are so specific that no treatment is available, and some for which practical uses of a vaccine has not been developed.[6] There are also bacteria such as anthrax, plague bacillus, rabbit disease bacillus, and viruses that cause viral hemorrhagic fevers, which could be used for biological terrorism.[7] Under these circumstances, there is a need to strengthen initiative for zoonotic disease.[8]

One of such efforts is the One Health approach, which calls for collaboration between the human disease sector, the animal disease sector, and the environmental sector that links these two sectors. The question is, how do different sectors work together? Many challenges remain in this regard.[9,10]

Table 2-1. Outbreaks of major viral diseases that have occurred in Africa since 2015

Viral Diseases	Outbreak Country	Viral Diseases	Outbreak Country
Measles	2019: Madagascar, Tunisia 2020: Central Africa, Burundi	Marburg fever	2017: Uganda, Kenya
Yellow fever	2016: Angola, DR Congo, Uganda, Kenya 2017: Nigeria 2018: Congo 2019: Nigeria, Mali 2020: Uganda, South Sudan, Ethiopia, Togo	Lassa Fever	2016: Benin, Nigeria, Liberia 2017: Benin, Togo, Burkina Faso, Nigeria 2018: Liberia, Nigeria 2019: Nigeria 2020: Nigeria
Monkey Pox	2016: Central Africa, 2017: Nigeria 2018: Cameroon, Nigeria 2020: DR Congo	Rift valley fever	2016: Niger 2018: Gambia, Kenya 2019: Sudan
Ebola hemorrhagic fever	2017: DR Congo 2018: DR Congo 2019: DR Congo, Uganda 2020: DR Congo	Dengue fever	2015: Egypt 2016: Burkina Faso 2017: Côte d'Ivoire, Burkina Faso 2019: Sudan
Chikungunya fever	2019: Congo 2020: Chad	Hepatitis E	2017: Chad, Niger, Nigeria 2018: Namibia

(Source) WHO Disease outbreaks by year https://www.who.int/csr/don/archive/year/en/ (Accessed on December 25, 2020)

2-2. Global trends in health crisis responses

2-2-1. WHO

In 2016, WHO launched a new Health Crisis Response Program called WHO Health Emergencies Program (hereinafter referred to as "WHE") to swiftly respond to outbreaks of infectious diseases, natural disasters, and humanitarian crises around the world, and has begun to build comprehensive and effective support.[11] This program came about after seeing how the WHO's declaration of a Public Health

[5] Ministry of Health, Labour and Welfare, Japan. (2020) Handbook of zoonoses 2020
[6] See Footnote 5: Ministry of Health, Labour and Welfare, Japan. (2020)
[7] See Footnote 5: Ministry of Health, Labour and Welfare, Japan. (2020)
[8] Africa CDC (2019) Meeting report - 1st International One Health Forum
[9] See Footnote 8: Africa CDC (2019)
[10] Hitziger M, Esposito R, Canali M, Aragrande M, Häsler B, Rüegg SR. (2018) Knowledge integration in One Health policy formulation, implementation and evaluation. Bull World Health Organ. 96(3):211-218.
[11] WHO (2016) News Release World Health Assembly agrees new Health Emergencies Programme
https://www.who.int/news/item/25-05-2016-world-health-assembly-agrees-new-health-emergencies-programme (Accessed on December 25, 2020)

Emergency of International Concern (hereinafter referred to as "PHEIC")[12] was not sufficient in preventing the outbreak of Ebola virus diseases that occurred in the West African region in 2014 and spread to nine Western countries. There has been an increase in momentum for building a system to continually manage global health crisis from reflections of this event.[13]

Traditionally, WHO's primary role has been to present the norms and standards, such as guidelines for the country concerned, and provide technical assistance and small-scale material support. However, in WHE, on-site operation functions are strengthened, and WHO is also becoming more directly involved in the operation of the "humanitarian crisis responses" that have been carried out by international humanitarian organizations and NGOs in the concept of "health crisis responses."[14] To strengthen its operational functions, the WHO Headquarters, regional offices, and offices in each country have come together to create an organizational structure and Standard Operating Procedures that enable smooth collaboration with other international organizations.[15]

The importance of complying with the contents of IHR (2005)[16] was confirmed in the planning and preparation of WHE, and the policy of strengthening the compliance to IHR was also confirmed.[17] Behind this was the awareness of the problem from the response mentioned earlier to Ebola virus diseases and the low achievement of strengthening Member States' IHR core capacity in those days. The initial deadline for achieving IHR core capacity was June 2012, but at that time, only 42 out of 193 countries said they did not need to extend the deadline. More than half, 118 countries, have applied for an extension of the deadline, and two years later, 81 countries have applied for an additional two-year extension, and 48 have shown no interest in WHO.[18]

Under these circumstances, WHO first established the Country Preparedness and International Health Regulations Programme within WHE and established a system to promote and support Member States in strengthening their core capacity (health system) to respond to health crises.[19] Concerning the evaluation of IHR core capacities, which had been monitored through self-assessment before the WHE, the WHO decided to form a "Framework of Monitoring and Evaluation" called the Joint External Evaluation, which would incorporate external parties' perspectives. WHO has begun to develop a transparent and collaborative process to analyze core capacities more objectively.[20] More recently, in 2019, "the WHO Benchmarks for IHR Core Capacities" was released, providing tools for Member States and development partners to work more strategically to strengthen core capacities, as defined in the Framework of Monitoring and Evaluation.

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[12] Disease outbreaks that require an international response. In the past, PHEIC referred to the epidemic of yellow fever, cholera, and plague, but the International Health Regulations were revised in 2005 from the perspective of responding to emerging infectious diseases, re-emerging infectious diseases, and bioterrorism, and preventing concealment of infectious disease detection. Every event has been a possible threat to international public health, regardless of the cause.

[13] Chiori Kodama, Hiroki Nakatani (2017) WHO's new approach toward strengthening global management of emergencies. Modern Media Vol. 63, No. 11

[14] See Footnote 13: Kodama, Chiori and Nakatani, Hiroki (2017).

[15] See Footnote 13: Kodama, Chiori and Nakatani, Hiroki (2017).

[16] The IHR is a legally binding document under international law, originating from the 1851 International Health Convention, in response to growing concerns about the link between international trade and the spread of disease. The purpose of IHR is to prevent the international spread of disease, to prevent and control it, and to implement public health measures, which are related to and limited to public health risks, as well as international movement and unnecessary trade. It stipulates that necessary interference should be avoided. To conform to IHR, WHO Member States are required to conduct surveillance and respond to emergencies and have the minimum capacity (core capacity) to be prepared for daily hygiene management and response in the event of an emergency. At the border between air, sea and land, in order to detect, evaluate, notify, and report on the occurrence of public health emergencies.

[17] See Footnote 13: Kodama, Chiori and Nakatani, Hiroki (2017).

[18] Tomoya Saito (2017) Development of core capacities for health security under IHR (2005): New monitoring and evaluation framework. J. Natl. Inst. Public Health Vol. 66 No.4 p.387-394 (in Japanese)

[19] See Footnote 13: Kodama, Chiori and Nakatani, Hiroki (2017).

[20] See Footnote 18: Tomoya Saito (2017)

Table 2-2. 18 technical areas listed in the WHO Benchmarks for IHR Core Capacity (2019)

No	Technical areas	No	Technical areas
1.	National legislation, policy, and financing	10	Human resources
2	IHR coordination, communication, advocacy, and reporting	11	Emergency preparedness
3	Antimicrobial resistance	12	Emergency response operations
4	Zoonotic disease	13	Linking public health and security authorities
5	Food safety	14	Medical countermeasures and personnel deployment
6	Immunization	15	Risk communication
7	National laboratory system	16	Points of entry
8	Biosafety and biosecurity	17	Chemical events
9	Surveillance	18	Radiation emergencies

(Source) WHO (2019) WHO Benchmarks for International Health Regulations (IHR) Capacities

In this way, WHO has been working to strengthen Member States' and international efforts for infectious disease control and health crisis response capacity, focusing on strengthening the IHR core capacity. In response to the spread of COVID-19 from the end of 2019, WHO established a committee to review the IHR in September 2020.[21] This is an attempt to evaluate the function of the IHR in preventing the spread of COVID-19 and make necessary revisions. As of November 2020, WHO announced the following preliminary findings obtained through the committee[22]:

- Both strong public health and health care systems are needed for effective pandemic response.
- Preparedness capacities need to be further examined considering the observed performance in the response of many States Parties; this includes tools as well as approaches and mechanisms for assessing and reporting.
- Multisectoral coordination and capacity to enable rapid response to all dangerous pathogens/diseases is needed for successful pandemic preparedness.
- Appropriate authority of National IHR Focal Points is critical to ensure rapid communication and coordination.
- Adequate national legislation needs to ensure sufficient support for health and non-health measures to detect, prevent and respond in line with the IHR.
- A universal peer-review mechanism, such as that used in human rights, may be useful for IHR core capacities assessment, monitoring, and reporting.
- Generic national response plans covering more respiratory illnesses than influenza can strengthen pandemic preparedness.
- Official information as well information obtained through other channels, such as media and social media, is useful surveillance information. Digital technology can be useful to enhance efficiency, standardization, and traceability of information collection and transparency.
- WHO-provided Rapid Risk Assessments are of utmost importance for informing response decisions.
- The meaning and consequences of Public Health Emergencies of International Concern have to be fully understood by the Member States and the international community, as well as supranational institutions. The relevance of an intermediate level of alert to prevent a PHEIC from occurring, and options for its implementation, need to also be clearly examined.
- The role of WHO in relation to travel recommendations, as well as incentives for States Parties to

[21] WHO (2009) First meeting of the review committee on the functioning of the International Health Regulations (2005) during the COVID-19 response https://www.who.int/publications/m/item/first-meeting-of-the-review-committee-on-the-functioning-of-the-international-health-regulations-(2005)-during-the-covid-19-response. (Accessed on January 25, 2021)

[22] WHO (2020) Report of the Third Meeting of the Review Committee of the Functioning of the International Health Regulations (2005) during the COVID-19 Response

comply with their obligations related to travel measures, need to be further examined.

- Facilitating the development and implementation of strategies to ensure the rapid international sharing of essential specimens and information is key to efficient pandemic control.

2-2-2. International frameworks and initiatives in the African region

The following are some of the major international frameworks and initiatives related to health crisis response in the African region:

(1) Integrated Disease Surveillance and Response

Integrated Disease Surveillance and Response (hereinafter referred to as "IDSR") is a strategy for developing and implementing a comprehensive mechanism for disease surveillance and response that has been introduced and strengthened in each country in the African region over the past 20 years. This strategy was initially referred to as "Integrated Disease Surveillance in Africa: A Regional Strategy" (1999–2003) by the World Health Organization Africa Regional Office (hereinafter referred to as "WHO/AFRO"), and was first formulated in 1998 to strengthen surveillance and response capabilities with various development partners[23,24] against the background of large-scale outbreaks such as meningitis, cholera, yellow fever, and measles. Later, as the linkage between surveillance and response became more important, the name was changed to "Integrated Disease Surveillance and Response" in 2000.[25] Then, the first edition of the IDSR Technical Guidelines was published in 2002,[26] Many WHO Member States have adopted this and would strengthen IDSR for early detection, confirmation, and response to public health crises.

Subsequently, in 2010, the IDSR Technical Guidelines were revised, and a second edition was published. This was due to changes in the international environment, including the entry into force of the IHR (2005), the increase in emerging and re-emerging infectious diseases, the increase in non-communicable diseases, and the formation of the Disaster Risk Management (hereinafter referred to as "DRM") strategy.[27] There were also growing calls for greater community-based surveillance and broader health system strengthening for early detection and response.[28]

However, even after the publication of the second edition of the IDSR Technical Guidelines, the African region still faced many challenges in surveillance and response. For example, although IDSR was introduced in each country, it had not always been fully implemented in all countries.[29] As of the end of 2017, 44 of 47 countries had implemented IDSR, 85% of which had IDSR introductory training at the provincial level, 68% had community-based surveillance, and 35 countries conducted event-based surveillance.[30] However, only 12% of countries had an IDSR implementation rate of over 90% at the county/municipal level.[31] The following was reported as factors that hindered the spread of IDSR: lack of

[23] Fall IS, Rajatonirina S, Yahaya AA, Zabulon Y, Nsubuga P, Nanyunja M, Wamala J, Njuguna C, Lukoya CO, Alemu W, Kasolo FC, Talisuna AO. Integrated Disease Surveillance and Response (IDSR) strategy: current status, challenges and perspectives for the future in Africa. BMJ Glob Health. 2019 Jul 3;4(4):e001427.
[24] AFRO/WHO (2019)Technical guidelines for integrated disease surveillance and response in the who African region third edition
[25] See Footnote 23: Fall IS et al. (2019).
[26] See Footnote 24: WHO/AFRO (2019)
[27] See Footnote 24: WHO/AFRO (2019)
[28] See Footnote 24: WHO/AFRO (2019)
[29] See Footnote 23: Fall IS et al. (2019).
[30] See Footnote 23: Fall IS et al. (2019).
[31] See Footnote 23: Fall IS et al. (2019).

sustainable domestic resources, lack of training at the municipal level, repeated reassignment of human resources, lack of sharing of surveillance data and information, lack of supervision, insufficient laboratory capacity, etc.[32,33,34]

In light of this situation, WHO/AFRO also announced the third edition of the IDSR Technical Guidelines in 2019. Based on the 2nd edition, the 3rd edition aims to materialize the method of scaling up the IDSR and emphasize supervision.

(2) IDSR and IHR

The IHR is currently an important guideline for countries in the African region. In the African region, WHO Member States have declared that they should adhere to the IHR through the IDSR strategy described above.[35] The African countries have indicated that IDSR and the IHR have a complementary relationship centered on "detection," as shown in Fig. 2-3 below.[36] In other words, IHR does not present surveillance or a response different from IDSR, but requires each country to build a mechanism with high sensitivity, reliability, and flexibility in line with international standards. On the other hand, IDSR is the required mechanism itself and is positioned to provide the state's information to meet the requirements of IHR.[37]

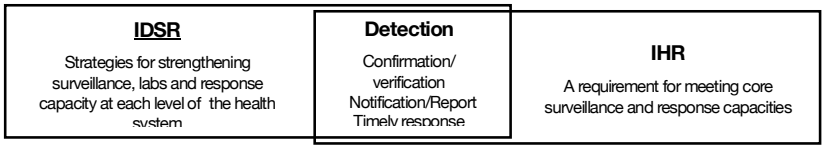

Fig. 2-3. Implementation of IHR through IDSR Strategy
(Source) WHO/AFRO (2019) Technical guidelines for integrated disease surveillance and response in the who African region third edition

(3) Regional Strategy for Integrated Disease Surveillance and Response: 2020-2030

The document that defines the strategy for strengthening IDSR by WHO/AFRO is "Regional Strategy for Integrated Disease Surveillance and Response (2020-2030)". It is designed to carry on the outcomes of the Regional Strategy for Health Security and Emergencies 2016-2020 and to respond to the latest evidence and technological innovation. It is also positioned as a strategy that emphasizes the linkage of the various elements involved in IDSR as an integrated part of health system strengthening to achieve universal health coverage.[38] Specifically, the strategy has the following four objectives.

- To strengthen national capacity for early detection, complete recording, timely reporting, regular analysis, and prompt feedback of IDSR priority diseases, events, and conditions at all levels.
- To strengthen national and supranational laboratory capacity to confirm IDSR priority diseases, events, and conditions.
- To strengthen capacity for public health emergency preparedness and response at all levels.
- To strengthen integrated supervision, monitoring, and evaluation system.

[32] See Footnote 23:.Fall IS et al. (2019).
[33] Mandyata CB, Olowski LK, Mutale W. (2017) Challenges of implementing the integrated disease surveillance and response strategy in Zambia: a health worker perspective. BMC Public Health. Sep 26;17(1):746.
[34] Nsubuga P, Brown WG, Groseclose SL, Ahadzie L, Talisuna AO, Mmbuji P, Tshimanga M, Midzi S, Wurapa F, Bazeyo W, Amri M, Trostle M, White M.(2010) Implementing Integrated Disease Surveillance and Response: Four African countries' experience, 1998-2005. Glob Public Health. 5(4):364-80.
[35] World Health Organization Regional Committee for Africa. (2006) International Health Regulations (2005): Informational Document (AFR/RC56/INF.DOC/2).
[36] See Footnote 24: WHO/AFRO (2019)
[37] See Footnote 24: WHO/AFRO (2019)
[38] WHO/AFRO (2019) Report of the Secretariat, Regional Strategy for Integrated Disease Surveillance and Response: 2020-2030

As mentioned earlier, the IDSR is also correlated with the IHR. For example, the numerical target for strengthening laboratories in the strategy discussed above is to reach Level 4 IHR core capacity in all Member States by 2030.

(4) IDSR and One Health approach

The One Health approach, in which there is a collaboration among people involved in topics around humans, animals, and the environment, is emphasized within the IDSR and IHR. For example, the Regional Strategy for IDSR 2020-2030 states that the One Health approach supports IDSR. A multisectoral coordination strategy based on the One Health approach is essential for expanding and optimizing IDSR as its guiding principles.

In conjunction with this regional strategy, the Africa CDC held the first One Health Forum in South Africa in 2019 to draw out governments and international organizations' commitment to the One Health approach.[39] In October 2020, the Africa CDC released the One Health Framework, which details the activities and specific goals undertaken by countries in the African region.[40]

(5) IDSR and Disaster risk management

In 2012, the 62nd session of the Regional Commission for Africa of the WHO/AFRO approved the "Disaster Risk Management: A Strategy for the Health Sector in the African Region"[41] and adopted a comprehensive approach to address disaster risk management. A disaster is defined as a "serious disruption of the functioning of a community or a society, causing widespread human, material, economic or environmental losses exceeding the ability of the affected community or society to cope using its own resources." Disaster risk management was defined as "a systematic process for reducing the adverse effects of hazards and the likelihood of disasters by using administrative and organizational directives, operational skills, and capabilities to implement strategies, policies, and enhance coping capacities."[42]

The ultimate goal of disaster risk management is to reduce risk by reducing vulnerabilities and increasing the ability to mitigate hazards. IDSR is regarded as an essential tool in disaster risk management because it provides early warning information critical for risk assessment and, ultimately, risk mitigation.[43] IDSR assists in hazard identification, assessment, risk communication, disaster risk monitoring, and strengthening the early warning component.

(6) WHO: Stepwise Laboratory Quality Improvement Process towards Accreditation in Africa

There is a Stepwise Laboratory Quality Improvement Process towards (International) Accreditation (hereinafter referred to as "SLIPTA") that serves as a WHO-led laboratory guideline. This initiative has been developed in response to the need to provide comprehensive support to laboratories for major disease control and to formulate a national laboratory policy and strengthening plan. These needs were clarified by the 2008 WHO/AFRO resolution AFR/RC58 R2 on Strengthening Public Health

[39] Africa CDC (2020) Meting Report 1st International One Health Forum. 14-15 November 2019. Addis Ababa, Ethiopia
[40] Africa CDC (2020) Framework for One Health Practice in National Public Health Institutes – Zoonotic Disease Prevention and Control
[41] WHO/AFRO (2012) Disaster Risk Management: A Strategy for the Health Sector in the African Region
[42] See Footnote 24: WHO/AFRO (2019)
[43] See Footnote 24: WHO/AFRO (2019)

Laboratories and the Maputo Declaration on Strengthening of Laboratory Systems in the same year.[44]

SLIPTA aims to meet the requirements for obtaining ISO15189 (International Standard for Clinical Laboratory Quality) so that laboratories in each country can make safe, rapid, and accurate diagnoses. The guide released in 2015 shows the procedures for strengthening laboratory quality and improving the organization to be taken for that purpose. For example, the SLIPTA guidelines use checklists in 12 sections: Documents and Records Management, Organization and Leadership, Personnel Management, Customer Focus, Equipment Management, Assessments, Supplier and Inventory Management, Process Management, Information Management, Nonconforming Event Management, Continual Improvement, Facilities, and Safety Management 334 items in 12 sections are evaluated, and the target laboratories are scored. The highest score is 258 points, and stars are given according to the score. This assessment is conducted by an independent evaluating group who established a Memorandum of Understandings with WHO/AFRO.

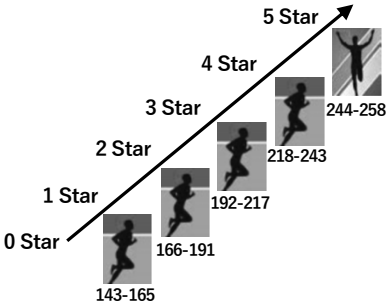

Fig. 2-4. SLIPTA tiers of recognition of laboratory quality management
(Source) AFRO/WHO (2019) Technical guidelines for integrated disease surveillance and response in the who African region third edition

2-3. Activities of other aid agencies in response to health crises across Africa

2-3-1. WHO/AFRO

The activities of the WHO/AFRO are diverse. Still, concerning the health crisis response, the aim is to work with Member States to formulate regional policies and frameworks related to IDSR, as described above, and support governments' practices. Specifically, the Regional Strategy for IDSR: 2020-2030 states that WHO/AFRO plays the following roles as the secretariat.[45]

- Disseminate the IDSR technical guidelines (third edition) to support the implementation of this strategy.
- Support countries to develop plans that are regularly monitored and evaluated.
- Ensure that the regional IDSR taskforce is operational and serves as a platform for coordinated action, mobilizing resources, and forging consensus among partners.
- Facilitate synergy and complementarity in the partnerships for IDSR implementation.
- Establish a regional team of experts to build country capacity.

Also, the IDSR technical guidelines (third edition) cite the following as technical assistance related to surveillance and response at every level of the health system in each country, including:[46,47]

- The development of comprehensive technical guidelines for each level
- A protocol for adapting the guidelines to every level within each country
- Training of human resources involved in surveillance and response system
- Advocacy for resources and resource mobilization

[44] WHO (2015) WHO Guide for the Stepwise Laboratory Improvement Process Towards Accreditation in the African Region (SLIPTA)
[45] See Footnote 38: WHO/AFRO (2019)
[46] See Footnote 24: WHO/AFRO (2019)
[47] See Footnote 24: WHO/AFRO (2019)

- Coordinating the monitoring, detection, and control of diseases, conditions, and events
- epidemics and public health emergencies across countries
- Sharing public health information and promoting documentation of best practices

2-3-2. OIE

The OIE, based in the Regional Office for Africa (Mali) and through the Sub-Regional Office for Southern Africa (Botswana), the Sub-Regional Office for Eastern Africa (Kenya), and the Sub-Regional Office for Northern Africa (Tunisia), promotes regional cooperation and national measures based on the OIE Code, the international standards for animal health and zoonoses in Member States. The focus areas relevant to this survey include AMR, rabies control, and veterinary education. The Southern Africa region also aims to provide policy advice and training on laboratories, etc., to support new OIE reference centers (e.g., reference laboratories and collaborative research centers). The OIE is also working to establish a network among regional scientists in veterinary medicine laboratories.[48]

2-3-3. Africa CDC

Established at the AU Summit in January 2016, it is a special organization of the African Union that started its activities in 2017 with funding from the World Bank, the United States, Japan, China, and AU. The Africa CDC, as shown in Fig. 2-5, divides African countries into five, and Regional Collaborating Centres have been set up in Egypt, Gabon, Kenya, Nigeria, and Zambia as their bases to strengthen and coordinate the health crisis response of each region and country.

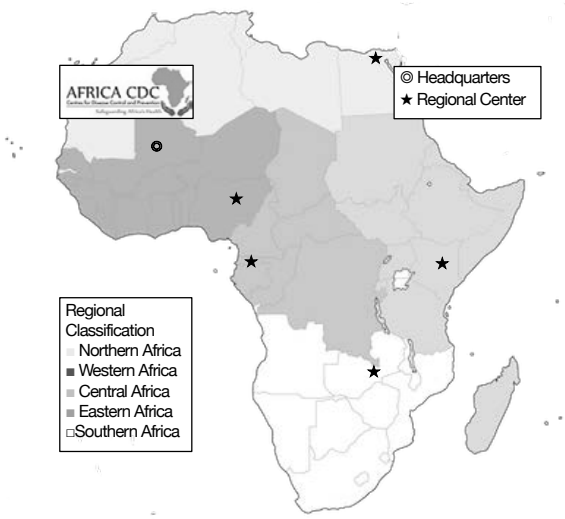

Fig. 2-5. Regional classification of Africa CDC

Table 2-3 shows the main areas of work of the Africa CDC. Support for the formulation of policy frameworks, support for the establishment of major institutions such as the National Institute of Health, support for human resource development involved in laboratories and surveillance and strengthening cooperation between countries is being carried out across the board.

[48] OIE website https://rr-africa.oie.int/en/the-oie-sub-regional-representations-for-southern-africa/activities/（Accessed on January 25, 2021）

Table 2-3. Africa CDC Initiatives

Strategic Pillar	Goal	Strategic Objectives
Emergency preparedness and response	Ensure effective public health emergency preparedness and response	1) Support the development and testing of multi-hazard and multisectoral preparedness and response plans for public health emergencies. 2) Support the development of surge capacity at national, regional, and continental levels that integrate capabilities of NPHIs and RCCs. 3) Support the establishment of functional national public health emergency operation centers (PHEOC) as part of the National Public Health Institutes. 4) Establish and manage national and regional stockpiles for public health emergency response. 5) Facilitate and promote sustained partnerships for multisectoral coordination and collaboration.
Laboratory Systems and Networks	Strengthen Africa's clinical and public health laboratory systems and networks by continually improving workforce competency to assure quality and safety	1) Support for building and strengthening national laboratory systems and networks. 2) Support for countries to develop comprehensive national laboratory strategic and implementation plan. 3) Support for the introduction of modern advanced molecular technologies and multiplex pathogen assays. 4) Supporting the introduction of a patient-centered approach for integrated point-of-care diagnostic testing. 5) Development and management of strain banks as repositories for diagnostics and vaccine development. 6) Laboratory workforce development and support (including a field laboratory training/program).
National Public Health Institutes and Research	Strengthen public health science and improve public health decision-making and practice to achieve positive health outcomes	1) Establish Africa CDC public health research agenda 2) Strengthen public health research capacity within public institutions in partnerships with academic institutions in the Member States. 3) Promote collaboration and coordination to research issues of public health research agenda. 4) Recharacterize the known burden of "disease" and other health concerns from a continental and/or regional perspective. 5) Assess effectiveness of existing public health interventions that have been prioritized by the health policy instruments of the African Union. 6) Support research on surveillance methodologies: quality interventions and innovative technologies. 7) Apply multisectoral/cross-cutting One Health strategies to public health research agenda.
Public health information system	Develop and strengthen information systems that support public health strategies in Africa	1) Design and implement a continental data-sharing platform for the Member States. 2) Develop and promote network domains and adoption of informatics guidelines and standards 3) Support training on informatics 4) 4) Establish data observatories at Africa CDC Regional Collaborating Centers through training and collaboration.
Surveillance and Disease Intelligence	Strengthen health-related surveillance systems for improved public health decision making and action	1) Establish event-based surveillance 2) Support establishment and strengthening of National Public Health Institutes to coordinate surveillance systems 3) Strengthen implementation of the existing surveillance systems and ensure linkages with animal, agriculture, and environmental sectors 4) Support countries to strengthen disease-specific surveillance systems for priority diseases appropriate for the African context. 5) Facilitate and strengthen Regional Collaborating Centers in promoting inter-country and regional collaboration on surveillance, shared data use 6) Support enhanced FETP training 7) Assist in developing a surveillance workforce and continued development of tools that support the strengthening of the workforce

CHAPTER 3.
HEALTH CRISIS RESPONSE SYSTEM & NATIONAL CORE LABORATORIES IN SOUTHERN AFRICAN COUNTRIES

3-1. Health status in Southern African countries

This chapter discusses the systems for responding to health crises caused by infectious diseases and the national core laboratories. However, the following section provides an overview of the needs for strengthening infectious disease control and health crisis response in terms of population, health indicators, and infectious disease outbreak trends.

3-1-1. Population

The African region population is currently estimated at 1.3 billion and on the rise. By 2050, it is expected to be doubled.[1] The same is true for each country in Southern Africa, which is steadily increasing, as shown in Table 3-1 below. Simultaneously, the total fertility rate and crude mortality rate have decreased, and the population aged 24 and over and the average life expectancy at the age of 65 have increased. It is predicted that the demographic structure will change from the prolific type, and the population will age.[2,3]

Table 3-1. Population and other indicators of each country in the Southern African region

Country	Year	Total Pop. (million)	Population ratio (%)				Potential support ratio (persons)	Pop. Growth rate(%)	Gross fertility rate (per 1,000 pop.)	Total fertility rate	Crude mortality rate (per 1,000 pop.)	Life expectancy (years)	
			Under 15	15-24	24-64	Over 65						At birth	At the age of 65
Angola	2019	**31.8**	46.6	19.4	**31.8**	2.2	**14.4**	3.2	40.2	5.44	8.0	**61.2**	**12.3**
	2010	23.4	47.0	**19.7**	30.9	2.4	13.1	**3.7**	46.8	6.00	13.5	52.7	11.6
	2000	16.3	**47.2**	**19.7**	30.6	**2.6**	11.9	3.2	**48.5**	**6.75**	**18.8**	45.7	11.2
Botswana	2019	**2.3**	33.8	18.3	**43.6**	**4.4**	10.0	2.1	24.2	2.84	5.7	**69.6**	**15.4**
	2010	2.0	35.0	20.6	41.1	3.3	**12.4**	2.0	28.2	3.03	11.2	58.1	12.3
	2000	1.6	**38.7**	**22.5**	35.6	3.3	10.9	**2.2**	**29.9**	**3.49**	**12.2**	49.9	12.1
Eswatini	2019	**1.2**	37.8	21.0	**37.2**	**4.0**	9.3	1.0	25.9	2.96	9.1	**60.2**	**13.3**
	2010	1.1	40.2	22.1	34.0	3.7	9.3	0.7	31.9	3.56	**18.1**	46.0	12.3
	2000	1.0	**43.0**	**22.9**	31.3	2.8	**11.1**	**1.6**	**33.4**	**4.14**	11.7	56.3	12.1
Lesotho	2019	**2.1**	32.5	19.8	**42.8**	**4.9**	**8.7**	0.8	26.4	3.11	13.9	**54.3**	**12.4**
	2010	2.0	34.9	**22.7**	37.8	4.7	8.1	0.0	29.7	3.37	**20.4**	43.1	11.8
	2000	2.0	**40.0**	22.6	33.3	4.1	8.2	**1.4**	**30.9**	**3.96**	13.5	52.0	12.0
Malawi	2019	**18.6**	43.5	**20.9**	**33.0**	2.6	**12.5**	2.7	33.7	4.13	6.4	**64.3**	**13.3**
	2010	14.5	**46.4**	20.6	30.4	2.7	11.4	**2.8**	42.3	5.73	13.3	51.3	11.3
	2000	11.1	46.1	19.2	31.6	**3.1**	10.1	2.5	**44.3**	**6.20**	**18.3**	45.6	11.4
Mozambique	2019	**30.4**	44.4	**20.5**	32.2	2.9	**11.2**	**2.9**	37.2	4.78	8.2	**60.9**	**12.9**
	2010	23.5	**45.7**	19.4	31.9	3.0	10.6	2.8	41.9	5.54	14.0	51.1	11.7
	2000	17.7	44.5	19.5	**32.7**	**3.3**	9.8	2.7	**44.9**	**5.85**	**17.4**	48.0	11.7
Namibia	2019	**2.5**	36.9	19.5	**39.9**	3.6	**11.1**	1.9	28.2	3.34	7.9	**63.7**	**13.0**
	2010	2.1	37.4	**21.8**	36.7	**4.1**	8.9	1.8	30.0	3.61	**13.1**	53.0	12.2
	2000	1.8	**42.0**	21.3	33.5	3.2	10.3	**2.0**	**33.1**	**4.26**	11.1	55.0	11.6
South Africa	2019	**58.6**	29.0	16.8	**48.9**	**5.4**	9.0	1.3	20.1	2.38	9.4	**64.1**	**13.4**
	2010	51.2	29.7	20.4	45.2	4.8	**9.5**	1.4	23.5	2.63	**13.6**	54.7	12.1
	2000	45.0	**33.9**	**20.7**	40.9	4.5	9.1	**1.6**	**23.8**	**2.88**	10.4	59.0	12.0
Zambia	2019	**17.9**	44.5	20.9	**32.5**	2.1	**15.4**	**2.9**	35.8	4.56	6.3	**63.9**	**13.5**
	2010	13.6	**47.3**	20.2	30.4	2.1	14.6	2.8	42.4	5.60	12.2	51.8	11.5
	2000	10.4	46.4	**21.2**	30.0	**2.4**	12.5	2.7	**45.3**	**6.10**	**18.7**	43.4	11.5
Zimbabwe	2019	**14.7**	**42.2**	20.1	**34.8**	3.0	**11.7**	**1.5**	29.8	3.53	7.8	**61.5**	**13.1**
	2010	12.7	41.6	22.6	32.7	**3.1**	10.6	1.0	**35.2**	**3.89**	**16.9**	45.0	11.5
	2000	11.9	42.1	**23.5**	31.5	3.0	10.5	0.8	31.9	3.88	14.8	47.0	12.0

(Source) UN（2019）World Population Prospects 2019 Volume II: Demographic Profiles

Note: **Bold black**…Maximum value among 3-time points (The year 2000, 2010, 2019), Gray…Minimum value among 3-time points

[1] United Nations. (2019) World Population Prospects
[2] David Canning, Sangeeta Raja, and Abdo S. Yazbeck. (2015) Africa's Demographic Transition -Dividend or Disaster? African Development Forum
[3] Wan He, Isabella Aboderin, and Dzifa Adjaye-Gbewonyo (2020) Africa Aging: 2020. International Population Reports. U.S. Census Bureau

This population growth and demographic transformation in the Southern African countries will increase the burden on health systems in the future.[4,5] To reduce the burden, it will be necessary to strengthen preparedness and response capacity to prevent infectious diseases, control their spread, and mitigate their impact.

3-1-2. Health indicators

Table 3-2 shows the DALYs and the mortality rate for maternal and child health-related and non-communicable diseases in the Southern African countries. In all countries, the total number of DALYs has decreased significantly, suggesting an improvement in the health situation. In particular, it can be seen that there has been improvement mainly in infectious diseases and maternal and child health.

Table 3-2. Major Health Indicators in the Southern African region

Country	Year	Total DALYs (Year)	Percentage of total DALYs (%)			Maternal mortality rate (per 100,000 births)	Under -5 mortality rate (per 1,000 births)	Infant mortality rate (per 1,000 births)	Neonatal mortality rate (per 1,000 births)
			Communicable diseases/ maternal & child health, etc.	Non communicable disease, etc.	Injuries, etc.				
Angola	2019	41,750	54.4	**36.3**	9.3	241	80.6	53.5	29.0
	2010	65,759	65.3	25.5	9.1	326	120.3	75.9	36.2
	2000	**106,152**	**70.5**	10.1	**19.4**	**827**	**203.9**	**121,2**	**50.3**
Botswana	2019	48,047	50.9	**38.6**	**10.5**	144	43.8	**32.5**	**17.8**
	2010	60,256	61.0	29.2	9.8	179	35.1	24.6	10.5
	2000	**96,969**	**74.6**	19.1	6.3	**262**	**69.3**	32.0	5.8
Eswatini	2019	55,758	56.7	**32.6**	**10.7**	437	62.3	44.8	19.1
	2010	**88,259**	71.2	21.2	7.6	450	86.6	53.2	19.8
	2000	86,800	**73.6**	19.6	6.9	**521**	**109.7**	**67.1**	**21.6**
Lesotho	2019	78,777	62.1	**27.5**	**10.3**	544	88.7	71.7	**43.6**
	2010	**91,382**	67.7	23.3	9.1	594	97.9	73.7	40.5
	2000	90,002	**73.1**	19.9	7.0	**614**	**106.8**	**75.3**	36.9
Malawi	2019	40,692	60.8	**33.5**	**5.6**	349	46.9	32.5	21.1
	2010	67,080	73.8	22.1	4.1	444	84.9	53.2	28.2
	2000	**118,614**	**82,0**	14.9	3.1	**749**	**172.6**	**99.8**	**38.7**
Mozambique	2019	58,149	68.4	**25.6**	**6.0**	289	79.4	57.9	29.8
	2010	80,797	75.5	19.7	4.8	412	104.9	72.4	33.7
	2000	**103,764**	**80.5**	15.2	4.3	**798**	**169.7**	**112.0**	**46.1**
Namibia	2019	40,743	50.7	**39.1**	**10.3**	195	44.5	31.8	19.8
	2010	50,551	60.3	30.5	9.3	266	49.7	36.3	20.1
	2000	**67,479**	**66.9**	24.5	8.5	**348**	**75.4**	**44.9**	**22.6**
South Africa	2019	47,830	49.6	**38.4**	12.0	119	35.6	28.2	11.4
	2010	66,270	60.6	29.0	10.4	**171**	51.2	32.5	11.2
	2000	**68,501**	**57.2**	29.3	**13.5**	160	**71.1**	**46.3**	**14.9**
Zambia	2019	43,853	60.5	**33.1**	**6.4**	213	64.3	44.1	23.9
	2010	65,267	71.3	23.5	5.1	305	79.6	52.3	25.7
	2000	**112,646**	**81.6**	14.9	3.5	**528**	**152.1**	**89.7**	**33.9**
Zimbabwe	2019	47,938	58.2	**32.8**	**9.0**	458	58.2	40.5	26.9
	2010	72,611	73.1	21.4	5.5	**598**	87.6	**53.8**	**31.7**
	2000	**87,616**	**80.5**	15.5	4.0	579	**92.7**	51.5	26.4
World Average	2019	32,802	63.8	26.4	9.8	211	37.7	28.2	17.5

(Source) DALY…Institute for Health Metrics and Evaluation (IHME)/ Global Health Data Exchange (GHDx) http://ghdx.healthdata.org/ (Accessed on December 25, 2020)
World average maternal mortality rate, etc.… World Bank Open Data https://data.worldbank.org/ (Accessed on December 25, 2020)
Note: **Bold black** … Maximum value among 3-time points (The year 2000, 2010, 2019), Gray … Minimum value among 3-time points

[4] United Nations Economic Commission for Africa（2019）Healthcare and Economic Growth in Africa
[5] African Development Bank (2013) Health in Africa over the next 50 years

However, DALYs and mortality rates related to infectious diseases and maternal and child health are still high. There are also concerns that these indicators may deteriorate due to the spread of COVID-19. For example, at the time of this survey, some respondents assumed that health indicators would worsen as they were discouraged from using essential health services due to restrictions on mobility and service use. Some development partners have also predicted deterioration in maternal and child health-related indicators in African countries.[6] Therefore, there is a great need to strengthen infectious disease control and health crisis response to infectious diseases to cope with the future deterioration of infectious disease and maternal and child health-related indicators.

3-1-3. Infectious disease indicators

Table 3-3 shows the three major infectious diseases (HIV/AIDS, tuberculosis, malaria) and neglected tropical diseases (hereinafter referred to as "NTDs") in the Southern Africa countries.

Table 3-3. Situations of three major infectious diseases, neglected tropical diseases, and COVID-19 in the Southern African region

Country	Year	New HIV infection rate among 15-49 years old (%)	HIV positive rate (%)	TB prevalence rate (per 100,000 population)	Malaria prevalence rate (per 1,000 population)	Number of people requiring interventions against NTD	Cumulative number of COVID-19 positive cases reported (persons)*	Number of COVID-19 fatalities reported (persons)*
Angola	2019	1.5	**1.9**	355	229	15,220,708	17,533	405
	2010	1.9	1.7	**384**	186	**15,879,207**	0	0
	2000	**16.0**	0.8	297	**324**	-	0	0
Botswana	2019	8.2	20.7	275	0.6	238,203	14,805	42
	2010	13.6	23.3	518	1.7	**264,669**	0	0
	2000	**30.7**	**26.1**	**914**	**17.9**	-	0	0
Eswatini	2019	9.8	27.0	329	0.8	247,084	9,358	205
	2010	28.5	**27.6**	**1,190**	0.9	**580,187**	0	0
	2000	**34.1**	22.1	731	**2.9**	-	0	0
Lesotho	2019	11.4	22.8	611	-	382,336	3,094	51
	2010	21.0	**24.2**	**1,120**	-	**530,231**	0	0
	2000	**36.7**	23.3	992	-	-	0	0
Malawi	2019	3.7	8.9	181	214	12,423,068	6,583	189
	2010	6.9	10.6	310	386	**15,182,245**	0	0
	2000	**14.1**	**14.4**	**386**	**426**	-	0	0
Mozambique	2019	8.9	**12.4**	551	305	**23,023,478**	18,642	166
	2010	13.1	11.9	**948**	398	20,995,373	0	0
	2000	**15.0**	8.3	585	**493**	-	0	0
Namibia	2019	5.3	11.5	524	26.7	**1,094,020**	23,941	205
	2010	9.0	12.8	892	1.5	999,049	0	0
	2000	**18.2**	**13.4**	**985**	**58.1**	-	0	0
South Africa	2019	6.9	**19.0**	**551**	1.7	**18,807,465**	1,057,161	28,921
	2010	15.5	18.2	545	1.6	6,144,429	0	0
	2000	**22.3**	12.6	513	**4.2**	-	0	0
Zambia	2019	6.0	11.5	346	157	**12,032,435**	20,725	388
	2010	9.1	12.4	495	177	10,713,944	0	0
	2000	**13.5**	**14.3**	**759**	**396**	-	0	0
Zimbabwe	2019	4.9	12.8	210	51	**10,660,813**	13,867	363
	2010	9.9	15.1	416	109	6,437,391	0	0
	2000	**18.1**	**22.9**	**605**	123	-	0	0

(Source) HIV: World Bank Open Data https://data.worldbank.org/ (Accessed on December 25, 2020)
TB, Malaria, NTD Indicators: WHO Global Health Observatory https://www.who.int/data/gho (Accessed on December 25, 2020)
Note: **Bold black** … Maximum value among 3-time points (The year 2000, 2010, 2019), Gray … Minimum value among 3-time points
* Cumulative number through December 31, 2020

[6] Global Financing Facility. Our Response to COVID-19. https://www.globalfinancingfacility.org/CoVid19 (Accessed on January 25, 2021)

The epidemics of infectious diseases in the African region in the 2000s began with the confrontation with three major infectious diseases; HIV/AIDS, tuberculosis, and malaria. 70% of HIV-positive people were estimated to be living in Africa around 2000, and most of them were concentrated in the Southern African region, with the top eight countries in the African continent.[7] The prevalence of tuberculosis jumped threefold in the African region in the decade of 1990-2000[8] because of the possibility of co-infection with HIV, in spite of the fact that it had been declining worldwide. In addition, malaria was a disease that kills millions of people every year, 90% of which occur in sub-Saharan Africa, and was thought to be responsible for about 20% of infant deaths in Africa.[9]

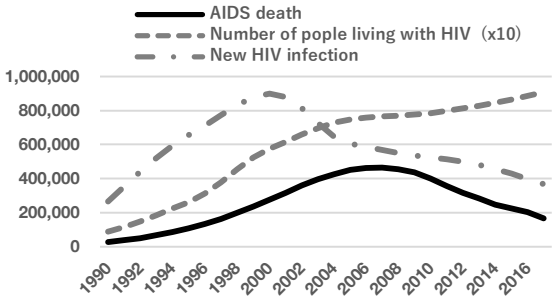

Fig. 3-1. HIV / AIDS Index for Sub-Saharan Africa
(Source) World Bank Open Data https://data.worldbank.org/ (Accessed December 25, 2020)

Under these circumstances, several international organizations were established, and international cooperation and support were directed toward efforts to these three major diseases. For example, the Joint United Nations Programme on HIV/AIDS was established in 1996, the Global Fund to Fight AIDS, Tuberculosis, and Malaria was in 2002, and the U.S. President's Emergency Plan for AIDS Relief (hereinafter referred to as "PEPFAR") was in 2003. Also, technological innovations occurred around the year 2000, such as developing and advancing antiretroviral therapy, and the emergence of prevention methods using pre-exposure prophylaxis and post-exposure prophylaxis. As a result, the prognosis of people with HIV greatly improved, and new infections have been suppressed, as shown in Fig. 3-1, and the indicators of the three major infectious diseases were significantly improved, as shown in Table 3-3.

On the other hand, with the improvement of the three major diseases' infection situation, NTDs have been gathering more attention. NTDs are infectious diseases that are prevalent in developing countries in the tropics, mainly among the poor, but for which there are fewer services and resources in comparison to the three major infectious diseases. There are currently 20 diseases defined as NTDs.[10,11] With the establishment of the Division for NTD Control at WHO Headquarters in 2005, the publication of the Global Plan to Combat NTDs in 2007,[12] the agreement to support NTD control at the G8 Hokkaido Toyko Summit in 2008, and the issuance of the London Declaration on NTDs in 2012, countries around the world have increased their commitment to efforts for NTD control.[13] However, there are still many countries where the population requiring intervention against NTD is rising, as shown in Table 3-3.

Since the end of 2019, the international community is facing the spread of COVID-19. WHO/AFRO has issued a strategic response plan.[14] The AU has established a response fund (African Union COVID-19 Response Fund),[15] and international agencies and development partners support the response with various

[7] JICA (2003) Report on the Basic Survey on Infectious Diseases in Africa
[8] WHO (2005) WHO Report 2005 Global Tuberculosis Control -Surveillance, Planning, Financing
[9] See Footnote 7: JICA (2003)
[10] WHO Control of Neglected Diseases https://www.who.int/teams/control-of-neglected-tropical-diseases (Accessed December 25, 2020)
[11] Those include Guinea worm disease, yaws, African sleeping sickness, leprosy, river blindness, changas disease, leishmaniasis, lymphatic filariasis, rabies, schistosomiasis, soil-transmitted helminths, trachoma, bruli ulcer, dengue fever, Echinococcosis, foodborne trematodiases, Mycetoma, Black Yeasts and Their Filamentous Relatives, scabies and other ectoparasitic infections, Snakebite envenoming, and Streptococcosis and coccidiosis.
[12] WHO (2007) Global plan to combat neglected tropical diseases 2008-2015
[13] Japan Alliance on Global Neglected Tropical Diseases NTDs Chronology https://jagntd.org/ntds (Accessed December 25, 2020)
[14] WHO/AFRO (2020) COVID-19 Strategic Response Plan in the WHO African Region
[15] AU・COVID-19 Response Fund website: https://au.int/en/AUCOVID19ResponseFund (Accessed January 25, 2021)

forms of assistance, as described in Chapter 4. Although the epidemic of COVID-19 in each country differs, the number of reported cases and deaths, which had once settled down in mid-2020, began to rise again around the end of 2020. As of the end of January 2021, the fatality rate of COVID-19 in Africa reached 2.5%, higher than the global average of 2.2%, and the African CDC has stated, "the fatality rate is beginning to reach an extremely worrisome level."[16]

Also, it should be noted that about 75% of human infectious diseases are of animal origin, and the need to address zoonotic diseases has become increasingly important in recent years, as mentioned in Chapter 2.[17] Today, there are more than 200 known zoonotic diseases. Tuberculosis and many types of diseases among NTDs are also zoonotic diseases,[18] and "neglected zoonoses" is also defined as a subcategory of NTDs.[19,20] The outbreaks of anthrax, rabies, etc., have been confirmed every year in Southern Africa except Botswana. There is also some information that bats are the source of infection for the new coronavirus infection, and there is some debate as to whether or not it is zoonotic.[21]

Table 3-4. Number of reports of zoonotic diseases in the Southern African region over the last three years (Excerpt from the most common diseases in the total number of years reported in 10 countries *)

Country	Year	Anthrax	Rabies	Brucellosis	Toxoplasma	Strongyloidiasis	Echinococcus
Angola	2016-18	300 (0) +	733 (733)				
Botswana	2016-18						
Eswatini	2016-18		+	+	+	+	
Lesotho	2016-18	+	+				+
Malawi	2016-18		+++				
Mozambique	2016-18		264(264)	+++	+++	+++	+++
Namibia	2016-18	19(1) +++	18(18)	1(0) +			+
South Africa	2016-18		24 (24)	3(0) +++	+++	+++	+++
Zambia	2016-18	29 ++	+++			+	
Zimbabwe	2016-18	375(4) +++	43(43)	+++	++	++	+

(Source) OIE WAHIS – Zoonotic diseases in humans https://www.oie.int/wahis_2/public/wahid.php/Countryinformation/Zoonoses
Numerical value: Total number of case reports for three years
( ) In parentheses: Total number of reported human deaths over three years+
+ Number of years reported but includes years for which no figures have been reported. (+… 1 year, ++… 2 years, +++… .3 years)
Other reported illnesses include Trypanosoma leptospirosis, spiral worm infection, currant disease, bovine tuberculosis, Swine erysipelas, salmonella, babesiosis, campylobacter disease, West Nile fever, Crimean-Congo hemorrhagic fever, Q fever, Rift Valley fever, leishmaniasis

3-2. Overview of health systems in the Southern African countries

The health systems in Southern African countries for responding to health crises caused by infectious diseases and on which the national core laboratories is based are outlined below in terms of their performance, administration and governance, human resources for health, finances, and infrastructure. The strengthening of infectious disease control and health crisis responses will be influenced by these systems and the sufficiency of resources.

3-2-1. Health system performance

Table 3-5 shows the WHO/AFRO assessment results of health systems' performance and universal health coverage (hereinafter referred to as "UHC") in each Southern African country. These suggest that the characteristics of the health system differ from country to country. Still, all countries tend to have lower

[16] Reuters (2021) Africa COVID-19 fatality rate exceeds global average = Africa CDC director
[17] Africa CDC (2019) Meeting report - 1st International One Health Forum -
[18] For example, rabies, Echinococcosis, streptococcosis and coccidiosis, foodborne trematodiases, African sleeping sickness, leishmaniasis, and schistosomiasis.
[19] WHO (Neglected zoonotic diseases) https://www.who.int/neglected_diseases/zoonoses/infections_more/en/ (Accessed on January 25, 2021)
[20] In addition to the zoonotic diseases listed in the NTD, non-malarial febrile illness such as anthrax, brucellosis, and leptospirosis are also considered important.
[21] Haider, N., Rothman-Ostrow, P., Osman, A. Y., Arruda, L. B., Macfarlane-Berry, L., Elton, L., Thomason, M. J., Yeboah-Manu, D., Ansumana, R., Kapata, N., Mboera, L., Rushton, J., McHugh, T. D., Heymann, D. L., Zumla, A., & Kock, R. A. (2020). COVID-19-Zoonosis or Emerging Infectious Disease?. Frontiers in public health, 8, 596944.

physical access and health habits on the service demand side (users) than other items.

Table 3-5. Health system performance in the Southern African region

Country	Healthy Life Expectancy (Years)(2019)	Current expenditure on health per capita (US$, PPP) (2017)	UHC Index (2019)		Health System Performance (0-100) **											
						Access			Quality			Demand		Resilience	
			Service Coverage Index(0-100)	Households spending > 10% 0f income on health (%)	Index	Physical	Financial	Sociocultural	User experience	Safety	Care effectiveness	Healthy actions	Health seeking	Inherent resilience	IHR core capacity
Angola	55.8	185.9	40	12.4	48.8	**16.1**	36.3 54.9	**37.8**	53.7	55.9 46.7	67.2	44.6 45.6	43.7	58.3 **22.6**	94.0
Botswana	57.5	1044.3	61	1.0	69.2	**64.6**	71.6 69.4	80.7	83.3	77.9 82.9	**67.5**	58.0 **46.7**	69.4	69.3 69.7	69.0
Eswatini	50.2	600.1	63	13.4	70.6	**43.5**	56.9 66.4	**60.8**	80.5	71.8 84.8	**50.1**	71.9 70.5	73.3	81.7 63.5	100.0
Lesotho	46.6	85.5	48	4.5	63.0	**35.4**	56.1 66.8	66.1	60.1	57.3 70.1	**41.7**	55.6 **44.1**	67.1	82.8 65.6	100.0
Malawi	56.2	1,278.0	38	6.5	47.0	**13.6**	44.8 62.6	58.6	44.3	64.6 63.2	86.4	56.6 45.9	67.4	22.0 **36.0**	**8.0**
Mozambique	52.2	895.4	46	1.6	58.2	**7.1**	42.6 69.6	51.2	**45.9**	67.3 71.3	84.6	52.7 **43.0**	62.4	70.2 54.4	86.0
Namibia	55.9	265.5	62	1.2	65.0	**35.1**	56.3 69.4	64.4	76.7	80.2 94.6	69.2	55.1 **36.8**	73.3	68.5 **46.9**	90.0
South Africa	55.7	1,097.8	69	1.4	71.5	**47.7**	62.0 67.3	71.0	**51.3**	60.4 76.3	53.5	69.8 **50.1**	89.4	93.8 87.6	100.0
Zambia	54.3	180.3	53	0.3	59.0	**35.8**	33.3 62.1	65.0	67.3	72.6 67.9	82.5	59.2 **46.2**	72.2	52.6 55.2	**50.0**
Zimbabwe	54.4	201.0	54	2.1	65.8	**24.0**	55.1 **64.0**	77.1	65.0	69.1 74.4	68.0	66.3 **60.4**	72.2	72.6 78.3	67.0

(Source) WHO/AFRO (2020) Report on the performance of health system in the WHO African region
Note: **Bold**: 3 types of indicators with low scores among ten types of indicators of health system performance in each country
*PPP…purchasing power parity
**Health system performance is an indicator calculated from multiple health service indicators and other data, with 100 being the highest performance and 0 being the lowest. See Attachment 6 for details.

3-2-2. Administrative structure

In African countries, the relationship between governmental organizations and public health services with their respective activities and service areas for achieving UHC and the Sustainable Development Goals are illustrated in the WHO/AFRO document as shown in Fig. 3-2. In reality, non-state organizations such as the private sector, people involved in sectors other than health such as society, economy, environment, and politics, and residents who are beneficiaries of services are deeply involved[22].

[22] WHO/AFRO (2018) The State of Health in the WHO Africa Region -An analysis of the state of health, health services and health systems in the context of Sustainable Development Goals

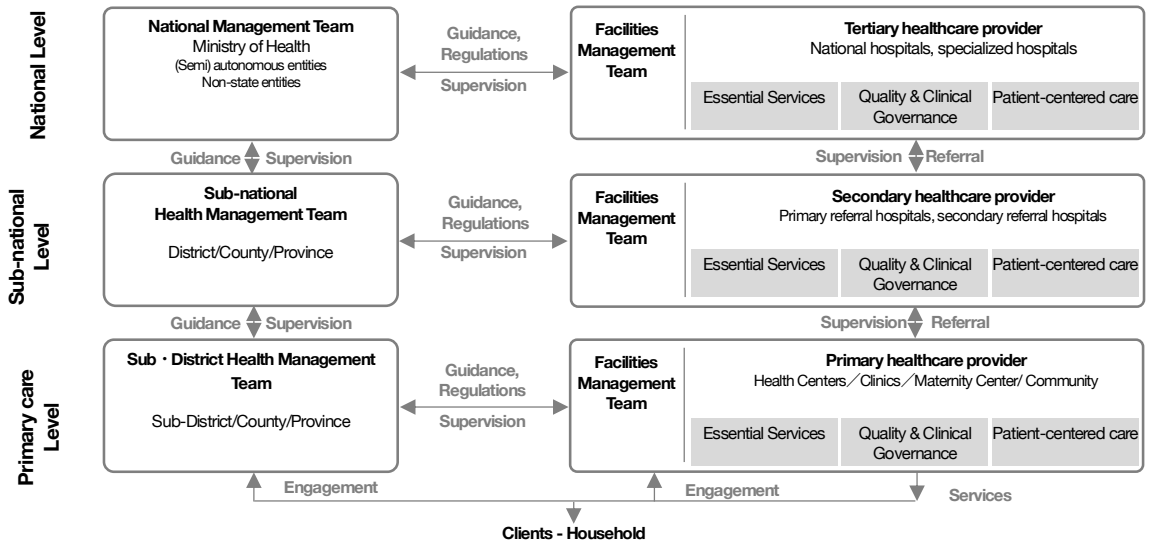

Figure 3-2. Conceptual diagram of administrative structure and service provision system
(Source) WHO/AFRO (2018) The State of Health in the WHO Africa Region -

Because countries worldwide have been aiming to strengthen their health systems to achieve UHC in recent years, the governance indicators and other information for achieving UHC in 10 Southern African countries are shown in Table 3-6. It implies that all countries in the Southern African region, except Botswana, have not yet developed laws pertaining to UHC. Also, half of the countries, such as Eswatini, Lesotho, Malawi, Mozambique, and Zambia, still rely heavily on external resources. On the other hand, the introduction of Results-based financing (hereinafter referred to as "RBF") is underway in many countries.[23] In the RBF, service contracts will be introduced between the administrative body and the health facilities that provide the services, and the function of each will be separated clearly, and the role of the administration will be changed.

Table 3-6. Health governance in the Southern African region

Country	Name of the ministry in charge of the health sector	WHO Governance Index			RBF Adaptation*Qd
		Provisions in the UHC Law (2017) *a	External resources for health as a percentage of total expenditure on health (%) (2014) *b	External health expenditure (EXT) as a percentage of current health expenditure: (2017)	
Angola	Ministry of Health	No	2.6	3.1	Yes
Botswana	Ministry of Health & Wellness	Yes	10.1	9.6	?
Eswatini	Ministry of Health	No	21.7	23.8	Yes
Lesotho	Ministry of Health	No	52.2	20.4	Yes
Malawi	Ministry of Health & Population	No	73.8	52.4	Yes
Mozambique	Ministry of Health	No	48.7	61.2	Yes
Namibia	Ministry of Health & Social Services	No	8.0	4.0	Yes
South Africa	Ministry of Health	No	1.8	2.0	Yes
Zambia	Ministry of Health	No	38.4	42.6	Yes
Zimbabwe	Ministry of Health & Child Care	No	No data	14.7	Yes

(Source)WHO Health Systems Strengthening https://www.who.int/data/gho/data/themes/topics/health-systems-strengthening (Accessed December 25, 2020)
a: Countries that have passed legislation on Universal Health Coverage (UHC) WHO. Yes: Law enacted, No: Not enacted (one of WHO governance index)
b: External resources for health as a percentage of total expenditure on health (WHO governance index that can be used as a guide for dependence on development partners, etc.)
c: External health expenditure (EXT) as a percentage of current health expenditure: Although it is not a WHO governance index, the index *b above has not been updated since 2014, so it was used as a reference.
d: Country names and keywords such as RBF, PBF, and P4P were searched and confirmed policies and businesses through the Internet.

[23] Renmans D, Holvoet N, Criel B, Meessen B. (2017). Performance-based financing: the same is different. Health Policy Plan. 32(6):860-868.

3-2-3. Human resources for health

As for human resources for health, according to WHO, 23 doctors, nurses, and midwives are required for 10,000 population,[24] but none of the Southern African countries have reached this goal, as shown in Table 3-7. Among them, the best situation in Botswana is 5.93 per 10,000. Behind this are the overseas outflow of health care personnel, low remuneration and incentives, uneven allocation of existing personnel, lack of investment in human resource development, lack of ability in human resource administration, and lack of human resource development strategies.[25] In order to remedy these problems, a roadmap for expanding the human resources for health care 2012-2025 has been established.

Table 3-7. Status of Major Health Human Resources in the Southern African region

Country	Medical doctors (per 10,000 pop.)	Nurses and midwives (per 10,000 pop.)
Angola	0.21	0.41
Botswana	0.53	5.40
Eswatini	0.33	4.14
Lesotho	0.07	3.26
Malawi	0.04	0.44
Mozambique	0.08	0.68
Namibia	0.42	1.95
South Africa	0.91	1.31
Zambia	1.19	1.34
Zimbabwe	0.21	1.93

(Source) Doctors, nursing / midwives, dentists, pharmacists：WHO (2020) World Health Statistics 2020 Monitoring Health for the SDGs

3-2-4. Health financing

Figure 3-3 shows the overview of health financing in the African region. In health financing, different factors are complexly correlated, and there are various flows from financial resources to service provision. Still, each country builds a different institutional design based on the health care situation, objectives of financing, policy, financial resources, etc. However, at present, it is reported that 29 out of 47 WHO/AFRO member countries have not yet started to formulate health-financing strategies and that there is no sufficient balance between financial resources, health systems, processes, service provision, and purchasing, etc.[26]

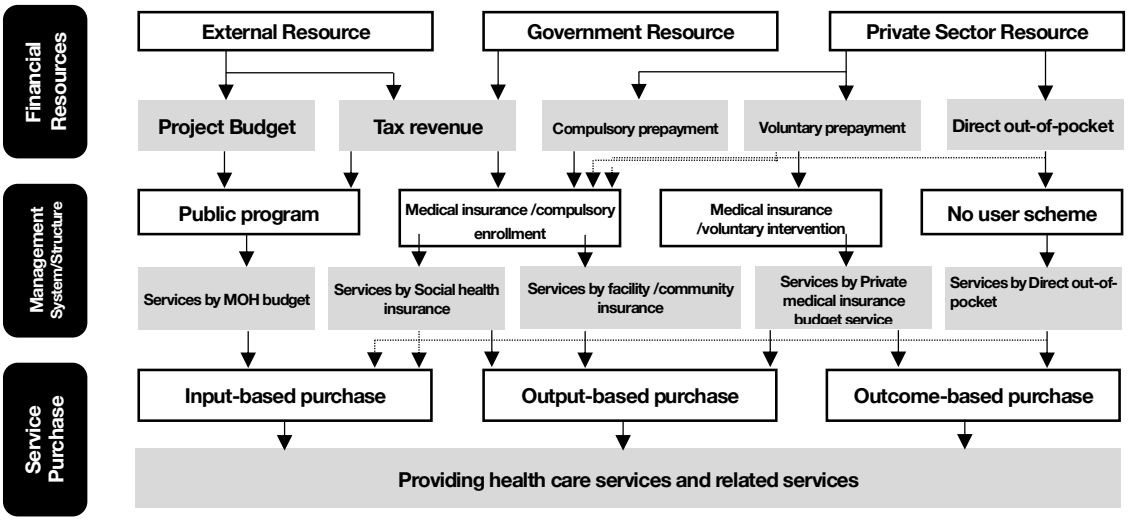

Figure 3-3. Overview of the health financing in the African region

(Source) WHO/AFRO (2018) The State of Health in the WHO Africa Region -An analysis of the state of health, health services and health systems in the context of Sustainable Development Goals

[24] WHO Health Workforce https://www.who.int/hrh/workforce_mdgs/en/ (Accessed January 25, 2021)
[25] WHO/AFRO (2012) Road map for scaling up the human resources for health: for improved health service delivery in the African region 2012-2025
[26] See Footnote 22 WHO/AFRO (2018)

Table 3-8 shows the status of medical expenditure in each country in the Southern African region. Still, there is no common trend among the ten countries, and each country is considered to have a different situation

Table 3-8. Healthcare financing status of each country in the Southern African region

Country	Year	GDP per capita (USD, PPP)	Medical expenditure per person (USD, 2017)	Government expenditure on total healthcare expenditure (%)	Government expenditure on health for the % of GDP	% of out-of-pocket in total health expenditure (%)	Healthcare expenditure in the national budget (%)
Angola	2017	4,100	114	46.3	1.3	34.1	**5.4**
	2011	**4,301**	114	**64.8**	**1.7**	18.0	4.6
	2005	3,443	98	44.8	1.3	**42.3**	4.8
Botswana	2017	**7,595**	**466**	**75.7**	**4.6**	3.0	**14.3**
	2011	6,639	384	61.4	3.5	4.6	9.6
	2005	5,536	278	56.5	2.8	**8.8**	8.2
Eswatini	2017	**3,243**	225	**50.7**	3.5	10.5	10.0
	2011	3,018	**256**	42.6	3.6	10.5	**14.3**
	2005	2,779	205	49.4	3.6	**13.2**	12.6
Lesotho	2017	**1,193**	**105**	**62.9**	**5.5**	16.6	**11.8**
	2011	1,125	99	56.8	5.0	18.2	9.9
	2005	880	45	48.2	2.4	**34.4**	5.8
Malawi	2017	**334**	**32**	**30.6**	**3.0**	**10.6**	**9.8**
	2011	321	24	21.7	1.6	9.0	6.8
	2005	257	16	24.5	1.5	9.1	6.1
Mozambique	2017	**426**	**21**	29.9	1.5	7.4	4.7
	2011	358	16	9.1	0.4	9.2	1.3
	2005	279	18	**48.8**	**3.1**	**9.4**	**15.8**
Namibia	2017	**5,231**	447	**46.1**	3.9	7.7	10.7
	2011	4,793	**471**	40.6	4.1	**10.3**	10.6
	2005	4,228	436	44.1	**4.5**	6.9	**16.3**
South Africa	2017	6.153	**499**	53.7	**4.4**	7.8	**13.3**
	2011	**6,075**	455	**54.4**	4.1	8.4	13.2
	2005	5,405	362	41.1	2.8	**12.4**	9.8
Zambia	2017	**1,513**	68	**38.6**	1.7	11.8	6.9
	2011	1,388	48	34.8	1.2	21.6	6.2
	2005	1,025	**70**	26.7	**1.8**	**31.5**	**8.2**
Zimbabwe	2017	**1,660**	110	**51.6**	**3.4**	20.6	**15.2**
	2011	1,458	**112**	27.5	2.1	**35.8**	9.1
	2005	-	-	-	-	-	-

(Source) WHO Global Health Expenditure Database https://apps.who.int/nha/database/country_profile/Index/en (Accessed December 25, 2020)
Note **Bold black**…Maximum value among 3-time points (2000, 2010, 2019), Gray…. Minimum value among 3-time points

3-2-5. Health infrastructure

Table 3-9 shows the health care infrastructure index[27] and its underlying infrastructure development status of the Southern African countries.

Across Africa, the Health Infrastructure Index ranges from 0.06 to 0.67. In comparison, the Southern African countries have a smaller variation, ranging from 0.06 to 0.48, and is generally lower, indicating that the infrastructure is not in place to perform as required. It has been pointed out that this situation is because insufficient attention has been paid to coordinating investments in health infrastructure.[28]

[27] The Health Infrastructure Index is a WHO-defined index that is calculated based on the availability of basic facilities and equipment, the number of health care facilities, and the number of hospital beds, etc.,[27] and is an indicator of the readiness of infrastructure for the provision of essential health care services.
[28] See Footnote 22: WHO/AFRO (2018)

Table 3-9. Number of healthcare facilities per 100,000 populations in the Southern African region

Country	Health Infra. Index*	Health Post		Health center		District Hospital		Provincial Hospital		Specialized Hospital		Hospital	
		Number	Per 100,000 populations	Number	Per 100,000 populations	Number	Per 100,000 populations	Number	Per 100,000 populations	Number	Per 100,000 populations	Number	Per 100,000 populations
Angola	0.13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Botswana	0.11	N/A*	N/A	N/A	N.A	16	0.79	7	0.35	3	0.15	26	1.29
Eswatini	0.19	162	12.97	8	0.64	2	0.16	6	0.48	2	0.16	10	0.80
Lesotho	0.21	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Malawi	0.06	73	0.45	377	2.30	37	0.23	23	0.14	5	0.03	65	0.40
Mozambique	0.13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Namibia	0.19	294	12.8	53	2.30	30	1.30	4	0.17	10	0.43	44	1.91
South Africa	0.13	3,105	5.89	289	0.55	279	0.53	63	0.12	14	0.03	356	0.67
Zambia	0.41	171	1.18	1,211	8.33	43	0.30	18	0.12	5	0.03	66	0.45
Zimbabwe	0.48	0	0.00	1,331	9.41	52	0.37	11	0.08	11	0.08	74	0.52

(Source) Health Infrastructure Index: WHO/AFRO (2018) The State of Health in the WHO Africa Region -An Analysis of the status of health, health services, and health systems in the context of the Sustainable Development Goals./ Others: Global Health Data Exchange (GHDx) http://ghdx.healthdata.org/ (Accessed December 25, 2020)
*The Health Infrastructure Index, if it is 1, means that the facilities and equipment necessary for the provision of essential health services are in place, and vice versa if it is 0.

Table 3-10. Medical equipment in the Southern African region

Country	MRI		CT		PET		Nuclear Medicine		Mammography*		Linear Accelerator		Tele cobalt Unit		Radio Therapy	
	Num.	Per 100,000 pop.	Num.	Per 100,000 pop.	Num.	Per 100,000 pop.	Num.	Per 100,000 pop.	Num.	Per 100,000 pop.	Num.	Per 100,000 pop.	Num.	Per 100,000 pop.	Num.	Per 100,000 pop.
Angola	1	0.05	9	0.42	0	0.00	0	0.00	5	6.3	0	0.00	1	0.05	1	0.05
Botswana	1	0.50	2	0.99	0	0.00	0	0.00	2	19.1	0	0.00	0	0.00	0	0.00
Eswatini	0	0.00	3	2.40	0	0.00	0	0.00	2	33.62	0	0.00	0	0.00	0	0.00
Lesotho	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Malawi	1	0.06	5	0.31	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Mozambique	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Namibia	2	0.87	11	4.78	0	0.00	2	0.87	5	42.30	0	0.00	1	0.43	1	0.43
South Africa	12	0.23	51	0.97	3	0.06	28	0.53	32	7.78	21	0.40	9	0.17	30	0.57
Zambia	1	0.07	3	0.21	0	0.00	1	0.07	2	4.56	1	0.07	1	0.07	2	0.14
Zimbabwe	4	0.28	6	0.42	0	0.00	4	0.28	4	6.89	3	0.21	3	0.21	6	0.42

(Source) WHO (2017) Global atlas of medical devices -2014

3-3. Plans and strategies for health crisis response in the Southern African countries

To provide an overview of the status of infectious disease control and health crisis response in the Southern African countries, these positions in the development plans and health policies of the countries are summarized. Table 3-11 shows the descriptions of human and animal infectious diseases in the development plans, health policies, and agricultural policies of countries in the Southern African region.

Interventions for human diseases are explicitly mentioned in all countries' development plans. Also, except for Namibia and Zimbabwe, all countries have included the strengthening of laboratories and surveillance. In countries other than Namibia, the health sector's strategic plan, which is subordinate to the development plan, consists of strengthening IDSR and laboratories.

On the other hand, many countries have not specified issues of animal health or have not pointed to specific targets in their development plans. Although we cannot clarify the situation because we could not collect agricultural policy documents of some countries such as Angola, Botswana, and Lesotho, only a few countries specify the strengthening of laboratories and surveillance. Some more countries have descriptions of animal disease control. Furthermore, while Lesotho and South Africa mention the need to take measures in terms of animal health's impact on humans, more countries discuss animal health issues in the context of livestock production. During the interviews for this survey, some officials from the Ministry of Agriculture responded that discussions on agricultural productivity were in the mainstream and that budget allocation for livestock disease control and laboratories was not necessarily a high priority.

Table 3-11. Development plans and health policies for infectious disease control in the Southern African region

Country	Policy Document	Overview
Angola	National Development Plan (PND 2018-2022)	Human: To strengthen the health information system and medical research, it aims to promote medical research by improving epidemiological surveillance (digitization, etc.) and expanding the laboratory network. Animal: It has set a numerical target to reduce the prevalence of animal diseases from 15% (2017) to 5%, to prevent, control, and eradicating animal diseases to improve livestock productivity.
	Angola's National Plan for Health Development 2012–2025 (PNDS)	With the priority goal of expanding the Centers of Excellence for Disease Control and Surveillance, the laboratory network is supervised adequately at the central level. The strategy is to formulate regulations to improve planning and coordination activities.
	National agriculture and food/nutrition security investment plans	Documents could not be collected in this survey.
Botswana	National Development Plan 11 (2017-2023)	Human: In addition to improving the quality of lab services through international accreditation, it aims to strengthen surveillance, preparation, and response capabilities for early response and mitigation of global health crises. Animal: Based on the experience of foot-and-mouth disease outbreaks in the past, it emphasizes the economic importance of animal disease control (no specific measures are found).
	A Strategy for Changing the Health Sector for Healthy Botswana 2010–2020	Under the perceptions that HIV and tuberculosis are challenges, it set out individual strategies centered on providing services and human resources development related to HIV/AIDS and on strengthening laboratory diagnosis and daily monitoring at the medical facilities and central laboratories.
	—	No agricultural plan could be found at the time of this survey.
Eswatini	National Development Plan 2019/20 – 2021/22	Human: Improving access to quality health services is one of the health sector's goals. Strengthening inter-sectoral cooperation and partnerships and improving IDSR are strategies established to achieve the goal. Animal: No mention of animal health.
	National Health Sector Strategic Plan (NHSSP III)	It aims "to build an efficient, equitable, client-centered health system for accelerated attainment of the highest standard of health for all people in Eswatini." (Document not yet available. The above is from World Bank documents.)
	Agriculture Strategic Plan (2018 – 2023)	Strategies for continuous improvement of the beef industry include strengthening animal health and veterinary services, promoting One-Health Approach, developing an early warning system for infectious diseases, strengthening veterinary service outreach and surveillance, and laboratories. It also plans to invest in concerning infrastructure development.
Lesotho	National Strategic Development Plan (NSDP II) 2018/19-2022/23（Zero-draft is only available)	Human: The medium-term goal is to build a resilient health system and to promote systematic screening for disease prevention, prepare for emergencies, and strengthen response capabilities. Animal: Sustainable commercial agriculture and food security are medium-term goals and set strategies to expand comprehensive management of pests and diseases and enhance animal disease control through surveillance.
	National Health Strategic Plan 2017 – 2022	It plans to strengthen routine surveillance for all diseases, including indigenous infectious diseases and animal diseases, and to increase lab capacity in case of emergency to achieve goals such as ensuring fairness in health services and securing human resources necessary to provide effective health services.
	—	At the time of this survey, strategic plans for the agricultural sector could not be collected. However, the Strategic Plan for agriculture & rural statistics - 2019/20-2023/24 is available. It was confirmed that the surveillance system for livestock diseases is one of the targets and that the national livestock policy is also available.
Malawi	Malawi Growth and Development Strategy (MGDS) III 2017-2022	Human: It mentions strategies to strengthen lab screening and other diagnostic services for infectious disease prevention and management and to strengthen surveillance against HIV/AIDS and community surveillance for primary health care programs. Animal: As a measure of agricultural risk management, it set the strategy to promote the management of pests and diseases and develop the infrastructure, including the disinfection tank (Dip tank) and the chemical sprayer (Mist blower). It also aims to strengthen the capacity of the community and to try biotechnology.
	Health Sector Strategic Plan II (HSSP II) 2017-2022	It set the strategies to strengthening preparedness and response to the epidemics, and it planed establishment of emergency operation center, human resource development, cooperation with the animal health department of the Ministry of Agriculture, evaluation of IHR core capacity, monitoring of drug resistance, the establishment of One Health committee and the strengthening of surveillance in accordance with IDSR.
	National Agriculture Policy 2016	It states integrated management and control of pests and diseases as a priority policy for agricultural risk management. It aims to strengthen community capacity and surveillance for the operation and management of concerning infrastructure and strengthen animal health programs.
Mozambique	National Development Strategy (2015-2035)	Human: As one of the elements for the development of human health and well-being, it sets a program to eradicate endemic diseases, HIV, tuberculosis, malaria, and other

		diseases that contribute significantly to the population's mortality. Animal: No detailed description regarding animal health.
	Health Sector Strategic Plan (2014-2019)	Strategies for preventing infectious disease outbreaks include capacity building of health care workers, training of field and lab-based epidemiology leaders, and strengthening of provincial and district-level surveillance. It also calls for strengthening the laboratory network in HIV and tuberculosis programs.
	Strategic Plan for Agricultural Development (2010-2019)	The strategic goal is to expand agricultural productivity and competitiveness. To manage necessary pests and diseases, measures such as infrastructure development for veterinary services, prevention and control of livestock diseases, human resource development of laboratories and related facilities, and infrastructure investment are listed.
Namibia	5th National Development Plan 2017/18 – 2021/22	Human: The importance of infectious disease control is emphasized, and cross-border cooperation through implementation with SADC's Health Protocol[29] is stated. It also sets goals such as reducing the prevalence of tuberculosis from 73% to 43%. Animal: The goal is to improve animal health and increase productivity, aiming to minimize the impact of foot-and-mouth disease and contagious bovine disease, and to expand veterinary courses, set up pharmaceutical factories, and cooperate with neighboring countries. One of the goals is to strengthen the capacity for disaster response preparation, response, recovery, and reconstruction.
	Ministry of Health and Social Services, Strategic Plan (2017/18-2021/22)	The strategic goal is to reduce the rate of new infections and prevalence of malaria, tuberculosis, HIV, measles, and neglected infectious diseases. There is no mention of strengthening surveillance or laboratories.
	Ministry of Agriculture, Water, and Forestry, Strategic Plan 2017/18-2021/22	As one of the 14 strategic issues, improvement and maintenance of domestic animal health is set as a strategic goal. As specific measures, it plans to vaccinate animals and install control fences for animal movement at Angola's border.
South Africa	National Development Plan 2030	Human: Prevention and treatment of tuberculosis and HIV are emphasized as measures against infectious diseases. Improvement of the health information system is mentioned as one of the priority issues for promoting public health. The health information system aims to cooperate with other information systems such as laboratories. Animal: No mention of animal health.
	National Health Strategic plan 2015-2020	In the primary health care program, infectious disease control is mentioned. The emphasis is on improving surveillance, preparing for health crisis response strengthening core capacity following IHR, preventing and controlling influenza and neglected diseases, and eliminating malaria.
	Agricultural Policy Action Plan (APAP) 2015-2019.	It includes developing a national surveillance monitoring program for poultry diseases, the introduction of biosecurity controls for such as zoonotic diseases and foot-and-mouth disease, and the formulation of animal health management plans.
Zambia	7th National Development Plan (7NDP) (2017-2021)	Human: The strategy is to strengthen public health programs. Specific measures include strengthening disease response preparedness and control, establishing laws and regulations to promote disease surveillance, and conducting public health research for preventive measures. Animal: As a concrete measure of the strategy for improving the production and productivity of the agricultural sector, the establishment of an early warning system for disasters is set, and it is stated that cattle disease is one of the disasters.
	National Health Strategic Plan 2017-2021	Priority areas are infectious disease control, disease outbreaks, and surveillance. It also plans to establish a national public health laboratory, strengthen the laboratory network, and build a sustainable supply system for the materials and equipment required for the laboratory. It also describes IHR legislation, the use of appropriate medicines for human and animal health, and the One-Health approach to respond to health crises.
	Second National Agricultural Policy 2016 -2020	The goal is to strengthen agricultural production and productivity, and as a concrete method for that purpose, it is set to strengthen control and prevention methods for livestock diseases.
Zimbabwe	Vision 2030	Human: Infectious diseases such as HIV and malaria and non-communicable diseases are listed, emphasizing preventive activities at the community and household level. It also states that it promotes investment in strengthening labs at the county hospital level. Animal: It is stated that measures against diseases and pests will be taken. There is no detailed description.
	National Health Strategy For Zimbabwe 2016-2020	Strengthening infectious disease control, public health surveillance, and disaster preparedness and response are prioritized. Specific measures are planned to strengthen human resources development and surveillance related to IDSR, public health laboratories, border control, and IHR compliance.
	National Agriculture Policy Framework (NAPF) 2018-2030 (Draft)	It is stated that the recognition that changes in the livestock sector affects animal disease management. In this current situation, animal health and disease management are taken up in agricultural education, and that the outbreak of livestock diseases is increasing due to climate change. However, specific strategies and measures are not described.

(Source) Organized based on the contents of each country's policy documents

[29] Agreements of SADC member countries for regional measures for preparedness and mapping and prevention, control and eradication of infectious diseases and non-communicable diseases.

In the Southern African countries, the WHO Joint External Evaluation on IHR Core Capacity described in the previous chapter is being conducted as shown in Table 3-12, to monitor and evaluate the implementation status of the policies mentioned above, etc., and identifying issues that should be prioritized for improvement.

Table 3-12. Recent WHO joint external evaluations in the Southern African region and the status of their reports

Country	Period of Joint Evaluation	Report status	Country	Period of Joint Evaluation	Report status
Angola	November 17-22, 2019	Unpublished*	Mozambique	April 18-22, 2016	Published
Botswana	December 3-8, 2017	Published	Namibia	November 28-December 2, 2016	Published
Eswatini	April 8-13, 2018	Published	South Africa	November 26-December 1, 2019	Published
Lesotho	July 10-14, 2017	Published	Zambia	August 7-11, 2017	Published
Malawi	February 11-15, 2019	Published	Zimbabwe	February 19-23, 2018	Published

(Source) WHO Strategic Partnership for Health Security and Emergency Preparedness (SPH) Portal (Accessed January 25, 2021)
*At the time of this survey, it was verbally confirmed that the report was being prepared through online interviews, but it was not available.

3-4. Surveillance systems in the Southern African countries

The following is an overview of the status of IDSR, which is a central strategy for infectious disease control and health crisis response, and its core surveillance system.

Table 3-13. Status of IDSR in the Southern African region

Country	Adoption of IDSR Technical Guidelines 2nd Edition	TOT for IDSR	Cascade-style IDSR training to lower levels	Total number of health districts	Health districts with IDSR training between 2015 and 2017	Production and dissemination of IDSR (Bulletin)	Timeliness of IDSR reporting	A complete report of IDSR
Angola	Yes	No	-	166	50-89%	Yes	-	-
Botswana	Yes	Yes	No	28	50-89%	No	82	92
Eswatini	Yes	No	Yes	4	50-89%	Yes	85	52
Lesotho	Yes	—	—	10	More than 90	—	—	—
Malawi	Yes	—	—	29	Less than 50%	No	—	—
Mozambique	Yes	No	No	159	Less than 50%	No	52	92
Namibia	Yes	—	—	35	NA	No	90	99
South Africa	Yes	—	—	52	50-89%	—	—	—
Zambia	Yes	—	—	105	50-89%	Yes	—	—
Zimbabwe	Yes	Yes	—	63	50-89%	—	90	90

—No information provided, NA. Not applicable
(Source) WHO/AFRO (2019) Regional strategy for integrated disease surveillance and response: 2020-2030

The implementation status of IDSR in the Southern African countries is shown in Table 3-13. It can be said that IDSR has been introduced in all countries and is in the process of being introduced from the central level to the lower levels. And for the implementation of IDSR at lower levels, several issues need to be resolved. For example, there is a lack of sustained budget to strengthen the surveillance system, high turnover of surveillance workers, inadequate sharing and utilization of surveillance data and information, and low laboratory capacity.[30]

Table 3-14 shows the IHR core capacity score and GHS index[31] for surveillance systems, which suggests delays in digitizing reporting systems and fragmentation of the system.

[30] Fall IS, Rajatonirina S, Yahaya AA, Zabulon Y, Nsubuga P, Nanyunja M, Wamala J, Njuguna C, Lukoya CO, Alemu W, Kasolo FC, Talisuna AO. Integrated Disease Surveillance and Response (IDSR) strategy: current status, challenges and perspectives for the future in Africa. BMJ Glob Health. 2019 Jul 3;4(4):e001427.
[31] The GHS Index is an indicator of global health security capabilities compiled by John Hopkins University and other organizations in the United States. The GHS Index is based on data from available sources in each country.

Table 3-14. IHR Core Capacity Score and GHS Index for Surveillance in the Southern African region

Country	IHR Core Capacity Score*				GHS Index
	Indicator and event-based surveillance systems (D2.1)	Interoperable, interconnected, electronic real-time reporting system (D2.2)	Integration and analysis of surveillance data (D2.3)	Syndromic surveillance systems (D2.4)	Real-time surveillance and reporting（2.2）
Angola	Unknown	Unknown	Unknown	Unknown	26.7
Botswana	3	3	3	4	40.0
Eswatini	4	2	4	4	38.3
Lesotho	4	2	3	4	26.7
Malawi	2	2	2	-	23.3
Mozambique	3	2	3	3/2	36.7
Namibia	3	2	3	4	20.0
South Africa	3	2	4	4	78.3
Zambia	3	2	3	3	10.0
Zimbabwe	3	2	4	4	20.0
Average	3.1	2.1	3.2	3.6-3.75-	32.0

* Lowest point 1, highest point 5
(Source) IHR Core Capacity Score: The latest version of each country's IHR Core Capacity Analysis Report (published in any year 2016-2019)
GHS Index：Nuclear Threat Initiative and Johns Hopkins Bloomberg School of Public Health (2020) Global Health Security index 2019 Building Collective action and Accountability

From Table 3-14 above, it can be suggested that there is a situation in which regional policies, etc., focus on the completeness and timeliness of reporting priority diseases, and data quality is overlooked. In the review and interviews conducted during this survey, it was pointed out that there are still issues regarding the quality of the data and the response to these issues, for example, whether it is possible to identify all the cases that need to be identified, and or to respond appropriately and promptly to the identified cases.[32]

Table 3-15: Issues related to the surveillance system in the four countries of the online interviews and questionnaire survey

Country	Issues
Angola	Human health: Although there is a hierarchical surveillance system led by the Ministry of Health, the system is fragmented and not integrated due to the influence of aid, as it is built by disease programs, such as those of HIV and tuberculosis. There is also a shortage of human resources for surveillance, which is also related to the lack of financial resources. Although personnel is hired and assigned, because of low payment, retention is low. Animal health: Although Namibian, Congolese, and Zambian border provinces conduct animal disease surveillance in cooperation with other countries, laboratories are not fully integrated into activities.
Malawi	Human health: A system using the social networking site Whatsapp and an electronic system (DHIS2) has been established, but the reporting rate and timeliness are not good. Event-based surveillance has been introduced but is not systematic. Laboratory data is not always reported to the IDSR team. Animal health: Due to a lack of financial resources and external support, surveillance systems and activities are not carried out as planned. There is a need for outreach to the community for surveillance, but the necessary equipment is not available, and field personnel's capacity is not sufficient.
Mozambique	Human health: There are two types of surveillance systems for public health: routine surveillance for 10 priority diseases and sentinel surveillance for four diseases, but as shown in Table 3-12, the implementation of IDSR is not good, and the introduction of event-based surveillance and other systems is slow. Animal health: Surveillance at the community level is weak, and para-veterinarians' capacity to go to communities is not sufficient. The budget allocated for surveillance is inadequate, and computerization attempts have been discontinued due to insufficient funding.
Zimbabwe	Human health: An electronic system (DHIS2) has been established, and there is little fragmentation among diseases. However, there is poor internet connectivity, lack of capacity building of personnel at the facility level, and high turnover. In addition, the linkage between laboratory data and patient data is weak, and the introduction of case-based surveillance has been slow. Animal health: A surveillance system has been established by the Ministry of Lands, Agriculture, Water, Climate, and Rural Resettlement, as well as the provincial veterinary office, county veterinary offices, and animal health management centers, but it is not electronic. There is a lack of IT human resources for reporting, data analysis, and management, and inadequate vehicles and budgets for outreach.

(Source) Responses to online interviews with stakeholders and IHR JEE report.

[32] See Footnote 30: Fall IS et al. (2019)

Furthermore, Table 3-15 shows the four countries' issues covered by the online interviews and questionnaire. This indicates that there are differences in the surveillance systems for human and animal health. In human health, there are concerns about the existence of multiple surveillance systems for each disease. There is a lack of human resources in animal health to conduct outreach to the community and collect information.

3-5. Functions of national core laboratories in the Southern African countries

In infectious disease control and health crisis response, the laboratory network plays a role in identifying diseases. This is an area where JICA has provided cooperation by combining grant aid for facility development with technical collaboration for human resource development and research. The following is an overview of the national core laboratories' status and challenges and the laboratory network.

3-5-1. Challenges for laboratories in the African region

First, an overview of the challenges that laboratories in the African region are facing is presented. However, it is not easy to grasp the specific issues that are unique to each country in this survey, and it is necessary to keep in mind that the issues that exist in one country may exist in another country. This section summarizes the issues that generally exist in the African region.

It has been pointed out that public health laboratories have been neglected in the health system of the African region.[33,34] After the Ebola virus disease outbreak in 2014, attention was focused on the role and strengthening of public health laboratories. Still, some studies on the existence and impact of health care workers did not include personnel involved in the laboratories.[35] Even if they need to strengthen the laboratories, the laboratories' performance data is still not sufficiently available in each country. There are issues for finance and legislation in the African region. It is said that the situation is continuing in which specific interventions cannot be planned and laboratory diagnosis is not expanding in Africa.[36,37]

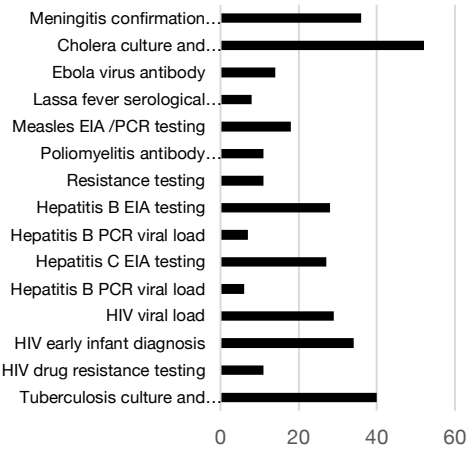

Figure 3-4. Percentage of laboratories performing laboratory diagnosis
(Source) Preparing national tiered laboratory systems and networks to advance diagnostics in Africa and meet the continent's health agenda: Insights into priority areas for improvement. Afr J Lab Med. 2020 Sep 21;9(2):1103.

Laboratory diagnostics available in Africa are considered to be limited. For example, after the spread of the COVID-19 in 2020, the African Society for Laboratory Medicine (hereinafter referred to as "ASLM") and the Africa CDC surveyed the national core laboratories in 12 countries [38] and 101 laboratories one level below. According to the survey

[33] Nkengasong JN, Nsubuga P, Nwanyanwu O, Gershy-Damet GM, Roscigno G, Bulterys M, Schoub B, DeCock KM, Birx D. Laboratory systems and services are critical in global health: time to end the neglect? Am J Clin Pathol. 2010 Sep;134(3):368-73.
[34] Nkengasong JN, Skaggs BA. Are post-Ebola reconstruction efforts neglecting public health laboratory systems? Lancet Glob Health. 2015 Nov;3(11):e678.
[35] Evans DK, Goldstein M, Popova A. Health-care worker mortality and the legacy of the Ebola epidemic. Lancet Glob Health. 2015; 3:e439–e440.
[36] Ondoa P, Ndlovu N, Keita MS, Massinga-Loembe M, Kebede Y, Odhiambo C, Mekonen T, Ashenafi A, Kebede A, Nkengasong J. Preparing national tiered laboratory systems and networks to advance diagnostics in Africa and meet the continent's health agenda: Insights into priority areas for improvement. Afr J Lab Med. 2020 Sep 21;9(2):1103.
[37] Best M, Sakande J. Practical recommendations for strengthening national and regional laboratory networks in Africa in the Global Health Security era. Afr J Lab Med. 2016 Oct 31;5(3):471.
[38] 12 countries are unknown

report, the availability of the minimum laboratory diagnostic package recommended by WHO is limited, as shown in Fig. 3-4. Another report also points out that the tests and diagnoses that can be performed in the African region for the COVID-19 are also limited.[39]

Table 3-16. Challenges for laboratories in each country in Africa

Item	Most common critical weakness	Implication on diagnostic services
Policy & System	- The nine essential public health functions have no legal effect and are not included in the National Lab Strategic Plan. - There is no national system for lab licensing. - There is no budget allocation for routine/emergency lab services.	- Compliance for laboratory diagnostic does not match biosafety, biosecurity, waste management, and environmental protection. - The facilities with low capacity are allowed to carry out laboratory diagnosis. - The organization and coordination of laboratory diagnostics are not optimized, including during outbreaks.
Laboratory network	- The network does not include community-level surveillance activities.	- The rapid and POC tests at the community level are not supervised, and quality is not controlled.
Laboratory network coverage and rapid response	- Lab data on GIS has not been updated. - The required surveillance packages at each level have not been decided. - There is no diagnosis service at the point of entry. - There is no national plan for mobilizing laboratories in an emergency.	- The laboratory diagnosis does not respond to optimal laboratory needs and the provision of cost-effective services. - Laboratory diagnostics are not utilized at the most appropriate level, and laboratory diagnostic strategies' public health impact is small. - Laboratory diagnosis does not contribute to controlling the spread of infection across national borders. - Laboratory diagnostics does not contribute to the response to the public health crisis.
Information management system	- At the national level, diagnostic test request forms and result reply forms are not standardized. - There is no health data analysis department at the national level. - There is no mechanism to protect the confidentiality and anonymity of test results.	- Even if testing is available, the demand for diagnostic testing and the results are not being utilized. - Diagnostic test results are not properly communicated for public health intervention. - Confidence in laboratory diagnostic services is declining, damaging the demand for laboratory diagnostics.
Infrastructure, reagent supply	- There are no regulations for the construction of laboratory facilities. - The laboratory facility is not well maintained. Water and power supply and connection to the Internet are often interrupted. - Insufficient systems for forecasting reagent consumption and adequate supply, both daily and in emergencies.	- Diagnostic tests are conducted in unsafe, unsecured, and illegal places. - Diagnostic tests are not performed in compliance with biosafety and security requirements. The device is not utilized. - Diagnostic testing services are interrupted, including in an emergency.
Human resources	- Insufficient training in laboratory operation management. - Laboratory staffing plans are inadequate, inappropriate, or non-existent. - There is a shortage of personnel for diagnostic testing services. - There is no specific and comprehensive strategy for human resources for laboratory personnel.	- Laboratory diagnosis is not effective at the facility level and at the national level. - Laboratory diagnostics are not performed correctly.
Quality management	- Internal quality control procedures are inconsistent. - Some laboratories do not have quality control personnel. - There are no national standards for lab certification or accreditation.	- The results of diagnostic testing are not reliable. - The quality of laboratory diagnosis is not verified.
Biosecurity	- Insufficient availability of biosecurity that meets the criteria. - There is no mechanism for storing specimens (including dangerous pathogens). - There is a disparity in the waste management systems.	- The results of diagnostic testing are not reliable. (Drug susceptibility test, etc.) - Dangerous tests are conducted on staff and the environment. - No opportunity to confirm internal or external laboratory diagnosis.
Priority diseases	- Low capacity for isolation of drug-resistant bacteria. - Insufficient reports of drug-resistant bacteria.	- Drug resistance test results are not fed to the drug resistance surveillance system. - The list of important pathogens and antibiotics has not been updated, and many unnecessary drug susceptibility tests are performed.

(Source) Ondoa P, Ndlovu N, Keita MS, Massinga-Loembe M, Kebede Y, Odhiambo C, Mekonen T, Ashenafi A, Kebede A, Nkengasong J. (2020) Preparing national tiered laboratory systems and networks to advance diagnostics in Africa and meet the continent's health agenda: Insights into priority areas for improvement. Afr J Lab Med. 9(2):1103.

[39] Oladipo EK, Ajayi AF, Odeyemi AN, Akindiya OE, Adebayo ET, Oguntomi AS, Oyewole MP, Jimah EM, Oladipo AA, Ariyo OE, Oladipo BB, Oloke JK. Laboratory diagnosis of COVID-19 in Africa: availability, challenges and implications. Drug Discov Ther. 2020;14(4):153-160..

Although there are various factors behind this situation, ASLM and the Africa CDC's above reports summarize the main issues shown in Table 3-16, focusing on the lack of human, financial, and technical resources and the delay in standardization of systems.

At the time of this survey, the survey team could not find any literature on laboratories related to animal health, where the current situation and issues in the African region, as described above, were analyzed and discussed cross-sectionally in each country.

3-5-2. Overview of laboratory networks in the Southern African countries

(1) Lab governance

The 2008 Maputo Declaration requested each country to establish a department dedicating to laboratories (department of laboratory systems, etc.) within the Ministry of Health. Zimbabwe is the only country in the Southern Africa region with a department dedicated to laboratories within the Ministry of Health, confirmed as of 2017.[40] The department dedicating to laboratories is indispensable for cross-disciplinary efforts such as establishing regulations, laws, standards, etc., related to laboratories, promoting their compliance, budget allocation specialized for laboratories, and promoting accreditation of laboratories. The need for advocacy has also been pointed out.[41]

However, countries in the Southern African region are also considered to be more advanced in strengthening systems and creating policy frameworks compared to the other African regions.[42] This is because countries with high HIV prevalence rates, such as those in Southern Africa, have made significant progress in strengthening their laboratories in the areas of HIV and tuberculosis through PEPFAR and the Global Fund to Fight AIDS, Tuberculosis, and Malaria (hereinafter referred to as "GFATM"). Their assistance in AIDS, tuberculosis, and malaria has given high priority to the strengthening of laboratories and systems development, including legislation.[43]

Table 3-17. Governance of laboratories in the Southern African region

A Country with departments dedicated to laboratories within the Ministry of Health	A country with a department that has jurisdiction over both laboratories and other fields (e.g., drug management)	A country where the service provider/ research institution has jurisdiction over the laboratory	Country with multiple departments within the Ministry of Health has jurisdiction over the laboratory	Unknown
Zimbabwe	N/A	South Africa（National Health Laboratory System, NHLS）	Eswatini, Malawi*1, Mozambique*2, Zambia*3, Namibia	Angola*4 Botswana Lesotho

(Source) Ondoa, P., van der Broek, A., Jansen, C., de Bruijn, H., & Schultsz, C. (2017). National laboratory policies and plans in sub-Saharan African countries: gaps and opportunities. *African journal of laboratory medicine*, *6*(1), 578.

*1 Although it is described as "unknown" in the source document, the Diagnostics Unit under the Directorate of Health Technical Services is in charge of the lab service from the literature reviews. On the other hand, the central public health lab (reference lab) is supervised by the Directorate of Preventive Health Services. Therefore, it is listed in the above category.

*2 JEE report of IHR states that the laboratory network in Mozambique is under various directors' jurisdiction.

*3 While the Department of Clinical Care and Diagnostic Services of the Ministry of Health is in charge of laboratory services, ZNPHI will play a central role in public health laboratories.

*4 At the time of this survey, it was impossible to confirm the ministries and agencies' key departments.

[40] Ondoa, P., van der Broek, A., Jansen, C., de Bruijn, H., & Schultsz, C. (2017). National laboratory policies and plans in sub-Saharan African countries: gaps and opportunities. *African journal of laboratory medicine*, *6*(1), 578.

[41] See Footnote 40: Ondoa, P. et al. (2017).

[42] See Footnote 40: Ondoa, P. et al. (2017).

[43] See Footnote 40: Ondoa, P. et al. (2017).

(2) Overview of national core laboratories and laboratory networks

Table 3-18 shows the national core laboratories and laboratory networks in the Southern Africa region. The central laboratories are generally considered to have high laboratory and diagnostic capabilities in some countries. Still, few countries cover all the core tests of IHR, and many of them require the cooperation of neighboring countries, and foreign laboratories are required for laboratory diagnosis. For example, some interviewees at the time of this survey reported that samples were sent to Europe in the early stages of the spread of the COVID-19. The IHR Joint External Evaluation report addresses issues such as financial problems (Eswatini, etc.). Even if inspections are required overseas, there is no official agreement between laboratories with overseas laboratories (Botswana, etc.). Furthermore, many countries have a disparity in testing and diagnostic capabilities (including the maintenance of facilities and equipment) between human laboratories and veterinary laboratories.[44] The laboratory network has a hierarchical network structure for human health, except for Eswatini, which has a small population. Still, the laboratory network for animal health is less systematic than human health in some countries.

The IHR core capacity score and GHS index, which quantitatively indicate the performance status, are shown in "(3) Laboratory network capacity."

Table 3-18. Overview of laboratory network and testing function of national core laboratories in the Southern African region

Country	Overview	
Angola	Laboratory network	For human health, there are provincial labs located in each of the 18 provinces, with the National Health Institute at the top. Besides, some municipalities have their laboratories. For animal health, nine laboratories for animal health have been established in the country. Although there are differences in the laboratories' size and the samples tested, there is no hierarchical relationship among them, and they support each other in their activities. Recently, there is a movement to turn one of the laboratories into a reference laboratory.
	Diagnosable diseases, etc.	The National Health Institute has six laboratories, including molecular biology, immunology, and microbiology, capable of testing and diagnosing bacterial and viral diseases: malaria, dengue fever, chikungunya fever, Zika fever, yellow fever, and new coronavirus infections. For animal health laboratories, the information could not be collected in this survey.
	Challenges, etc.	The National Health Institute is also facing a chronic shortage of human resources and problems in the maintenance of laboratory facilities and equipment and the procurement of test reagents. Laboratory equipment cannot be manufactured in the country, which means that reagents suitable for the equipment must be procured from overseas. After the spread of COVID-19, WHO has supported it, but there is still a great need to strengthen the equipment and technology for genetic analysis.
Botswana	Laboratory network	Public laboratories are divided into levels 1 to 4, and the diagnostic tests at each level are specified. For measles, polio, rotavirus, etc., they participate in regional and global networks.
	Diagnosable diseases, etc.	Testing for HIV, malaria, tuberculosis, and salmonella can be conducted at all levels, but influenza, measles, and cholera are only tested at the Central Lab.
	Challenges, etc.	The laboratories cannot conclude a contract for equipment maintenance service. They do not have public agreements with foreign reference laboratories. The central laboratory has diagnostic technology regarding drug resistance, but it has not been put into practice. Regarding biosafety, pathogens other than HIV and polio cannot be stored, and there is no capacity to have a BSL-3 laboratory.
Eswatini	Laboratory network	The National Reference Laboratory is responsible for human diseases, and there is also a dedicated specimen referral and transport system. Animal diseases are based on the Central Veterinary Laboratory. Veterinarians visit rural areas and send samples to the Central Veterinary Laboratory, but there is no dedicated transportation system.
	Diagnosable diseases, etc.	Human diseases include malaria, measles, meningitis, food poisoning, typhoid fever, and cholera. Animal diseases include tuberculosis, bird flu, brucellosis, salmonella, and rabies.
	Challenges, etc.	Some IHR core laboratory diagnoses are not performed for human diseases and are commissioned to foreign laboratories, relying on the WHO budget. Insufficient maintenance of lab equipment. There is also a lack of coordination between NHL and CVL regarding biosecurity and training for lab staff.

44. As noted in the interview responses during this survey and in external evaluation reports of the IHR in several countries, the difference between human and animal laboratory networks is that the former may require patients to come to a health care facility for testing, while the latter may require outreach to the community to collect specimens for testing.

Country	Overview	
Lesotho	Laboratory network	For human disease, there are 18 county laboratories and the national reference lab in the capital. On the other hand, there is only one national reference laboratory for animal diseases.
	Diagnosable diseases, etc.	Human diseases include cholera, HIV, malaria, measles, meningitis, rubella, tuberculosis, intestinal typhoid, and dysentery. Animal diseases include anthrax, brucellosis, rabies, bird flu, Newcastle disease, etc.
	Challenges, etc.	Laboratories for human diseases are in good condition, including the specimen referral and transport system, quality assurance system, and personnel allocation. Still, it is not systematically managed for the animal disease laboratory due to insufficient facilities, equipment, and personnel. Both human and animal laboratories have not obtained international accreditations. The cooperation between the two is not good. Specimens are not stored in the country, and there is no biosecurity mechanism.
Malawi	Lab network	There is a hierarchical inspection system with the reference lab at the top for human and animal diseases. Lower-level facilities that do not have testing facilities refer samples to the central laboratories, the reference laboratories, and overseas laboratories.
	Diagnosable diseases, etc.	Human diseases include HIV, TB, and measles. Animal diseases include rabies, bovine tuberculosis, brucellosis, cysticercosis, and African human trypanosomiasis. The Measles Reference Lab is internationally accredited with support from WHO.
	Challenges, etc.	Management of priority diseases and zoonotic diseases, specimen referral, transport system, etc., are not unified between human and animal sectors. Although the human health lab network covers the country, it is not sufficient for animal health. There is no written description of hierarchical testing strategies from lower to higher laboratories. The equipment required for testing is not entirely in place. There are some activities regarding biosafety and biosecurity, but they are not systematically conducted, and the budget is not sufficient. Lab data is not integrated with surveillance data.
Mozambique	Lab network	The National Institute of Health leads about ten reference laboratories, and a hierarchical network has been built regarding human diseases. There are provincial laboratories in each province, with the central veterinary laboratory at the top regarding animal diseases. Some human reference laboratories have obtained international accreditations. There is also a national quality assurance program.
	Diagnosable diseases, etc.	Human and animal diseases related to bacteria and viruses; tuberculosis and smear microscopic examination, rapid malaria examination, HIV serum examination, microscopic examination of parasites in the digestive organs, etc., are conducted daily.
	Challenges, etc.	In addition to the lack of human resources, there is insufficient testing capacity at the province/county/facility level. Some health facilities are not equipped with electricity, water, and equipment, insufficient cooperation between human and animal laboratories. Animal laboratories are not involved in the testing and diagnosis of the COVID-19. Some AMRs are monitored at central and provincial hospitals, but there is no comprehensive national strategy and no national surveillance. Regarding biosafety, the management system and various laws and regulations are being developed, but it is not sufficient, and there are still problems in laboratory accreditation and pathogen management.
Namibia	Laboratory network	There is no public health lab for human illness, and only clinical laboratory services are available. The clinical laboratory service is supervised by the National Institute of Pathology, a state-owned enterprise. For animal health, the central veterinary laboratory under the Ministry of Agriculture is in charge of laboratory diagnosis.
	Diagnosable diseases, etc.	Ebola hemorrhagic fevers, measles, rubella, tuberculosis, HIV, malaria, rabies, anthrax, etc., are tested.
	Challenges, etc.	Insufficient human resources and infrastructure. Collaboration between human and animal laboratories is not sufficient. There is also no coordination mechanism between the two sectors for AMR. There are biosafety regulations, but only for genetically modified organisms. Both the National Institute of Pathology and the Central Veterinary Lab have bio-safety manuals, but there is no coordination between them.
South Africa	Laboratory network	Human diseases are managed under a service contract between the National Health Laboratory Service (NHLS) and each province. Under NHLS, there are 10 central laboratories, 17 provincial laboratories, 44 district laboratories, and 150 county laboratories, including the National Institute of Communicable Diseases, an international hub laboratory. The Agricultural Research Council-Onderstepoort Veterinary Research (ARC-OVR) has 7 reference laboratories for OIE for animal diseases.
	Diagnosable diseases, etc.	For human diseases, information is not available, but a BSL-4 lab can handle many diseases. Animal diseases include African horse sickness, African swine fever, bluetongue virus, foot-and-mouth disease, rabies, Rift Valley fever, etc.
	Challenges, etc.	The staffing of the laboratory is uneven. It is challenging to secure a sufficient number of lab personnel due to the long training period and low pass rate. Access to veterinary laboratories and their coverage is lower than in human health. More investment is needed for provincial and lower labs. Regarding AMR, the strengthening plan has been announced, but the capacity of the laboratory is not yet sufficient.
Zambia	Laboratory network	Zambia has about 300 public health laboratories and a three-tiered (reference, region, county/state) lab network. A university teaching hospital heads the lab network, the Central Veterinary Research Institute, the National Food and Drug Control Lab, the National Chest Disease Lab, the UNZA/School of Veterinary Medicine, and 5 Regional laboratories of the Institute of Veterinary Research.
	Diagnosable diseases, etc.	Core tests for pathogens as defined by IHR are performed. Several BSL-3 laboratories can handle highly contagious pathogens such as viral hemorrhagic fever.

Country	Overview	
	Challenges, etc.	Reference laboratories are concentrated in the capital, limiting the capacity of rural laboratories. Lab data is not shared with other ministries and is not linked to surveillance. There is weak coordination between sectors and laboratories regarding biosafety and security. The training and Standard Operating Procedures are not in line with needs and are not unified across sectors. The capacity of the entire laboratory network is not always high for animal health.
Zimbabwe	Laboratory network	There is a hierarchical network structure consisting of 3 reference laboratories, 5 central laboratories, 8 provincial laboratories, 64 other (district/mission/private/municipal, etc.) laboratories, and 1,500 clinical laboratories in the clinics. Each role is stipulated in the policy document. Some of these laboratories are internationally accredited and have undergone external quality assurance inspections by the Zimbabwe National Quality Assurance Program and the National Institute of Communicable Diseases in South Africa.
	Diagnosable diseases, etc.	6 of the 10 core tests listed in the IHR are performed. There is no clear policy on what to do with the remaining four types of tests.
	Challenges, etc.	Due to a serious shortage of human resources, about half of the lab posts are vacant. Equipment maintenance contracts are also a challenge. Cooperation between human and animal health sectors is insufficient. Lab data is not used for surveillance. As for the veterinary lab, much of the equipment is old and needs to be updated. There is no in-country lab accreditation body. Due to lack of budget, only two types of drug resistance (Salmonella and E. coli) are monitored regarding AMR. Regarding biosafety, it has 3 BSL-3 laboratories (2 for humans and 1 for the animal), but they need to be redeveloped.

(Source) Latest analysis reports of IHR core capacity in each country (published in any year from 2016 to 2019) and online interviews.

3-5-3. Laboratory network capacities of the Southern African countries

Concerning the management of the laboratory network, the evaluation of IHR core capacity and the GHS index's evaluation are shown in Table 3-19 below. South Africa's situation is outstandingly good in the Southern Africa region, while it is deficient in Angola, Malawi, and Zambia. For example, in Zambia, the IHR Joint External Evaluation report and the GHS Index each point out that there are many problems with inadequate specimen transport systems and laboratory quality control.[45]

Table 3-19. IHR Core Capacity Score and GHS Index for lab network management in the Southern African region

Country	IHR Core CapacityScore*				GHS Index	
	Laboratory testing for detection of priority diseases (D1.1)	Specimen referral/transport system (D1.2)	Effective modern point-of-care and laboratory-based diagnostics (D1.3)	Laboratory Quality System (D1.4)	Laboratory system ** (2.1)	Ranking (out of 195 countries)
Angola	Unknown	Unknown	Unknown	Unknown	16.7	161
Botswana	4	4	3	3	66.7	60
Eswatini	4	4	2	2	58.3	87
Lesotho	4	1	3	2	41.7	123
Malawi	2	2	2	2	16.7	161
Mozambique	3	3	2	2	50.0	95
Namibia	4	4	3	4	58.3	87
South Africa	5	4	3	3	100.0	1
Zambia	4	2	3	3	25.0	156
Zimbabwe	4	4	2	2	75.0	52
Average of 10 countries	3.8	3.1	2.6	2.6	50.8	-

* Lowest point 1, highest point 5

** The laboratory system is determined by three points: 1) laboratory and diagnostic capacity, 2) specimen transport, and 3) quality assurance mechanism. 1) laboratory and diagnostic capacity is determined by 1.1) the number of diseases that can be tested and diagnosed, and 1.2) whether or not the procurement of testing equipment and reagents is institutionalized. 2) Specimen transport depends on 2.1) the status of involvement in regional and international networks and 2.2) the presence or absence of a domestic transportation system. 3) The quality assurance mechanism is 3.1) Certification status to function as a reference lab, 3.2) Evaluated by the introduction status of external quality assurance to serve as a reference lab. However, although the current status analysis of each index is published on the GHS website, there is no breakdown of the points

(Source) IHR Core Capacity Score: The latest version of each country's IHR Core Capacity Analysis Report (published in any year 2016-2019)

GHS Index: Nuclear Threat Initiative and Johns Hopkins Bloomberg School of Public Health (2020) Global Health Security index 2019 Building Collective action and Accountability

[45] Since the GHS index is scored based on existing published materials, it is considered to be stricter than the IHR evaluation. For example, even though the JEE report states that Zambia has an external quality assurance system for laboratories, the GHS index states that "the specific status of system operation, including the JEE report, could not be confirmed."

3-5-4. SLIPTA accreditation status of laboratories in the Southern African countries

As mentioned in the previous section, SLIPTA is an accreditation system by WHO/AFRO that aims to meet the requirements for obtaining ISO 15189, the international standard for clinical laboratories. In other words, a 5-star rating means that the organization is ready to receive ISO 15189 (clinical laboratories).

Since 2013, a total of 209 laboratories in the Southern African region have been SLIPTA accredited. Of these, only 5 in South Africa and one in Zambia have received 5 stars. It has also been pointed out that the number of laboratories trying SLIPTA accreditation is low compared to the total number of laboratories in each country.[46] For example, there are 1,608 public and private laboratories in Zambia, but only 4 (0.25%) have been accredited. Even in Zimbabwe, which has a health policy of SLIPTA accreditation and is one of the countries with relatively high number of the accreditation, only 35 out of 1630 facilities (2.1%) are accredited.[47]

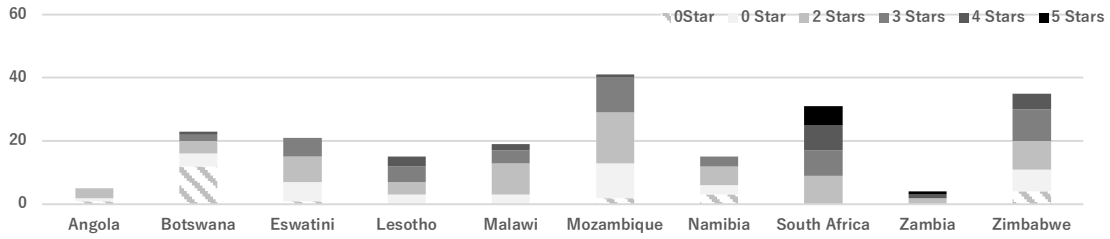

Figure 3-5. Number of SLIPTA accredited laboratories in the Southern African region (as of the end of September 2020)
(Source) https://aslm.org/slipta-database-analysis/

It has been pointed out that there are issues unique to the SLIPTA program as a factor behind the low number of accreditations. For example, not all laboratories can be covered without sufficient financial resources, and there is no easy-to-understand indicator linking laboratory quality assurance to improving people's health. Under such circumstances, advocacy activities for policymakers are challenging to be effective. The rules and policy frameworks are not sufficient. They do not spread within each country.[48] Although quality assurance related to diagnosis for individual diseases for which support has been directed through assistance (such as HIV) is being carried out, it has not led to the development of a cross-disease laboratory quality assurance program.[49]

Under these circumstances, there are trends to support the expansion of SLIPTA. For example, the Africa CDC Regional Investment Financing Program of the World Bank, which also targets Zambia, sets "increasing the number of BSL-2 and BSL-3 laboratories to receive 2 and 3 stars" as an indicator of project goals.[50]

3-5-5. AMR control in the Southern African Countries

The situation in each country regarding AMR is shown in Table 3-20, and the overall condition is not good.

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[46]. See Footnote 40: Ondoa, P. et al. (2017).
[47] See Footnote 40: Ondoa, P. et al. (2017).
[48]. See Footnote 40: Ondoa, P. et al. (2017).
[49] Ondoa P, Datema T, Keita-Sow MS, Ndihokubwayo JB, Isadore J, Oskam L, Nkengasong J, Lewis K. (2016) A new matrix for scoring the functionality of national laboratory networks in Africa: introducing the LABNET scorecard. Afr J Lab Med. 5(3):498.
[50] World Bank (2019) Africa CDC Regional Investment Financing Program (P167916)Combined Project Information Documents / Integrated Safeguards Datasheet (PID/ISDS)

Table 3-20. IHR Core Capacity Score and GHS Index for AMR in the Southern African region

Country	IHR Core Capacity Score*				GHS Index	
	Antimicrobial Resistance detection	Surveillance of infections caused by antimicrobial-resistant pathogens	Health care associated infection prevention and control programs	Antimicrobial stewardship activities	Prevention of AMR（1.1）**	Ranking (out of 195 countries)
Angola	Unknown	Unknown	Unknown	Unknown	0.0	165
Botswana	1	1	1	1	25.0	122
Eswatini	1	1	1	1	75.0	22
Lesotho	1	1	3	1	50.0	79
Malawi	3	2	1	1	33.3	109
Mozambique	1	2	3	1	33.3	109
Namibia	1	1	1	1	50.0	79
South Africa	3	3	1	2	58.3	61
Zambia	4	4	3	3	33.3	109
Zimbabwe	2	3	2	2	50.0	79
Average of 10 countries	1.9	2.0	1.8	1.4	40.8	

* Lowest point 1, highest point 5
*** The scores for AMR are as follows; 1) If there is a national plan for AMR for surveillance, detection, and reporting of priority pathogens for AMR, 2) If there is a laboratory or laboratory system for testing and diagnosing priority pathogens related to AMR?, 3) Determined by two points: environment detection and surveillance. However, although the current status analysis of each index is published on the GHS website, there is no breakdown of the points.
(Source) IHR Core Capacity Score: The latest version of each country's IHR Core Capacity Analysis Report (published in any year 2016-2019)
GHS Index：Nuclear Threat Initiative and Johns Hopkins Bloomberg School of Public Health (2020) Global Health Security index 2019 Building Collective action and Accountability

To improve this situation, WHO launched an action plan in 2015, including a proposal for the Global Antimicrobial Resistance Surveillance System (GLASS).[51] Based on this plan, WHO/AFRO and Fleming Fund are conducting sensitization activities about AMR control, policy development such as the formulation of the national AMR control action plan, and strengthening laboratory diagnostic ability and surveillance through financial and technical cooperation the AMR countermeasure system in each country.[52]

However, it has been pointed out that since the infrastructure and surveillance system for testing and diagnosis are generally fragile in the African region, and it is not always easy to create policies, systems, and programs after collecting and analyzing information and data related to AMR.[53,54] GLASS proposes quality control by antibiotic susceptibility test (AST), but it is reported that the countries in Africa region do not have sufficient capacity to carry it out.[55] In such a vulnerable AMR control system, there is a concern about "a pandemic threat of resistant bacteria that occurs after COVID-19" in the spread of COVID-19.[56,57]

Table 3-20 shows that IHR's core capacity and GHS index do not necessarily indicate similar countries' trends. For example, Zambia has good IHR core capacity scores but a low GHS index value. Since the GHS Index incorporates human and animal, and environmental efforts into the evaluation, it was not possible to confirm related measures in Zambia from existing materials. Similarly, Eswatini has a poor IHR core capacity score but a high GHS index. One of the reasons for this is that Eswatini has different index standards and implements environmental activities.

3-5-6. One Health approach in the Southern African countries

In the African region, a One Health approach focusing on the relationship between humans, animals, the

[51] WHO (2015) Global Action Plan on Antimicrobial Resistance
[52] WHO (2018) Global antimicrobial resistance surveillance system (GLASS) report: early implementation 2017-2018
[53] WHO (2014) Antimicrobial resistance: global report on surveillance
[54] Bernabé KJ, Langendorf C, Ford N, Ronat JB, Murphy RA. Antimicrobial resistance in West Africa: a systematic review and meta-analysis. Int J Antimicrob Agents. 2017 Nov;50(5):629-639.
[55] Perovic O, Yahaya AA, Viljoen C, et al. External Quality Assessment of Bacterial Identification and Antimicrobial Susceptibility Testing in African National Public Health Laboratories, 2011-2016. Trop Med Infect Dis. 2019;4(4):144. Published 2019 Dec 13. doi:10.3390/tropicalmed4040144
[56] Egyir B, Obeng-Nkrumah N, Kyei GB. COVID-19 pandemic and antimicrobial resistance: Another call to strengthen laboratory diagnostic capacity in Africa. Afr J Lab Med. 2020;9(1):1302. Published 2020 Sep 23.
[57] Tetsuya Matsumoto (2020) Challenges for prudent use of antimicrobial agents under the influence of COVID-19 Ignazo September issue https://www.bdj.co.jp/safety/articles/ignazzo/hkdqj200000w9xqk.html

environment, etc., is promoted to strengthen the health system and AMR control measures to deal with zoonotic diseases. For example, the AU included the One Health approach in its long-term development plan, Agenda 2063, and its affiliate, the Africa CDC, held its first One Health Forum in November 2019.[58] Furthermore, Zambia has articulated the One Health approach as one of its strategies to combat AMR.[59]

Table 3-21 shows the One Health approach's current status in each country in Southern Africa. "Building and functionalizing mechanisms for infectious and potentially zoonotic diseases" is generally low in IHR core capacity, and both of the two indicators are low in the GHS index. It is suggested that the human and animal health systems are not well integrated. At the Africa CDC Forum, it reports on a wide range of issues for the implementation of the One Health approach, such as issues within each sector and at the central, province, district, and community levels, problems of coordination and coordination of intersectoral systems (surveillance) and cooperation and coordination among countries.[60] Although. the importance of One Health approach was understood in the interviews for this survey, there is no firm and unified concept among the interviewees regarding the One Health approach. Some said that cooperation between sectors has just begun. Some include informal laboratory cooperation in the One Health approach, and others said that the laboratory is not included in the discussion of the One Health approach. Some talked about the One Health approach as the policy and institutional cooperation between sectors.

In response to this situation, the Africa CDC has developed a One Health approach framework and released it in October 2020.[61]

Table 3-21. IHR Core Capacity Score and GHS Index for zoonotic diseases in the Southern African region

Country	IHR Core Capacity Score*			GHS Index			
	Surveillance systems in place for priority zoonotic diseases/pathogens (P4.1)	Veterinary or animal health workforce	Mechanisms for responding to infectious and potentially zoonotic diseases are established and functional (P4.2)	Prevention of zoonotic diseases (1.2)***	Ranking (out of 195 countries)	Data integration related to humans, animals, and the environment (2.4) ****	Ranking (out of 195 countries)
Angola	Unknown	Unknown	Unknown	6.8	151	0.0	59
Botswana	4	4	1	16.3	120	0.0	59
Eswatini	3	4	2	14.6	125	0.0	59
Lesotho	3	4	2	4.4	160	0.0	59
Malawi	1	N/A**	1	0.8	172	0.0	59
Mozambique	3	2	1	8.8	134	0.0	59
Namibia	5	4	2	34.6	70	0.0	59
South Africa	4	4	4	53.9	29	100.0	1
Zambia	3	4	1	0.9	171	0.0	59
Zimbabwe	3	3	3	29.9	83	100.0	1
Average of 10 countries	3.2	3.6	1.9	17.1	-	20.0	

* Lowest point 1, highest point 5

** An analysis of Malawi's core capacity was conducted in 2019, but the analysis items excluded "human resources related to veterinarians or animal health."

***Zoonotic disease prevention are evaluated by the following 5 points for 1) legislation, 2) surveillance system, 3) international reporting on animal disease outbreaks, 4) animal health personnel, and 5) private sector involvement.

**** Data integration for humans, animals, and the environment is related to livestock, wildlife, and human surveillance. It is evaluated by whether the related ministries and agencies have a system for sharing information and data.

(Source) IHR Core Capacity Score: The latest version of each country's IHR Core Capacity Analysis Report (published in any year 2016-2019

GHS Index：Nuclear Threat Initiative and Johns Hopkins Bloomberg School of Public Health (2020) Global Health Security index 2019 Building Collective action and Accountability

[58] Africa CDC (2020) Meting Report 1st International One Health Forum. 14-15 November 2019. Addis Ababa, Ethiopia

[59] SIDA, ZNPHI, CSE (2020) Zambia's Integrated Antimicrobial Resistance Surveillance Framework

[60] See Footnote 58: Africa CDC (2020)

[61] Africa CDC (2020) Framework for One Health Practice in National Public Health Institutes – Zoonotic Disease Prevention and Control

3-5-7. Biosafety/Biosecurity status in the Southern African countries

Table 3-22 shows the IHR core capacity scores and GHS indexes of biosafety and biosecurity in the Southern Africa countries. The overall scores are low. It has been pointed out that the establishment of biosafety and biosecurity systems is one of the issues for dealing with infectious diseases and health crises in the Southern African region, and issues such as technical and infrastructure challenges have been raised.[62] For example, on the technical side, problems such as not being included in laboratories' regular supervision, lack of training, guidelines, and SOPs lack linkage between theory and practice. There are issues such as low awareness of the importance of laboratory management and lack of discussion on ethics in terms of recognition and others.[63,64]

While there are many challenges, from the perspective of the One Health approach, the importance of biosafety and biosecurity is also increasing from the perspective of coordinating laboratories in different sectors, thereby improving the efficiency of early detection and analysis of pathogens and providing a safe work environment.[65,66,67]

Table 3-22. Biosafety and biosecurity IHR Core Capacity Score and GHS Index in the Southern African region

Country	IHR Core Capacity Score*		GHS Index			
	Construction of government biosafety and biosecurity systems for humans, animals and agricultural facilities (P6.1)	Training and practice for biosafety and biosecurity (P6.2)	Biosecurity (1.3)	Ranking (out of 195 countries))	Biosafety (1.4) ***	Ranking (out of 195 countries)
Angola	Unknown	Unknown	0.0	107	50.0	21
Botswana	2	2	0.0	107	0.0	75
Eswatini	1	1	20.0	64	0.0	75
Lesotho	2	2	0.0	107	0.0	75
Malawi	1	1	20.0	64	0.0	75
Mozambique	2	2	0.0	107	0.0	75
Namibia	1	1	4.0	83	0.0	75
South Africa	3	3	8.0	79	50.0	21
Zambia	2	1	0.0	107	0.0	75
Zimbabwe	1	1	0.0	107	0.0	75
Average of 10 countries	1.7	1.5	6.2		11.2	

* Lowest point 1, highest point 5

*** Biosecurity includes 1) the existence of a government-wide biosecurity system, 2) the development of laws and regulations, 3) the promotion agency for legal and regulatory development, and 4) the storage of dangerous pathogens and substances based on evidence in the minimum number of facilities, 5) the ability to carry out PCR tests for anthrax and Ebola. Biosafety is judged by 1) the status of legal and regulatory development, 2) the promotion agency for legal and regulatory development, and 3) the training implementation status.

(Source)

IHR Core Capacity Score: The latest version of each country's IHR Core Capacity Analysis Report (published in any year 2016-2019)

GHS Index：Nuclear Threat Initiative and Johns Hopkins Bloomberg School of Public Health (2020) Global Health Security index 2019 Building Collective action and Accountability

3-5-8. Data management/Reporting system in the Southern African countries

In the African region, integration of laboratories and surveillance is an issue,[68] and IHR Joint External Evaluation reports of some Southern Africa countries also point out that laboratory data are not utilized for surveillance. To develop an appropriate laboratory information management system (hereinafter referred to

[62] AFRO (2015) The Current State of Biosafety in the African region. Biosafety Global Stakeholders Meeting Strengthening Laboratory Biosafety through Innovation and Sustainability September 23-24, 2015, Emory Conference Center, Atlanta, GA (presentation document)

[63] See Footnote 62: AFRO (2015)

[64] Academy of Science of South Africa (2018) The State of Laboratory Biosafety and Biosecurity in the Southern African Development Community (SADC) Region

[65] Melissa R. Finley (2010) One Health: Relevance to Laboratory Biosafety and Biosecurity （presentation document）

[66] See Footnote 59 : Africa CDC (2020)

[67] Ahmad T, Haroon, Dhama K, et al. Biosafety and biosecurity approaches to restrain/contain and counter SARS-CoV-2/COVID-19 pandemic: a rapid-review. Turk J Biol. 2020;44(3):132-145.

[68] Onyebujoh PC, Thirumala AK, Ndihokubwayo JB. (2016) Integrating laboratory networks, surveillance systems and public health institutes in Africa. Afr J Lab Med. 2016;5(3):431.

as "LIMS"), it is essential to access computers and the Internet, and other equipment necessary for information transmission.[69] As shown in Table 3-23, the information infrastructure that supports LIMS is not always sufficiently developed in the Southern African region. Some of the interviewees at the time of this survey cited the development of communication infrastructure as one important issue for their activities.

Under these circumstances, the WHO/AFRO Guidance for Establishing a National Health Laboratory System describes LIMS and suggests integrating laboratory data for surveillance and other health information management systems and human resource development and allocation for LIMS.[70] The SLIPTA check items also include items related to LIMS.[71] Recently, IDSR's regional strategy monitoring indicators have incorporated indicators that encourage laboratory data for surveillance and other purposes. WHO has also released WHONET (https://whonet.org/), a free application, to collect and utilize laboratory data related to microorganisms, especially AMR, and encourages each country to use it. The same applies to the animal health sector, with FAO and OIE playing a central role in strengthening information management systems.[72,73]

Table 3-23. Access to Communication Infrastructure in the Southern African region

Countries	GHS Index	
	Access to Communication Infrastructure (3.6)	Ranking (out of 195 countries)
Angola	49.7	178
Botswana	68.4	121
Eswatini	58.7	154
Lesotho	77.1	92
Malawi	41.7	186
Mozambique	57.7	157
Namibia	69.2	118
South Africa	86.0	56
Zambia	61.1	147
Zimbabwe	62.3	143
Average of 10 countries	63.2	

(Source) GHS Index：Nuclear Threat Initiative and Johns Hopkins Bloomberg School of Public Health (2020) Global Health Security index 2019 Building Collective action and Accountability

3-5-9. Materials and equipment in the Southern African countries

Although there is no country-specific quantitative data on infectious disease control materials and equipment, it is pointed out that the shortage is not a new problem in Africa and has an adverse effect on laboratory diagnosis, research, and educational activities.[74,75] In particular, since the epidemic of COVID-19, the problem of lack of materials and equipment has been pointed out, including medical supplies such as alcohol and masks, laboratory and diagnostic equipment such as PCR and necessary reagents, medical equipment such as ICU beds and respirators, and medicines.[76,77] In addition, funds are needed to make up for these shortages, and even if there are funds, as the Lancet magazine states, it is not always easy for the African countries to fill these shortages from the perspective of the North-South divide. The Lancet magazine also draws attention to this particular issue using the lessons of HIV in the past as an example.[78]

Regarding laboratory and diagnostic equipment, in an interview for this survey, officials from five countries

[69] See Footnote 37: Best M, Sakande J. (2016)
[70] WHO/AFRO (2014) Guidance for Establishing a National Health Laboratory System
[71] WHO/AFRO (2020) Guide for the Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA) in the WHO African Region
[72] Colangeli P, Del Negro E, Molini U, Malizia S, Scacchia M. (2019) "SILAB for Africa": An Innovative Information System Supporting the Veterinary African Laboratories. Telemed J E Health. 25(12):1216-1224.
[73] OIE (2019) A summary of the Strengthening Veterinary Services in Developing Countries (SVSDC) Project, 2016 – 2019
[74] Petti CA, Polage CR, Quinn TC, Ronald AR, Sande MA. Laboratory medicine in Africa: a barrier to effective health care. Clin Infect Dis. 2006 Feb 1;42(3):377-82. doi: 10.1086/499363. Epub 2005 Dec 20. PMID: 16392084.
[75] Webb H., Nurse JRC, Bezuidenhout L., Jirotka M.. . Lab Hackathons to Overcome Laboratory Equipment Shortages in Africa: Opportunities and Challenges. In ,. ACM, New York, NY, USA, 8 pages
[76] UN Webpage. Local production could solve shortages of essential pandemic-fighting equipment. https://www.un.org/technologybank/content/local_production_could_solve_shortages_pandemic_fighting_equipment
[77] Tony Blair Institute for Global Change (2020) COVID-19: Repurposing Manufacturing to Address Medical-Equipment Shortages in Africa
[78] Kavanagh MM, Erondu NA, Tomori O, Dzau VJ, Okiro EA, Maleche A, Aniebo IC, Rugege U, Holmes CB, Gostin LO. Access to lifesaving medical resources for African countries: COVID-19 testing and response, ethics, and politics. Lancet. 2020 May 30;395(10238):1735-1738.

reported that there was a shortage of molecular diagnostic equipment. Although the literature review is not limited to the Southern African region, it is estimated that a large amount of money will be required to meet the needs for equipment maintenance after the spread of COVID-19, as shown in Table 3-24.

Table 3-24. Estimated equipment maintenance and procurement costs (unit: dollars)

Items	South Africa	Ethiopia	Kenya	Senegal	Ghana
Testing and diagnostic equipment (PCR, antigen/antibody testing, chemical reagents, infrared thermometers, etc.)	30-40 mil	200 k - 2 mil	475 k – 8.8 mil	470 k – 8.6 mil	472 k – 8.7 mil

(Source) Tony Blair Institute for Global Change (2020) COVID-19: Repurposing Manufacturing to Address Medical-Equipment Shortages in Africa

In the spread of infection with COVID-19, attention is mainly focused on (1) molecular diagnosis targeting virus genes and (2) immunodiagnostic measurement using antibodies and antigens. For this survey, (1) is focused on given the role of the central laboratory, but in addition to the lack of equipment for molecular diagnosis, the following also need to be discussed; human resources and reagents that can handle equipment, supplies of materials and equipment related to sample collection, transport of specimens to the central lab, materials and equipment related to processing and analysis of laboratory test results.[79]

As COVID-19 spreads, there is also a movement to utilize laboratory facilities, equipment, human resources, specimen transportation systems, etc., that have been developed as measures against HIV and tuberculosis as measures to alleviate various resource shortages.[80] For example, the GeneXpert can be used as COVID-19 testing to replace PCR testing. Table 2-24 shows the situation of procurement of GeneXpert modules and cartridges.

Table 3-25. GeneXpert procurement in the Southern African region (until the end of 2016)

Country	Number of Xpert modules procured	Number of cartridges procured	Country	Number of Xpert modules procured	Number of cartridges procured
Angola	88	13,000	Mozambique	266	283,620
Botswana	154	49,780	Namibia	288	146,630
Eswatini	204	283,260	South Africa	4,395	10,853,000
Lesotho	172	139,950	Zambia	358	193,580
Malawi	296	177,700	Zimbabwe	584	394,490

(Source) WHO monitoring of GeneXpert MTB/RIF roll-out: Procurements of GeneXpert and GeneXpert MTB/RIF cartridges (https://apps.who.int/tb/laboratory/xpertmap/

3-6. Education system for laboratory technicians in the Southern African countries

For laboratory technicians, the situation is considered more severe than for doctors, nurses, and midwives. In addition to the limited number of personnel shown in Table 3-26, according to the World Bank, clinical laboratory technicians have been "neglected" in the health system of the African region.[81]

Thus, the laboratory technicians often work in laboratories where facilities and equipment are not maintained, and systematic consideration is not given to the safety of laboratory technicians against infections in the workplace.[82] Such a situation leads to a decrease in laboratory technicians' performance, which causes a loss of trust from doctors, resulting in a vicious cycle where the laboratory results are not utilized in the end.[83] It is pointed out that while professional and regulatory groups are functioning as doctors, nurses,

[79] Behnam M., Dey A. Gambell T., Talwar V. (2020) COVID-19: Overcoming supply shortages for diagnostic testing. McKinsey & Company. https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/covid-19-overcoming-supply-shortages-for-diagnostic-testing#

[80] WHO (2020) Existing HIV and TB laboratory systems facilitating COVID-19 testing in Africa. https://www.who.int/news/item/26-11-2020-existing-hiv-and-tb-laboratory-systems-facilitating-covid-19-testing-in-africa

[81] World Bank (2014) Laboratory professionals in Africa: the Backbone of Quality Diagnostics. The World Bank Discussion Paper

[82] See Footnote 81: World Bank（2014）

[83] See Footnote 81: World Bank（2014）

midwives, etc., those groups are not necessarily serving as laboratory technicians. Therefore, the situation described above has not been corrected.[84]

Table 3-26. Allocation of major lab personnel in the Southern African region

Country	Medical/ pathology lab scientists (persons)	Medical /pathology lab technicians (persons)	Number of veterinarians working in public labs (persons)	Number of veterinarians working in private labs (persons)	Number of veterinarians in academic/ educational institutions (persons)
Angola	-	1376 (2004)	30 (2018)	10 (2018)	178 (2018)
Botswana	35 (2004)	317 (2009)	15 (2018)	-	12 (2018)
Eswatini	-	41 (2011)	1 (2018)	-	-
Lesotho	-	73 (2003)	1 (2016)	-	2 (2015)
Malawi	-	397 (2016)	5 (2018)	-	6 (2018)
Mozambique	144 (2006)	1958 (2017)	31 (2018)	3 (2018)	197 (2018)
Namibia	-	160 (2004)	7 (2018)	1 (2016)	23 (2018)
South Africa	149 (2015)	453 (2015)	3 (2018)	8 (2018)	96 (2018)
Zambia	441 (2018)	1126 (2012)	43 (2018)	11 (2016)	73 (2016)
Zimbabwe	644 (2018)	1126 (2018)	25 (2018)	9 (2018)	54 (2018)

(Source) Medical and pathology lab scientists, medical and pathology lab technicians: WHO website https://apps.who.int/gho/data/node.main.HWFGRP_00120?lang=en (Accessed January 25, 2021)
Veterinarians: OIE WAHIS Interface - Veterinarians and veterinary para-professionals https://www.oie.int/wahis_2/public/wahid.php/Countryinformation/Veterinarians (Accessed January 25, 2021)

The basic education of laboratory technicians in the African region also has many problems. For example, the basic curriculum of laboratory technicians is not standardized in the African region in general. There are many classroom lessons without practical training equipment used in the actual workplace.[85] This is accredited to the lack of medical equipment in schools, lack of financial resources, and shortage of teachers with expertise and sufficient training.[86,87]

It is also reported that the curriculum does not always meet the needs of the public sector.[88] In an interview for this survey, it was mentioned that some veterinary laboratories in some countries hire those with bachelor's degrees or post-high school level laboratory technicians. Still, one of the challenges was that they had no prior education in veterinary medicine. In addition, an interviewee mentioned that some laboratory technicians prefer to work in labs neighboring countries that have a good reputation in the field. Although there are similar problems with in-service training, it has been reported that training opportunities are limited in the first place.[89,90,91] Even if there are training opportunities, in most cases, the only options available are non-structured in-house training organized by employers.[92]

[84] See Footnote 24: WHO/AFRO (2012)
[85] See Footnote 81: World Bank（2014）
[86] Fonjungo PN, Kebede Y, Arneson W, Tefera D, Yimer K, Kinde S, Alem M, Cheneke W, Mitiku H, Tadesse E, Tsegaye A, Kenyon T. Preservice laboratory education strengthening enhances sustainable laboratory workforce in Ethiopia. Hum Resour Health. 2013 Oct 28;11:56. doi: 10.1186/1478-4491-11-56. PMID: 24164781; PMCID: PMC3815253.
[87] See Footnote 81: World Bank（2014）
[88] See Footnote 81: World Bank（2014）
[89] Kasvosve I, Ledikwe JH, Phumaphi O, Mpofu M, Nyangah R, Motswaledi MS, Martin R, Semo BW. Continuing professional development training needs of medical laboratory personnel in Botswana. Hum Resour Health. 2014 Aug 18;12:46. doi: 10.1186/1478-4491-12-46. PMID: 25134431; PMCID: PMC4141587.
[90] See Footnote 81: World Bank（2014）
[91] Kiwanuka SN, Namuhani N, Akulume M, Kalyesubula S, Bazeyo W, Kisakye AN. Uganda's laboratory human resource in the era of global health initiatives: experiences, constraints and opportunities-an assessment of 100 facilities. Hum Resour Health. 2020;18(1):13. Published 2020 Feb 18. doi:10.1186/s12960-020-0454-5
[92] See Footnote 89:. Kasvosve I et al (2014).

Table 3-27: Status and issues related to human resource development of laboratory technologists in the four countries of the online interviews and questionnaire survey

Countries	Issues
Angola	Human health: About 90% of the National Health Institute technicians have studied at overseas institutions, and the in-country education system is weak. After joining the National Health Institute, a training program is provided for recruits. Still, participation in subsequent training programs is limited because there is no support for participants, even though a training plan exists. Anima health: Although the veterinary department is interested in cooperating with the veterinary service of the Ministry of Agriculture, the Ministry of Agriculture cannot be involved in the development of basic education and curricula in the field of veterinary medicine because it is under the jurisdiction of the Ministry of Higher Education.
Malawi	Human health: A Ph.D. degree is difficult to obtain in the country and requires study abroad, which is expensive and is difficult to find a scholarship provider for. It is necessary to improve higher education institutions. It is possible to obtain a bachelor's degree in laboratories at the universities in the country. Animal health: The country's first veterinary school was established in 2012, and the first graduating class is currently in its first year. Before that, veterinary qualifications were obtained at foreign universities with donor funding. The veterinary school facilities and equipment are not sufficient, and practical training is conducted at the Central Veterinary Laboratory.
Mozambique	Human health: About half of the National Institutes of Health technicians have a master's degree, and the rest have a bachelor's degree or higher. The National Institute of Health collaborates with universities and has a master's degree program, but no institution can offer a doctoral program. On the other hand, there are few highly educated engineers in rural areas. Animal health: It is difficult to secure "well-trained" personnel. There are few training institutions for laboratory technicians and few graduates. There is a need for post-graduate and in-service training, but it takes time to develop personnel. The Agricultural Research Institute of Mozambique (IIAM) has also stopped providing in-service training at the intermediate level.
Zimbabwe	Human health: There are not many issues related to human resources at the central level, but there is a need to strengthen technicians' capacity below the central level. However, there is not enough of a budget to conduct training and provide supervision to the lower laboratories. Animal health: University of Zimbabwe Faculty of Veterinary Science was one of the leading institutions in the Southern African region but was unable to maintain its quality due to the exodus of many graduates and professionals.

(Source): Responses to online interviews with stakeholders

3-7. Regional laboratory network in the Southern African countries

Rapid sharing of surveillance and laboratory data between the Member States is emphasized as a link for early detection, timely response, and more evidence-based decision-making in Regional strategy for integrated disease surveillance and response 2020-2030. This has also been mentioned even in the past regional strategy.[93] Similarly, Africa CDC acknowledges the importance of the network and builds five laboratory networks centered on five regional core laboratories in Africa.[94]

Following are the various networks on infectious disease control in Africa to detect the public health crisis. Each country's national core laboratory in the Southern Africa region belongs to at least one of the laboratory networks. Also, there are some networks that are not under the jurisdiction of WHO/AFRO, such as those established by the CDC in Africa, and various networks led by research institutes that are not listed below. There are also non-profit organizations such as ASLM, which works with WHO/AFRO,[95] the Africa CDC, and the U.S. CDC to strengthen laboratory networks in the African region and make policy recommendations.

- WHO: Emerging and Dangerous Pathogens Laboratory Network in the African Region (hereinafter referred to as "AFR EDPLN")
- WHO: Influenza Laboratory Network
- WHO: Polio Laboratory Network
- WHO: Measles and Rubella Laboratory Network
- WHO: Tuberculosis Laboratory Network
- WHO: Rotavirus Laboratory Network

[93] WHO/AFRO (2019) Regional Strategy for Integrated Surveillance and Response: 2020-2030
[94] Regional Integrated Surveillance and Laboratory Network (RISLNET) https://africacdc.org/rislnet/ (Accessed on January 25, 2021)
[95] For North African countries, ASLM is working with WHO/EMRO.

- WHO: HIV Drug Resistance Laboratory Network
- WHO: Pediatric Bacterial Meningitis Laboratory Network
- WHO: Pediatric Bacterial Meningitis Laboratory Network
- Africa CDC: Regional Integrated Surveillance and Laboratory Network (hereinafter referred to as "RISLNET")
- WHO/Africa CDC: COVID-19 Genome Sequencing Laboratory Network

Of these, the following laboratory networks are outlined; (1) ASLM, which is working to strengthen regional laboratory networks and health crisis response to zoonotic diseases; (2) RISLNET of African CDC[96] that has signed a Letter of Intent with JICA; and (3) a COVID-19 Genome Sequencing Laboratory Network established in response to the recent epidemic of COVID-19.

3-7-1. ASLM

ASLM is an international non-profit organization founded in Addis Ababa, Ethiopia, in 2011 to create an environment with access to world-class diagnostic services in the African region and improve its health care situation. It is an organization that aims to coordinate, mobilize, and mobilize stakeholders at various levels.[97,98] ASLM is the first regional community of laboratory professionals in Africa, endorsed by the AU and supported by several national ministries of health.[99] The ASLM is currently appointed as the focal point[100] for the subcommittee of The Public Health Laboratory Leadership Programme of the Africa CDC, and the Independent Advisory Group and the Independent Evaluation Group for SLIPTA.[101]

The five strategic axes of ASLM are (1) strengthening of laboratory networks, (2) human resource development, (3) improvement of the quality of laboratory diagnostic services, (4) promotion of the introduction and harmonization of regulatory systems for materials, equipment, technologies and services related to laboratory diagnostics, and (5) knowledge melioration, mainly in the African region. For (1), the goal is to establish a regional network of reference laboratories in African countries (at least 30 countries),[102] and the following activities are conducted:

- Launch of the Freetown Declaration on Building Resilient Laboratory Networks for the Global Health Security Agenda in Africa (2015)[103]
- Laboratory mapping (activities aimed at facilitating the mutual use of existing resources, improving laboratory diagnostic capacity and coverage of laboratory networks, and strengthening preparedness and response to disease outbreaks)
- Development of an assessment tool for laboratory networks (LABNET Scorecard)[104]
- Conducting international conferences (e.g., SLMTA/SLIPTA Symposium in 2018 (2 days, Nigeria))

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[96] JICA (2018) Africa Needs a New Public Health Order- Dr. John Nkengasong JICA's World
[97] This includes ministries of health and national public health institutions, research institutes, universities, other and tertiary laboratories, private medical laboratories, and professional associations of laboratory technicians.
[98] ASLM Webpage https://aslm.org/who-we-are/ (Accessed on January 25, 2021)
[99] See Footnote 98.
[100] ASLM (2017) ASLM to Lead Africa CDC Public Health Laboratory Leadership Programme https://aslm.org/news-article/aslm-lead-africa-cdc-public-health-laboratory-leadership-programme/
[101] See Footnote 71: WHO/AFRO (2020)
[102] ASLM (2014) Building laboratory capacity in Africa in a sustainable way. Annual AMDS meeting on September 29-30, Geneva.
[103] ASLM (2015) The Freetown Declaration on Developing Resilient Laboratory Networks for the Global Health Security Agenda in Africa https://aslm.org/what-we-do/freetown-declaration/
[104] Ondoa, P., Datema, T., Keita-Sow, M. S., Ndihokubwayo, J. B., Isadore, J., Oskam, L., Nkengasong, J., & Lewis, K. (2016). A new matrix for scoring the functionality of national laboratory networks in Africa: introducing the LABNET scorecard. African journal of laboratory medicine, 5(3), 498.

- Information sharing through mailing lists (African Public Health Laboratory Network (APHLN) Listserv), the publication of the quarterly journal "Lab Culture," publication of academic journal African Journal of Laboratory Medicine, etc.

ASLM's partners include the Africa CDC and WHO/AFRO, GFATM, UNITAID, the U.S. CDC and USAID, the Bill & Melinda Gates Foundation, the Clinton Health Access Initiative, and other international aid organizations, as well as universities such as Columbia University and the University of New Mexico, and other universities.[105]

3-7-2. RISLNET

RISLNET is a regional network launched by the Africa CDC in 2018 to coordinate and integrate national public health laboratories, surveillance systems, and emergency response.[106] Therefore, RISLNET plays a role in facilitating the strengthening of collaboration among national public health institutes, academic institutions, public and private laboratories, non-profit organizations, civil society, and veterinary networks for the development of interventions for AMR and infectious disease pandemics.[107] This facilitation is conducted at the Africa CDC's five Regional Collaborating Centers.

RISLNET's main activities are in the following five areas:

- RISLNET (Animal Health) [108]: Promoting disease prevention and control through the integration of human health and animal health, with a focus on the One Health approach.
- RISLNET (capacity building) [109]: Strengthening health systems by providing training, supplying health materials and equipment, and quality assurance to effectively implement IDSR and event-based surveillance strategies. These will improve laboratory diagnostics and data availability and improve linkages to surveillance.
- RISLNET (laboratories)[110]: Facilitate collaboration among laboratory experts in the region to share knowledge and strengthen the region's preparedness and response to threatening diseases.
- RISLNET (Partnerships)[111]: To build partnerships with existing public health experts and networks by leveraging Africa CDC's five Regional Collaborating Centers and national public health institutions in each country.
- RISLNET (Surveillance)[112]: Strengthen public health surveillance in the region by developing common standards for laboratory testing and diagnosis, establishing effective surveillance systems, and building capacity for effective response (contact tracing and monitoring).

3-7-3. COVID-19 Genome Sequencing Laboratory Network

In response to the spread of COVID-19 from the end of 2019, the WHO has established a network of reference laboratories on five continents to conduct definitive diagnosis tests in April 2020.[113] The African

[105] ASLM Webpage Our Partners http://34.204.3.214/who-we-are/partners/ (Accessed January 25, 2021)
[106] The Africa CDC RISLNET Webpage https://africacdc.org/rislnet/ (Accessed January 25, 2021)
[107] See Footnote 106: The Africa CDC RISLNET Webpage.
[108] The Africa CDC RISLNET Animal Health https://africacdc.org/rislnet/rislnet-animal-health/ (Accessed January 25, 2021)
[109] The Africa CDC RISLNET Capacity Strengthening https://africacdc.org/rislnet/rislnet-capacity-strengthening/ (Accessed January 25, 2021)
[110] The Africa CDC RISLNET Laboratory https://africacdc.org/rislnet/rislnet-laboratory/ (Accessed January 25, 2021)
[111] The Africa CDC RISLNET Partnerships https://africacdc.org/rislnet/rislnet-partnerships/ (Accessed January 25, 2021)
[112] The Africa CDC RISLNET Surveillance https://africacdc.org/rislnet/rislnet-surveillance-2/ (Accessed January 25, 2021)
[113] WHO (2020) WHO reference laboratories providing confirmatory testing for COVID-19 https://www.who.int/publications/m/item/who-reference-laboratories-providing-confirmatory-testing-for-covid-19 (Accessed January 25, 2021)

region includes the National Institute for Communicable Diseases in South Africa and the Pasteur Institute of Dakar in Senegal.

Six months later, the WHO and the Africa CDC collaborated to establish a laboratory network for the genome analysis of COVID-19.[114] The network includes 12 reference laboratories in the region (names and countries unknown) working on genomic analysis of COVID-19 and providing training and analysis in genomics, bioinformatics, and other technical expertise to neighboring countries.[115]

[114] WHO (2020) COVID-19 genome sequencing laboratory network launches in Africa https://www.afro.who.int/news/covid-19-genome-sequencing-laboratory-network-launches-africa (Accessed January 25, 2021)
[115] WHO (2021) Africa COVID-19 cases top 3 million, first wave peak surpassed https://www.afro.who.int/news/africa-covid-19-cases-top-3-million-first-wave-peak-surpassed (Accessed January 25, 2021)

CHAPTER 4.
DEVELOPMENT PARTNERS FOR HEALTH CRISIS RESPONSES

4-1. Cooperation of JICA

4-1-1. Past and present of JICA cooperation

For JICA, infectious diseases are an "old and new issue" in the health sector.[1] JICA started their international health cooperation with medical cooperation implementation survey in Ghana in 1968[2] and has been strengthening infectious disease diagnosis and national core research institutes through technical cooperation, financial cooperation, TCTP, training in Japan, etc. In 2000, amid the rapid rise in international interest in the world's three major infectious diseases (HIV, tuberculosis, malaria), JICA also worked on technical cooperation, grant aid related to the provision of consumables such as test kits and reagents, and aid coordination with the Global Fund to Fight AIDS, Tuberculosis and Malaria and other international initiatives, from the perspective of strengthening the health system. The three major infectious diseases subsided in the mid-2010s. Still, the outbreak of Ebola virus diseases in the West African region in 2014 revealed vulnerabilities in the African region's health system and health crisis response capabilities. In response to this, JICA began cooperating to strengthen these areas and continue doing so at present.

The foundation of JICA's current support for strengthening health crisis response capacity is PREPARE, discussed in Chapter 1.[3] To reiterate, PREPARE consists of the following components; (1) strengthening the functions of the national core laboratories that also serve as regional core laboratories for controlling infectious diseases in Africa, (2) medium to long-term human resource development for measures against infectious diseases through acceptance of students to universities, and (3) contributing to regional and international initiatives such as the newly launched Africa Centres for Disease Control and Prevention (Africa CDC).[4] In particular, in order to strengthen the functions of the national core laboratories, JICA is also considering improving the neighboring countries' response capabilities based on the national core laboratories and promoting cooperative relationships with concerned national core laboratories in Japan.

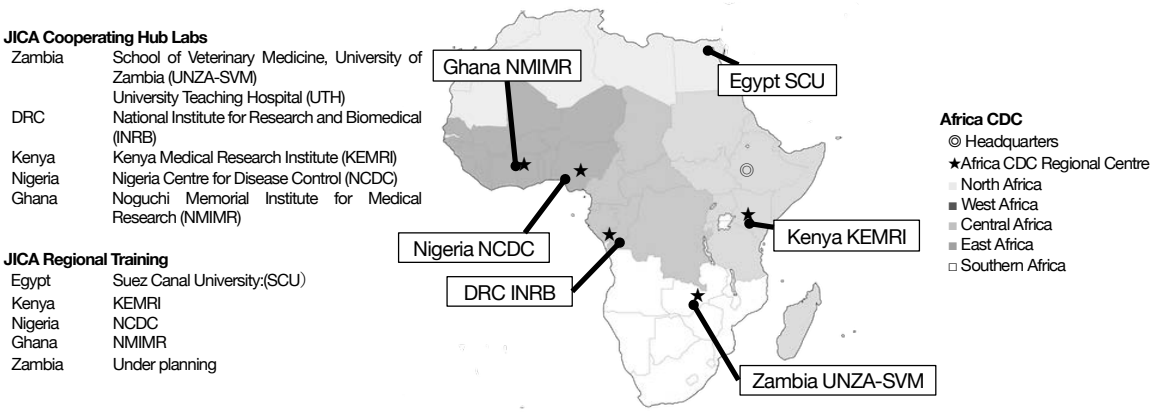

Fig. 4-1. PREPARE Concept

Japan's cooperation has entered a new phase in response to the global epidemic of COVID-19 from the end of 2019. In February 2020, the Government of Japan began financial cooperation in the form of the

[1] JICA(2017) Health Task Newsletter, Hoken Dayori Vol.45 (in Japanese)
[2] JICA (1968) Ghana Medical Cooperation Implementation Survey Report.
[3] The background of this PREPARE is as follows: (1) the integrated promotion of international and domestic countermeasures in the "Basic Policy and Basic Plan for Strengthening Countermeasures against Infectious Diseases that Pose an International Threat" decided by the Japanese government in February 2016, and the statement of strengthening support for countries and regions with outbreaks of infectious diseases, and (2) The agreement to achieve UHC, including preparedness for health crises, in the "G7 Ise-Shima Vision for International Health" set forth at the G7 Summit in May of the same year, and the announcement of support for strengthening the capacity to respond to health crises as part of the promotion of UHC in Africa in the "Nairobi Action Plan" of TICAD VI in August of the same year.
[4] JICA (2018) Partnership for Building Resilience against Public Health Emergencies through Advanced Research and Education (PREPARE)

"Economic and Social Development Prgramme" for countries affected by the outbreak of COVID-19, and the cooperation amounted to more than 170 billion yen (1.54 billion USD).[5] Furthermore, in October, the Government of Japan proceeded to cooperate with the international community to achieve Universal Health Coverage (hereinafter referred to as "UHC"), based on the idea of "leaving no one's health behind," as support for efforts for COVID-19.[6] In December 2020, the Government of Japan announced the "SDGs Action Plan 2021" to support the development, manufacture, and diagnosis of new treatments and vaccines and to ensure equity in access, and has indicated that it will focus on building a robust health system.[7]

In cooperation with this government movement, JICA also has prioritized efforts for COVID-19. Starting with an urgent statement by President Shinichi Kitaoka on May 29, 2020, JICA released a statement to the world that a "COVID-19 initiative is being planned to build a robust health care system" at the United Nations High-Level Political Forum 2020 on July 13.[8] On October 1, the Office for COVID-19 Response was set up in the Human Development Department of JICA.

4-1-2. JICA cooperation in the Southern African region

In the ten Southern African countries covered by this survey, cooperation on infectious disease control and health crisis response is as shown in Attachments 3 to 5. Regarding technical cooperation, in addition to technical cooperation projects, dispatch of experts such as infectious disease advisors, in-country training, and research cooperation such as the Science and Technology Research Partnership for Sustainable Development (hereinafter referred to as "SATREPS"), about 25 projects related to technical cooperation have been implemented from 2013[9] to the present (Appendix 3). Among the ten countries in the Southern African region, the number of cooperation projects in Zambia is the largest (Fig. 4-2). These technical cooperations can be broadly divided into (1) cooperation with Zambia's core organization (University Teaching Hospital (hereinafter referred to as "UTH") and School of Veterinary Medicine, the University of Zambia (hereinafter referred to as "SVM-UNZA"), and (2) HIV/AIDS-related training and dispatch of experts until mid-2010.

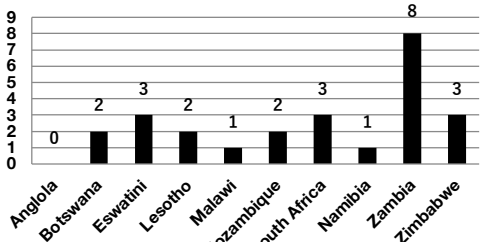

Figure 4-2: Number of technical cooperation projects in countries in the Southern African region (2013-2020)

TCTP was also conducted as regional technical cooperation in parallel with bilateral technical cooperation (Table 4-1). Infectious disease control officials from various countries have been given the opportunity to strengthen their capacity in Egypt, Kenya, and Ghana. In particular, during the latter half of the 2010s, after the announcement of JICA's PREPARE concept, TCTP was planned and put into practice at the core research institutes in each region.

[5] The Nikkei September 26, 2020 " Prime Minister's solidarity appeal, 170 billion yen for corona medical support in a UN speech." (in Japanese) https://www.nikkei.com/article/DGXMZO64289060W0A920C2AM1000 Accessed on December 25, 2020)
[6] Global Health Policy Division, International Cooperation Bureau, Ministry of Foreign Affairs (2020) Japanese cooperation to "Leave No One's Health Behind" - towards achieving Universal Health Coverage (UHC) (in Japanese)
[7] SDGs Promotion Headquarters (2020) "SDGs Action Plan 2021" "Better reconstruction" from the COVID-19 and social change to a new era" (in Japanese)
[8] JICA Webpage, "President Kitaoka delivers a video message at the UN High-Level Political Forum 2020 side event " https://www.jica.go.jp/COVID-19/ja/message/20200713.html (Accessed on December 25, 2020)
[9] As a guide, the starting point is the issuance of the "Request for Agency Action" by ASLM (December 2012), which is one of the breaks in the strengthening of laboratories in Africa, and cooperation since then has been organized.

Table 4-1. TCTPs in the African region

Country	Titles	Target region
Egypt	Research and Crisis Management in Combating Emerging Diseases for Africa (2019-2022) Overcome the Impact of NTD in Africa (Following the WHO Guidelines) (2017-2021) Infectious diseases: clinical and laboratory diagnosis (2012-2018) Clinical Immunology of Infectious Diseases and Introduction to Molecular Biology (1996-2008)	Africa only
Kenya	Strengthening Laboratory Preparedness for Building Resilience against Public Health Emergencies in Eastern Africa (2019-2024) Blood Screening for Viral Hepatitis and HIV/AIDS (1998-2002、2004-2009)	East Africa region
Ghana	TCTP Course on Enhancing Laboratory Skills for Infectious Diseases in West African Countries for Post Ebola (2018-2021) International Parasite Control (2001-2003)	West Africa region
Zambia	Planning a new TCTP Diagnosis, Control and Prevention of Tropical Animal Disease (1999-2003)	Southern Africa region

Furthermore, in parallel with technical cooperation, grant aid (general grant, emergency grant, etc.) is being implemented. The main categories are as follows: (1) Grant aid for Zambia's organizations working with the JICA technical cooperation projects (improvement of their facility and equipment and provision of consumables to them including pharmaceuticals), (2) Financial aid for the efforts for the epidemics of COVID-19, and (3) Others: small amount of grassroots grant aid for tuberculosis, malaria, and HIV/AIDS. Also, the Collaboration Program with the Private Sector for Disseminating Japanese Technology, technical cooperation-grassroots partner type, IPPF[10] Japan Trust Fund, etc., have been implemented.

On the other hand, most of the projects mentioned above are related to human infectious diseases, and there is almost no collaboration from projects related to livestock and animal diseases. Projects related to livestock and animal diseases in the Southern African region are limited to SATREPS projects and grant aid for the SVM-UNZA. This is not just the case in Southern Africa; in general, JICA's cooperation on livestock disease diagnosis in Africa is rare. For example, the one confirmed project, other than Zambia, was the Technical Assistance to Enhancement of Technical Capacity of Animal Disease Control in Uganda, which was implemented from June 2010 to June 2014. The project's final evaluation survey report states, "This is the only project on diagnosing livestock diseases conducted by JICA in Africa."[11]

Under these circumstances, JICA, the Ministry of Foreign Affairs of Japan, and the Africa CDC Tokyo held the "Japan & OIE Collaboration Program" as a side event of TICAD VII in 2019. Both organizations have announced that they would cooperate in animal health and zoonotic control in 10 countries in southern Africa, and they held a signing ceremony of the cooperation brief.[12] This cooperation aims to develop human resources, improve the provision of veterinary services and their skills, and strengthen the comprehensive health system in the Southern African region.[13]

4-2. Cooperation of other development partners in Southern African countries

4-2-1. U.S. Centers for Disease Control and Prevention and U.S. Agency for International Development

The U.S. Centers for Disease Control and Prevention (hereinafter referred to as "U.S. CDC") has been working with countries in the Southern African region. The main technical assistances related to laboratories and surveillance are (1) strengthening of the testing system, laboratories, and surveillance for HIV programs

[10] IPPF: International Planned Parenthood Federation
[11] JICA (2013) Final evaluation report of the Technical Assistance to Improve National Diagnostic Capacity for Animal Republic of Uganda Disease Control in Uganda.
[12] VM NEWS (2019) Japan and OIE Cooperation in livestock hygiene and zoonotic disease control in southern Africa https://buneido-shuppan.com/jvmnews/article/jvm20190901-001 (Accessed December 25, 2020)
[13] JICA Document (2019) [Side Event of the 7th African Development Conference] Combating Zoonosis in Africa: Japan-OIE Cooperative Program https://www.jica.go.jp/press/2019/ku57pq00002lcwp6-att/20190905_01_12.pdf (accessed on February 10, 2021)

through the PRPFAR (including strengthening of viral load measurement capacity and AMR surveillance), and (2) Field Epidemiology Training Program (hereinafter referred to as "FETP") or Field Epidemiology Laboratory Training Program (hereinafter referred to as "FELTP") and other training for the field epidemiology specialists, (3) strengthening the functions of laboratories or lab networks and supporting the quality assurance systems. Although it was not possible to collect information and data on the amount of U.S. CDC cooperation related to these items at the time of this survey. Table 4-2 shows the amount of aid provided by PEPFAR for reference.

Regarding the impact of COVID-19 at the end of 2019, according to the survey interviewees, there is no significant change because their implementing programs have possibly interacted with the COVID-19 support strategy. However, urgent financial and technical assistance has been provided in each country, and many personnel and resources have been transferred to the COVID-19 response from other programs.

Similar to U.S. CDC, U.S. Agency for International Development (hereinafter referred to as "USAID") also divides their support laboratories with U.S. CDC in HIV programs through PEPFAR to strengthen laboratories and support logistics for procurement and distribution of consumables, such as reagents for the laboratories. As for the One Health approach, USAID does not have a large presence in the Southern African region, although it has been active in Eastern Africa.[14]

Table 4-2. U.S. CDC support areas for strengthening major labs in in the Southern African region (Amount of cooperation budget for 2020 by PEPFAR in parentheses)

Country	Areas of support for strengthening major laboratories
Angola	Laboratory network, national strategic plan, quality control system of the laboratory by SLIMTA, FELTP, blood safety. (Budget for cooperation by PEPFAR: Lab strengthening: 320,000 USD, HIV testing: 2.84 million USD.)
Botswana	Strengthen laboratory functions for routine surveillance and respond to public health crises, improve the quality, quantity, and use of laboratory data, collaborative system for One Health approach. No lab-related PEPFAR budget.
Eswatini	Strengthening Lab to measure HIV viral load, promoting WHO SLIPTA implementation. (Budget for cooperation by PEPFAR: Lab Strengthening: 9.42 million USD, HIV Testing: 16.84 million USD.)
Lesotho	Strengthening lab network functions and diagnostic/testing capabilities, capacity development for coordinating lab-related programs, and capacity building for viral load measurement/testing. (Budget for cooperation by PEPFAR: Lab Strengthening: 4.25 million USD, HIV Testing: 37.6 million USD.)
Malawi	Lab capacity development for HIV viral load and four-step approach for TB control (central, county, facility, and community), the trial of the testing method using plasma instead of testing with dry blood spots. (Budget for cooperation by PEPFAR: Lab Strengthening: 7.19 million USD, HIV Testing: 18.8 million USD.)
Mozambique	Strengthening laboratories and surveillance related to HIV, conducting surveillance, FELTP, training laboratory personnel for malaria, strengthening laboratories' diagnostic capacity for influenza, and supporting external quality assessment. (Budget for cooperation by PEPFAR: Lab Strengthening: 21.78 million USD, HIV Testing: 11.5 million USD.)
Namibia	HIV and TB diagnosis, improvement and scale-up of viral load measurement for the Ministry of Health and Social Services, strengthening of HIV testing and diagnosis capacity and quality control system for the National Institute of Pathology (NIP). (Budget for cooperation by PEPFAR: Lab Strengthening: 1.86 million USD, HIV Testing: 8.33 million USD.)
South Africa	Improvement/expansion of laboratory diagnosis quality and public health lab services, management of test/ diagnosis results, improvement of access to laboratory information, training of instructors, and monitoring/ supervision personnel for clinical testing services. (Budget for cooperation by PEPFAR: Lab Strengthening: 16.08 million USD, HIV Testing: 126.7 Million USD.)
Zambia	Strengthening laboratory for HIV and TB. (Budget for cooperation by PEPFAR: Lab strengthening: 8.11 million USD, HIV testing: 34.7 million USD.)
Zimbabwe	Strengthening lab capacity for HIV viral load measurement and the specimens transportation system, improvement of lab information management system, promote ISO 15189 acquisition to improve lab quality. (Budget for cooperation by PEPFAR: Lab Strengthening: 2.74 million USD, HIV testing: 9.19 million USD.)

(Source) U.S. CDC Webpage (https://www.cdc.gov/globalhealth/index.html) and online interview results
PEPFAR's budget for cooperation: Country Operational Plan (COP/ROP) 2020 Strategic Direction Summary for each country

[14] Africa One Health University Network (AFROHUM) Webpage (https://afrohun.org/one-health-central-and-eastern-africa-ohcea-receives-five-year-usaid-funding-through-the-one-health-workforce-next-generation-project/ (Acceseed January 25, 2021)

4-2-2. World Bank

Although the World Bank's support for infectious disease control has been limited these days, it responded swiftly to the worldwide epidemic of COVID-19. On April 2, the World Bank announced a series of projects dealing with COVID-19 under the Fast Track Facility.[15] These projects are implemented in 25 developing countries and cost 1.9 billion USD.[16] To transfer funds from the World Bank's existing projects and reorganize existing projects, the World Bank carries out emergency response and utilization of emergency funding for disasters, including pandemics, etc., in each region where it operates. Also, the Global Financing Facility, the innovative mechanism of fund mobilization promoted by the World Bank, also launched support for providing essential health care services, such as maternal and child health and nutrition under the influence of COVID-19.[17]

Table 4-3. World Bank Infectious Disease Control Assistance in the Southern African region

Project Name	Country	Outline
Eswatini COVID-19 Emergency Response Project	Eswatini	(1) Emergency response for COVID-19, (2) Technical support for management, monitoring and evaluation of policy implementation, and financial support for equipment maintenance, (2) Includes strengthening the national reference laboratory and scaling up POC rapid molecular diagnosis. Project cost: 6 million USD, Project period: 2020-2022, Executing agency: Ministry of Health
Lesotho COVID-19 Emergency Response Project	Lesotho	(1) Emergency response for COVID-19, (2) Technical support for management and monitoring of policy implementation, and financial support for equipment maintenance, (3) Includes strengthening the laboratory diagnosis. Project cost: 7.5 million USD, Project period: 2020-2022, Executing agency: Ministry of Health
Malawi COVID-19 Emergency Response Project	Malawi	(1) Emergency response for COVID-19, (2) Technical support for management, monitoring, and evaluation of policy implementation, (3) Includes support for laboratory equipment. Project cost: 7 million USD, Project period: 2020-unknown, Executing agency: Ministry of Health
Mozambique Covid19 Response DPO	Mozambique	(1) Emergency response for COVID-19, (2) Support for structural reforms for post-disaster recovery and sustainability of finance. Development Policy Operation (DPO) Project cost: 100 million USD, Project period: 2020-unknown, Executing agency: Ministry of Economy and Finance
Mozambique COVID-19 Response Additional Financing	Mozambique	(1) Reconstruction of public-private infrastructure and lives in the cyclone-stricken area, (2) Strengthening resilience to climate change, and (3) Support for emergencies. Project cost: 73.5 million USD, Project period: 2020-, Executing agency: Water and Sanitation Infrastructure Administration (AIAS), Post-Cyclone Idai Reconstruction Office (GREPOC), National Institute of Social Action (INAS)
Zambia COVID-19 Emergency Response and Health Systems Preparedness Project	Zambia	(1) Emergency public health response for COVID-19, (2) Support for providing health services, including support for PCR tests and tests at isolation facilities. Project cost: 25 million USD, Project period: 2020-unknown, Executing agency: Ministry of Health
Zambia: Livestock Development and Animal Health Project	Zambia	(1) Strengthening surveillance and laboratory diagnostic capacities for zoonotic diseases and livestock infectious diseases, (2) Developing service provision capacities within the Ministry of Agriculture, and (3) Improving food safety monitoring capacities in target areas. Project cost: 64.75 million USD, Project period: 2012-2018, Executing agency: Ministry of Fisheries and Livestock.
Africa CDC Regional Investment Financing Program	Zambia, Ethiopia, Africa CDC	Support for strengthening the early detection response system for infectious diseases the Africa CDC. In Zambia, financial and technical support for ZNPHI's human resource development for both human and animal health. Project cost: 250 million USD, Project period: 2019-unknown, Executing agency: ZNPHI, Ministry of Health of Ethiopia, Africa CDC
Zimbabwe Health Sector Development Support Project - Additional Financing V	Zimbabwe	(1) Providing operational management and capacity building packages for essential healthcare services for reproductive health, mothers, newborns, children, and others, (2) Performance-based contract-based performance for monitoring, documentation, and validation, (3) Support for COVID-19. Project cost: 55 million USD, Project period: 2020-2023, Executing agency: CORDAID (Danish NGO)

(Source) World Bank (2020) World Bank Project List for Infectious Disease Control Assistance

[15] World Bank (2020)Project List for Infectious Disease Control Assistance https://www.worldbank.org/ja/about/what-we-do/brief/world-bank-group-operational-response-covid-19-coronavirus-projects-list (Accessed on December 25, 2020)
[16] See footnote 14: World Bank (2020) Project List for Infectious Disease Control Assistance
[17] Global Financing Facility's COVID-19 Webpage https://www.globalfinancingfacility.org/CoVid19 (Accessed on December 25, 2020)

As for the One Health approach, the World Bank has provided support for networking of relevant laboratories in the Eastern Africa region[18] but has not supported this in the Southern Africa region. However, the World Bank has raised the importance of One Health in its 2010 and 2012 reports, "Humans, Pathogens, and Our Planet."[19,20] Also, the World Bank recently published a report in 2018, "Operational Framework for Strengthening Human, Animal, and Environmental Public Health Systems," which outlines how to strengthen the One Health approach, and stated it in the conclusion of the report that the World Bank is in a leading position to promote the One Health approach.[21]

4-2-3. UK

The UK Department for International Development (DFID) has contributed funds to WHO and supports all countries surveyed in the Southern Africa region through their WHO country offices. The activities of each country differ based on the Memorandum of Understandings. Still, the health crisis response package mainly includes building and strengthening of data management and surveillance networks, emergency response, and strengthening of IHR core competence.[22]

In animal health, the Fleming Fund provides financial support to each country in Southern Africa through OIE. For example, in addition to supporting diagnosis, antimicrobial susceptibility testing, and activities related to AMR in the laboratories of the countries surveyed, it supports creating a global database on the use of antibacterial agents for animals, holding international conferences, implementing awareness campaigns of AMR and creating communication tools.[23] It also supports OIE by implementing evaluation missions and training for each country and has a strong relationship with the ministries and organizations related to agriculture and livestock in each country.[24]

As bilateral cooperation, there is an IHR strengthening project for Zambia. In this IHR strengthening project, IHR core capacity related to laboratories, surveillance, one health, emergency relief response, etc., will be strengthened, and personnel will be trained.

As bilateral cooperation, the Fleming Fund supports an IHR strengthening project in Zambia. This IHR strengthening project reinforces IHR core capacity related to laboratories, surveillance, One Health, emergency relief response, etc., and development of human resources.[25] The Department of Public Health, UK also has dispatched advisors to work on these projects.

4-2-4. WHO-FAO-OIE

In 2010, WHO, FAO, and OIE confirmed that under One Health's concept, the three organizations share responsibility and step up joint action to combat health threats associated with interactions between humans, animals, and the environment.[26] They defined "influenza," "rabies," and "AMR as the three priority areas in 2011.[27] They then signed on for the formation of the Africa CDC (2016) and established the regional

[18] World Bank Webpage East Africa Public Health Laboratory Networking Project https://projects.worldbank.org/en/projects-operations/project-detail/P111556
[19] World Bank (2010) People, Pathogens and Our Planet : The Economics of One Health
[20] World Bank (2012) People, pathogens, and our planet. Volume 2, The economics of One Health.
[21] World Bank (2018)One Health - Operational Framework for Strengthening Human, Animal, and Environmental Public Health Systems at their Interface
[22] WHO Strategic Partnership for IHR and Health Security https://extranet.who.int/sph/country/ (Acsessed December 25 2020)
[23] See Footnote 21 WHO strategic Partnership for IHR and Health Securitty
[24] See Footnote 21 WHO strategic Partnership for IHR and Health Securitty
[25] See Footnote 21 WHO strategic Partnership for IHR and Health Securitty
[26] FAO/OIE/WHO Collaboration (Tripartite) https://www.who.int/foodsafety/areas_work/zoonose/concept-note/en/ （Accessed December 25 2020）
[27] Hirofumi Kugita (2015) OIE Regional Representative for Asia and the Pacific, Activities on Antimicrobial Resistance under the Tripartite Alliance among FAO, OIE and WHO (in Japanese)

secretariat for three organizations and a platform for the partners and specialized committees in the African region.[28]

4-2-5. China

China's cooperation in health in Africa began with the dispatch of a medical team to Algeria in 1963, and its presence has grown in recent years. For example, the Chinese government launched the "Health Silk Road" concept in 2016 and signed a Memorandum of Understanding with WHO in 2017.[29] Health was listed as one of eight initiatives at the 2018 Beijing Summit of the Forum on China-Africa Cooperation.[30] Furthermore, in the same year, the China International Development Cooperation Agency (hereinafter referred to as "CIDCA") was established to strengthen health cooperation in the Africa region.[31]

However, the actual situation of China's international cooperation is not always clear due to its lack of transparency.[32] For example, Chinese medical teams were dispatched to 42 African countries in 2014,[33] with an estimated cost of U.S. $30-60 million.[34,35] Apart from dispatching medical teams, by 2014, it would support the infrastructure development of 30 hospitals and 30 malaria centers and train 3,000 health care workers, with an estimated cost of U.S. $124 million.[36] However, due to the limited availability of data, there are some inconsistencies among published data,[37] which make it difficult to judge the actual situation.[38]

Despite this situation, people's movement between Africa and China has become more active, and it is thought that attention should be paid to infectious disease control. For example, recently, the Chinese government supported the construction of the Africa CDC Headquarters in cooperation with infectious disease control and health crisis response for Africa and the Southern Africa region.[39] It has also been reported that the Chinese government supports strengthening the public health lab system, human resource development for health crisis response, and support for enhancing AMR control activities.[40] Regarding the spread of COVID-19, the Chinese government formulated a policy document called "Fighting Covid-19 China in Action" and highlighted the need for assistance to Africa in the document, and announced that it had deferred debt payments and provided medicine to 77 developing countries, including African countries and the African Union.[41]

4-2-6. Others

Table 4-4 on the next page shows the areas of cooperation of development partners other than those

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[28] Africa CDC, 1st (2019)International One Health Forum Meeting Report, 14-15 November, 2019
[29] China Daily (2017) WHO, China sign pact establishing 'health Silk Road' http://www.chinadaily.com.cn/business/2017wef/2017-01/19/content_27993857.htm (Accessed January 25, 2025)
[30] XinsuaNet (2018) Xi says China to implement eight major initiatives with African countrieshttp://www.xinhuanet.com/english/2018-09/03/c_137441563.htm (Accessed January 25, 2025)
[31] CIDCA (2018) CIDCA vice chairman speaks at 2018 High-level Meeting on China-Africa Health Cooperation http://en.cidca.gov.cn/2018-08/17/c_267618.htm (Accessed January 25, 2025)
[32] Daly G, Kaufman J, Lin S, Gao L, Reyes M, Matemu S, El-Sadr W. (2020) Challenges and Opportunities in China's Health Aid to Africa: Findings from Qualitative Interviews in Tanzania and Malawi. Global Health. 2020 Jul 29;16(1):71
[33] China's foreign aid (2014). The State Council of the People's Republic of China. 2014. http://english.gov.cn/archive/white_paper/2014/08/23/content_281474982986592.htm. (Accessed January 25, 2025)
[34] Lin S, Gao L, Reyes M, Cheng F, Kaufman J, El-Sadr WM. (2016) China's health assistance to Africa: opportunism or altruism? Global Health. 2016 Dec 3;12(1):83
[35] Liu P, Guo Y, Qian X, Tang S, Li Z, Chen L. China's distinctive engagement in global health. Lancet. 2014 Aug 30;384(9945):793-804. doi: 10.1016/S0140-6736(14)60725-X. Erratum in: Lancet. 2014 Sep 27;384(9949):1186.
[36] See footnote 33 : Lin S et al.(2016)
[37] McDade KK, Mao W. (2020) Making sense of estimates of health aid from China. BMJ Glob Health. 2020 Feb 13;5(2):e002261.
[38] Ngeow Chow-Bing (2020) COVID-19, Belt and Road Initiative and the Health Silk Road: Implications for Southeast Asia. Friedrich Ebert Stiftung
[39] XinxuaNet (2020) Construction of China-aided Africa CDC HQ commences in Ethiopia http://www.xinhuanet.com/english/2020-12/14/c_139589277.htm
[40] Tambo E, Khayeka-Wandabwa C, Muchiri GW, Liu YN, Tang S, Zhou XN. China's Belt and Road Initiative: Incorporating public health measures toward global economic growth and shared prosperity. *Glob Health J*. 2019;3(2):46-49.
[41] Chinese government（2020）Fighting Covid-19 China in Action

mentioned above in the countries of the Southern African region.

As for the European Union, many of the projects were not under the lead of the country offices. Some of the staff members who conducted the online interviews were not aware that such cooperation had been implemented.

Table 4-4. Cooperation with other development partners in strengthening IHR core capacity in the Southern African region

Partners	Main cooperation	Partners	Main cooperation
International Association of National Public Health Institute (IANPHI)	Mozambique Support to National Institute of Health Mozambique (INS) capacity building for surveillance, emergency response, laboratories, information systems, and human resources. Establish, expand, and strengthen rapid surveillance system (early warning system) and outbreak investigation capacity for IDAI cyclone. Preparation for COVID 19. Establishing COVID19 contact tracking system capacities. COVID19 spacemen collection, management, testing, and support for purchasing test reagents and consumables. Zambia (Financial support from 2015) ZNPHI staff and system support in surveillance, emergency response, laboratories, health information, and human resource development.	Resolve to Save Lives	<u>Multilateral Cooperation: Financial and technical assistance (2020)</u> 1 Training healthcare works in Africa for Project COVID-19 2 Adoption of public health and social measures <u>Bilateral Cooperation: Financial and Technical Assistance(2020)</u> ⊙Malawi and Zimbabwe: Finance and Technology (2020-2021) 1 Support for innovative technology in primary health care 2 Clarification of the effect of COVID pandemic on chronic diseases: provision of TB case detection data, HIV test data, COVID-19 data ⊙Zambia and Zimbabwe 1 Technical and financial support for COVID-19 2 Providing subsidies for countermeasure projects and promoting interactions between project target cities
GIZ	Technical support for rabies eradication to Namibia through OIE 1 Analysis and evaluation support of the current status of rabies and management strategies of the Ministry of Health Social Services (MHSS) 2 Strengthening surveillance and vaccination campaigns for rabies by the MHSS 3 Promotion of cooperation in human and animal health activities based on the One Health concept at the local level 4 Support for establishing OIE rabies vaccine bank for rabies vaccination and vaccine procurement 5 Implementation support for the rabies vaccination campaign	Norway	1 Implementing the latest IDSR guidelines and strengthening the dissemination of surveillance data 2 Support FETP for IDSR personnel 3 Training with lectures and exercises at the national and regional levels 4 Strengthen risk communication for surveillance and response for IHR-related public health threats
EU	2015-2018 1 Implementation and training of OIE PVS pathway missions in OIE member countries in Africa[42] 2 Strengthening various services related to animal health and hygiene	Ending Pandemics	Establishing 6 Regional Surveillance Network (Connecting Organizations for Regional Disease Surveillance：CORDS) for cross-border activities to tackle emerging infectious diseases.

[42] Performance of Veterinary Service (PVS) is a program implemented by the OIE in each country. Pathway means improving the capacity of veterinary services.

CHAPTER 5.
EXPERIENCES AND CURRENT STATUS OF IMPLEMENTING AGENCIES OF JICA'S TCTP IN EGYPT AND ZAMBIA

5-1. Faculty of Medicine at Suez Canal University (Egypt)

5-1-1. Outline of TCTP in Egypt

In Egypt, the Faculty of Medicine at the Suez Canal University (hereinafter referred to as "FOM/SCU") conducts the following TCTP on infectious disease control and health crisis response in Table 5-1.

Table 5-1. Current Third Country Training Program at the FOM/SCU (Egypt)

Training Title	Research and Crisis management in combating emerging diseases in Africa
Implementing Organization	FOM/SCU
Period	1st training: February 9th to March 9th 2020 (2nd and 3rd training are scheduled).
Participating country	Burkina Faso, Cameroon, Chad, Gabon, Kenya, Malawi, Nigeria, South Sudan, Tanzania, Zambia, Zimbabwe, and Egypt
Participant	The 22 training participants were divided into two groups: "a group led by epidemiological statisticians" (Group A, 15 participants) and "a group led by laboratory technicians" (Group B, 7 participants).
Goal	To strengthen global health security by reinforcing national health systems through advanced research for emerging infectious diseases strengthened national capacity for prevention and control of public health emergencies.
Purpose	The course aims to enhance participants' knowledge and skills in detection and response to emerging zoonotic diseases and vector-borne diseases. The course will help the participants to contribute to advance the national research agenda and strengthen operational capacity for public health emergencies.
Training Subject	1) Research and epidemiology, 2) Crisis management, 3) Health policy, 4) Quality assurance and quality improvement concepts, 5) Laboratory diagnosis of some infectious diseases (practice), 6) Technology and Software (GIS) in the fight against infectious diseases. Of these subjects, some subjects were taken by Group A/B together, some were taken only by Group A, and some were taken only by Group B.

(Source) FOM/SCU (2020) Course report on "the third country training program, the1st Group Training Course for African Countries Research and Crisis management in combating emerging diseases in Africa" February 9th to March 9th 2020

5-1-2. JICA cooperation with the FOM/SCU

FOM/SCU, the implementing organization for JICA TCTP, has been conducting the TCTP in infectious diseases for about 25 years.

Table 5-2. JICA Third-Country Training Program on infectious disease control at FOM/SU

Period	Training title	Outline
2019-2021	Research and Crisis management in combating emerging diseases in Africa	Improve knowledge and expertise in detection and countermeasures for zoonotic diseases, promote advanced research for emerging infectious diseases, and strengthen operational management capacities in a public health emergency.
2012-2017	Infectious Diseases: Clinical and Laboratory Diagnosis	Improve the technology of clinical laboratory medicine and research ability in infectious diseases, and contribute to the strengthening of prevention from infectious diseases, especially by laboratory diagnosis.
2008-2018	Concurrent Infections Control of TB/HIV Laboratory Training for Africa (Nile Basin Countries & Djibouti)	Promote joint activities of the TB/HIV programs based on the TB/HIV concurrent Infections Policy and DOTS through TB/HIV diagnosis and contribute to the strengthening of the TB/HIV concurrent infection control program.
2005-2008	Clinical Immunology on Infectious. Diseases and Total Quality Management	Acquire knowledge and skills regarding the history of infectious diseases, pathophysiology, and the concept of total quality management (TQM), and contribute to the strengthening of quality-assured testing and laboratory operations.
1996-2004	International Course of Clinical Immunology (ICCI)	Acquire knowledge and skills regarding the history of infectious diseases and pathophysiology, and contribute to research preparation focusing on the evaluation and decision analysis of immunology and infectious diseases, especially diagnostic tests.

(Source) JICA Project Summary https://www.jica.go.jp/activities/project_list/knowledge/index.html

The "International Course of Clinical Immunology" in 1996 for African countries is the first TCTP course at the FOM/SCU. A young doctor, Dr. Gohari, who participated in the JICA group training course "Seminar on Blood Transmitted Diseases: Special Reference to AIDS, ATL and Hepatitis" held at the Kumamoto National Hospital in 1989, initiated this training program after several years of interaction with Dr. Fumio Kono, who was the course leader of the Kumamoto training.[1,2] Since then, FOM/SCU has conducted the

[1] The Egyptian Times (2011) Dr. el-Gohary's Success Story
[2] Matsumi, Yasuko (2011-2012) Reading in Ethnography: International Cooperation Connected by People International Development Journal, August 2011 - February 2012 (in Japanese)

TCTP, as shown in Table 5-2, and has provided a platform for JICA regional training programs, and cultivated experience. Today this TCTP has been cited in several reports of other development partners as good examples of South-South cooperation.[3]

5-1-3. Cooperation with other development partners at FOM/SCU

According to the interview for this survey, FOM/SCU have built a cooperative relationship with experts such as WHO and other development partners, and have asked them to give lectures at the TCTP. FOM/SCU serves as the chair and secretariat of the African regional network of the International Clinical Epidemiology Network (hereinafter referred to as "INCLEN-Africa")[4,5] and contributes to regional cooperation in the field of research.

In areas other than infectious diseases, the FOM/SCU has a long history of cooperation with WHO as a central institution for medical education. Center for Research and Development (hereinafter referred to as "CRD") established within the FOM/SCU in 1986 leads this cooperation. CRD became the WHO Cooperation Center in 1988 and has been re-designated since then.[6] CRD holds workshops related to medical education and management leadership twice a year and holds training at universities in Egypt and neighboring countries. They held 30 international workshops and 100 domestic workshops in the ten years since 2005.[7] FOM/SCU is also a member of WHO's Partnership for Maternal, Newborn & Child Health, and cooperates with WHO in maternal and child health.

FOM/SCU also cooperates with educational institutions in Egypt and overseas, such as training on medical education, formulating curriculum and university regulations, and providing consultation. For example, the new university in Saudi Arabia is modeled on the FOM/SCU's medical education, requesting technical cooperation and the dispatch of faculty members when necessary.[8]

5-1-4. Trainings conducted at FOM/SCU

The contents of the training conducted at FOM/SCU are shown in Table 5-2 above. Since the 1990s, they have been conducting training on strengthening clinical testing techniques, mainly blood tests and diagnostics in infectious diseases. With a new focus on health crisis response, health care workers who are not necessarily closely related to the laboratory are also included in the training.

5-1-5. Current status and resources of FOM/SCU

(1) Implementation structure/Human resources

The Suez Canal University was founded in 1976 as Egypt's first community-oriented public university and is now a university with 27 faculties.

The TCTP was run by secretariat dedicating to TCTP on campus under the supervision of the Vice-President of Suez Canal University. According to the interviews for this survey, the secretariat has 8

[3] Shunichiro Honda, Hiroshi Kato and Yukimi Shimoda (2013) South-South and Triangular Cooperation for Sub-Saharan Africa's Development–With special emphasis on knowledge exchange and co-creation (in Japanese)
[4] Hosny S., Wazir Y EL. Kalioby M. EL, Farouk O. Ghaly M. (2016) Role of Suez Canal University, Faculty of Medicine in Egyptian Medical Education Reform. Health Professions Education Vol. 2, Issue 1, June 2016, P. 44-50
[5] INCLEN-Africa http://inclentrust.org/inclen/inclen-africa/
[6] See Footnote 3: Hosny S. et al. (2016).
[7] See Footnote 3: Hosny S. et al. (2016).
[8] See Footnote 3: Hosny S. et al. (2016).

staff members. The other 10 training course committee members are appointed to train, prepare, and implement operational management. The lecturers are mainly professors of the FOM/SCU. Still, external experts such as the Ministry of Health of Egypt, Ain Shams University, Cairo University, Cairo American University, WHO, etc. are also assigned.

In addition, during the past TCTP courses, the FOM/SCU has invited third country experts from the Kenya Central Medical Research Institute and other institutions for topics where Egypt does not have an advantage (e.g., HIV/AIDS control). In February 2020, the TCTP and the JICA Egyptian office's course leader visited the National Institute of Biomedical Research (Democratic Republic of Congo) and the WHO/AFRO headquarters in the Republic of Congo to discuss cooperation with third-country lecturers.

(2) Facilities and Equipment

For the TCTP, FOM/SCU has utilized the lecture rooms on campus, the clinical pathology lab/biochemistry lab at the University Hospital of FOM/SCU, laboratory units of Excellence Center in Molecular and Cellular Medicine Research at Canal Medicine, the Ministry of Health Information Center (GIS class), and other laboratories of educational institutions such as Shams University and infectious disease control laboratories.

(3) Others: the uniqueness of education at FOM/SCU

As mentioned above, FOM/SCU has also received high praise in medical education, and its uniqueness are shown in Table 5-3.

Table 5-3. Uniqueness of FOM/SCU

Characteristics	Overview
Community-based education, (CBE)	Utilize the community as a learning place and a learning method to acquire the knowledge, skills, and attitudes necessary to provide health care services in different communities. Community activities are included in the curriculum to improve teamwork, leadership, self-learning ability, etc., while aiming for horizontal and vertical integration of knowledge and skills.
Problem-based learning	Educational topics reflect actual health care issues. Under the facilitation of tutors, students are divided into groups and are required to collect and analyze information and data to solve the issues and learn problem-solving skills, self-learning ability, logical thinking, teamwork, etc.
Integration of primary medicine and clinical medicine	From the 1st year to the 6th year, basic science is integrated into clinical science (psychological science, behavioral science, social science, etc.)
Student-centered education	Each university and each student are responsible for their learning process. Students are encouraged to become proficient in the knowledge, skills, and attitudes needed to solve problems.
Comprehensive evaluation system	The evaluation includes knowledge, skills, and attitudes.
Evidence-based medicine	The university added a strategy in 2013 aimed at enabling students to make decisions based on guidelines and research results.

(Source) Hosny S., Wazir Y EL. Kalioby M. EL, Farouk O. Ghaly M. (2016) Role of Suez Canal University, Faculty of Medicine in Egyptian Medical Education Reform. Health Professions Education Vol. 2, Issue 1, June 2016, P. 44-50

5-1-6. Environment surrounding FOM/SCU

(1) IHR core capacity of Egypt

Egypt's IHR core capacity scores are shown in Table 5-4, which is considered to be in better condition than other African countries. Although the external evaluation of IHR was conducted in 2018, the report has not been published; therefore, the information on which the score is based is not available.

Table 5-4. Egyptian IHR Core Capacity (2018)

	National Legislation	Surveillance	Response	Preparedness	Human Reources	Laboratory	Zoonotic diseases
Egypt	75	90	100	100	100	96	100

(Source) WHO Strategic Partnership for International Health Regulation (2005) and Health Security (SPH) Country Profiles - Egypt
https://extranet.who.int/sph/country/278 (Accessed on January 10, 2021)

(2) BSL-3 Lab at the Medical Research Institute, Alexandria University

Until now, there was no BSL-3 laboratory in Egypt and neighboring countries, except the U.S. Naval Medical Research Unit-No.3 (hereinafter referred to as "NAMRU-3"). However, in early 2021, the Medical Research Institute, Alexandria University (hereinafter referred to as "MRI") will complete and own the BSL-3 laboratory. This means that a facility capable of testing and diagnosing at a higher biosafety level than the FOM/SCU will be created at the MRI.

The construction and completion of the BSL-3 Lab at the MRI is funded by a grant aid for the Development Debt Exchange Program between Egypt and Italy. The concept of BSL-3 lab construction was launched in 2011, and construction work began in 2018. According to interviews with the people concerned, construction is currently in its final stages and is scheduled to be completed in January 2021.

MRI, founded in July 1963, is an institution that, like the FOM/SCU, provides research, education, and advanced medical services. It will research bacterial and viral pathogens such as bird flu, swine flu, new coronavirus, brucellosis, and tuberculosis-resistant bacteria at the BSL-3 laboratory. Also, MRI will contribute human resource development related to infectious disease control.[9] Furthermore, MRI aims to strengthen surveillance for infection prevention and become an African hub for the diagnosis and technical expertise of emerging infectious diseases.[10]

Egypt is regarded as the North African center of the Africa CDC, but it is not clear which laboratory will play the role of the regional hub laboratory. At the time of this survey, it was impossible to confirm whether the BSL-3 laboratory at the MRI, or the central laboratory at the Ministry of Health would be responsible for this role. It is expected that discussions and deliberations will take place in the future, including the positioning of the BSL-3 lab at the MRI within the country and region, the collaboration with Africa CDC and so on.

(3) The U.S. Naval Medical Research Unit-No.3 (NAMRU-3)

NAMRU-3 in Cairo was the largest medical research institution in North Africa and the Middle East, had a BSL-3, and had conducted research on infectious disease control in collaboration with U.S. CDC.[11] The FOM/SCU had also established cooperative relationships with the NAMRU-3 and the U.S. CDC in conducting the TCTP. For example, when there are no lecturers available in the FOM/SCU, they request cooperation from dispatching their expert as a lecturer. However, in 2019, the NAMRU-3 was relocated to Italy, and according to an interview at the time of this survey, it was reported that the U.S. CDC stopped its activities at its base in Egypt. This means that the FOM/SCU lost one place to ask for cooperation in sending lecturers.

[9] Egypt Independent August 4, 2020 article https://egyptindependent.com/egypt-launches-first-biosafety-level-3-laboratory-in-the-middle-east/ (Accessed on December 25, 2020)
[10] See Footnote 8: Egypt Independent August 4, 2020 article
[11] U.S. CDC Webpage https://www.cdc.gov/globalhealth/countries/egypt/ (Accessed on December 25, 2020)

However, it is reported that USAID has started efforts for the COVID-19 in Egypt,[12] and that senior advisors have been dispatched to Egypt.[13] Thus, it is expected that U.S. agencies will continue to cooperate with Egypt on infectious disease control.

5-2. Zambia National Public Health Institute and other organizations in Zambia

5-2-1. Outline of Third Country Training Program in Zambia

Currently, a TCTP on infectious disease control, health crisis response, and the One Health approach is being planned in Zambia, with the Zambia National Public Health Institute (hereinafter referred to as "ZNPHI") as the implementing institution. However, UTH and SVM-UNZA, with which Japan has been cooperating for a long time, are expected to be deeply involved in the implementation of the TCTP.

5-2-2. JICA cooperation at ZNPHI and other organizations in Zambia

As shown in Table 5-5, JICA cooperated to construct the UTH facilities during the first half of 1980 with grant aid. Also, JICA supported to establish new facilities for SVM-UNZA. After these cooperation, JICA has implemented technical cooperation for infectious disease control using the facilities constructed simultaneously with UTH and SVM-UNZA. In recent years, multiple research projects by SATREPS have been implemented to improve research capacities and put into practice the research results. In reforming the infectious disease control system in Zambia, JICA dispatched an infectious disease control advisor to the ZNPHI, which is expected to become a main institution in the future. The Ministry of Foreign Affairs, Japan and the Japanese Embassy in Zambia is also contributing financial cooperation. These contributions were cultivated from relationships through many years of cooperation, such as dispatching researchers and accepting trainees with the Hokkaido University School of Veterinary Medicine and the Tohoku University School of Medicine.

Table 5-5. JICA cooperation with the implementing organizations

Organization	Major Project
ZNPHI	2020- 2022 Infectious disease control advisor
UTH	2009-2013 Establishment of Rapid Diagnostic Tools for Tuberculosis and Trypanosomiasis and Screening of Candidate Compounds for Trypanosomiasis 2009-2011 The Project for the Improvement of the Medical Equipment of the University Teaching Hospital 2001-2006 Strengthening of Laboratory systems for HIV/AIDS and TB control project 1995-2000 Infectious Disease Project 1995- UTH I Neonatal and Pediatric Surgical Center 1989-1995 Infectious Disease Control Project 1989-1994 Infectious Disease Project(UTH Virology Laboratory) 1981-1983 Basic design for UTH Neonatal and Pediatric Surgical Center 1980-1989 The Children's Program for the UTH
SVM-UNZA	2021-2023 Support for enhancement of clinical studies in SVM-UNZA 2019-2024 Project for the Epidemiological Research on Zoonotic Virus Infections in Africa 2013-2018 Project for Surveillance of Viral Zoonoses in Africa 2009-2013 Establishment of Rapid Diagnostic Tools for Tuberculosis and Trypanosomiasis and Screening of Candidate Compounds for Trypanosomiasis 2005-2008 Improvement of Animal Health and Production Delivery through Extension Services 1999-2003 Diagnosis, Control and prevention of Tropical Livestock Diseases (TCTP) 1985-1990, 1992-1997 The University of Zambia: Veterinary Education Project 1983-1985 The University of Zambia: Veterinary Education Project

(Source) JICA project summary: https://www.jica.go.jp/activities/project_list/knowledge/index.html (accessed on December 25, 2020)
JICA ODA visualization website: https://www2.jica.go.jp/ja/oda/index.php (accessed on December 25, 2020)
JICA library portal site: https://libopac.jica.go.jp/ (accessed on December 25, 2020)

[12] USAID Egypt.(2020) Response Operations to COVID-19 Epidemic https://www.usaid.gov/egypt/global-health/response-operations-covid-19-epidemic (Accessed January 25, 2021)
[13] USAID Egypt.(2020) 03/2020 SENIOR HEALTH ADVISOR https://www.usaid.gov/egypt/vacancy-announcement/032020-senior-health-advisor

5-2-3. Cooperation with other development partners at ZNPHI and other organizations

Table 5-6 shows cooperation from other development partners related to strengthening infectious disease control and health crisis response at the ZNPHI and other organizations. In Zambia, the U.S. and other countries have been strengthening laboratories and have been cooperating with the ZNPHI from before its establishment to the present. Of these, the Zambia Field Epidemiology Training Program (hereinafter referred to as "ZFETP") is the longest-term cooperation in terms of human resource development and training similar to the TCTP. ZFETP is also noteworthy for its quality improvement by the U.S. CDC and other U.S. agencies.

Table 5-6. Results of cooperation of other donors with the implementing organizations

Organization	Cooperation of major donors
ZNPHI	U.S.: Since their establishment in 2016, U.S. organizations such as the CDC, PEPFAR, and the International Association of National Public Health Institutes (IANPHI) have been providing support and cooperating with the Public Health Emergency Operations Center upon the spread of the cholera infection in 2017, and providing technical and financial support to respond to the spread of COVID-19 in 2020. ZFETP, which was launched in Zambia in 2014 and has received technical and financial support from the CDC, is currently managed by ZNPHI, and the CDC is a member of the Steering Committee.[14]
	U.K.: Since 2018, the U.K. has added ZNPHI to one of the target organizations of the Public Health England International Health Regulations Strengthening Project, and supports human resource development to strengthen its core capacity.[15] Since 2018, the UK has also provided financial support to ZFETP.[16]
	World Bank: ZNPHI is one of the target organizations for the Africa CDC Regional Investment and Financing Project launched in 2019, and the Zambia COVID-19 Emergency Response and Health Systems Preparedness Project launched in 2020. Through that support, ZNPHI will develop infrastructures such as training facilities and laboratories and develop human resources related to public health support, testing, and diagnosis capacities.
UTH	U.S.: CDC has cooperated with University of Zambia and UTH to develop human resources and strengthen the health system by providing academic and clinical training to medical professionals involved in HIV.[17] CDC also conducts surveys, such as the Zambia HIV Impact Survey, with the funds of PEPFER in cooperation with the UTH.[18] In December 2020, the CDC made an agreement with the Ministry of Health and UTH on assistance in research, HIV/TB control, and strengthening of public health infrastructure, including information systems and laboratories.[19] USAID support for the Challenge TB program, such as the TB ward at UTH[20] and the maintenance of laboratory and diagnostic equipment.[21]
	SIDA: Through the Tropical Health and Education Trust, SIDA supports two Zambia pathology students studying abroad in a South African lab in collaboration with UTH and the University of Zambia School of Medicine.[22] The aim is to improve the quality of laboratory diagnostic services in Zambia.
SVM-UNZA	U.S.: SVM-UNZA is a Steering Committee member for ZFETP, which CDC has provided technical and financial support.
	U.K.： Fleming Foundation supports the strengthening of AMR action plans and surveillance systems, One Health approach, and microbiology laboratories with grant aid.
	World Bank： Through the Africa Higher Education Centers of Excellence Project,[23] World Bank provides financial support to the Center of Excellence for Emerging and Zoonotic Diseases (ACEEZD) of SVM-UNZA.[24] ACEEZD is a training hub that aims to develop human resources such as master's and doctoral students related to infectious disease control.

(Source) U.S. Embassy in Zambia Website: https://zm.usembassy.gov/tag/znphi/
CDC in Zambia website https://www.cdc.gov/globalhealth/countries/zambia/default.htm
UTH Website http://www.uth.gov.zm/ SVM-UNZA Webpage https://www.unza.zm/schools/veterinary-medicine/about
World Bank (2020) World Bank (2020) Project List for Infectious Disease Control Assistance - Zambia's site in the project list
Fleming Foundation (Zambia) https://www.flemingfund.org/countries/zambia/
Tropical Health and Education Trust (2020) Country Programmes -Zambia https://www.thet.org/our-work/country-programmes/zambia/
Interviews with CDC and PHE staff in Zambia

[14] Kumar R, Kateule E, Sinyange N, et al. (2020) Zambia field epidemiology training program: strengthening health security through workforce development. Pan Afr Med J. 36:323.
[15] Public Health England (2019) Press Release on the Public Health England (PHE) International Health Regulation Strengthening Project support to the ZNPHI on Workforce Development
https://znphi.co.zm/news/press-release-on-the-public-health-england-phe-international-health-regulation-strengthening-project-support-to-the-zambia-national-public-health-institute-on-workforce-development/
[16] U.S. Embassy in Zambia (2020) U.S. CDC Celebrates 20 Years in Zambia and Signs New Five-Year Agreements with MOH and UTH
https://zm.usembassy.gov/u-s-cdc-celebrates-20-years-in-zambia-and-signs-new-five-year-agreements-with-moh-and-uth/
[17] CDC (2020) What CDC is Doing in Zambia https://www.cdc.gov/globalhealth/countries/zambia/default.htm
[18] CDC (2016) Zambia Population-Based HIV Impact Assessment ZAMPHIA 2015-2016
[19] See Footnote 15: U.S. Embassy in Zambia
[20] USAID (2018) United States Delivers Renovated Tuberculosis Ward at Zambia's University Teaching
https://www.usaid.gov/zambia/press-releases/august-10-2018-us-delivers-renovated-tuberculosis-ward-zambias-university (Accessed December 25, 2020)
[21] USAID (2019) Technical Brief - Rapid Scale-Up of New Drugs and Regimens for the Treatment of Drug-Resistant TB in Zambia (Accessed December 25, 2020)
[22] Tropical Health and Education Trust (2020) Country Programmes -Zambia https://www.thet.org/our-work/country-programmes/zambia/ (Accessed on December 25, 2020)
[23] World Bank (2018) Africa Higher Education Centers of Excellence for Development Impact (P164546) Project Information Document
[24] Lusaka times (2016) World Bank approves U$6million to UNZA vet dept. for ACEEZD
https://www.lusakatimes.com/2016/06/15/world-bank-approves-u6million-unza-vet-dept-aceezd/ (Accessed December 25, 2020)

The outline of ZFETP in Zambia is shown in Table 5-7. Established in 2014 with the U.S. CDC's technical and financial cooperation, the UNZA-School of Public Health has begun to play a central role in the implementation of coursework. Currently, ZNPHI is in charge of ZFETP, and the officials from UNZA-School of Public Health, SVM-UNZA, U.S. CDC, and the National Health Research Authority are members of the Steering Committee. Two types of courses are currently offered, ZFETP-Advance, a long-term training, and ZFETP-Frontline, a short-term training. So far, the former has produced 24 graduates, and the latter has produced 71 graduates.

Table 5-7. Overview of ZFETP

Purpose	1 Develop the capacity to train public health professionals in applied or field epidemiology. 2 Provide epidemiological services to strengthen health security at national, provincial, district, and local levels. 3 Reduce the burden of priority public health problems through strengthened epidemiology capacity and the service provided by FETP trainees.	
Title	ZFETP-Advance	ZFETP-Frontline
Period	2 years (Full time)	3 months
Content	6 months of coursework (30%) and 17 months of field work (70%)	1 month of workshops and 1 to 2 months at their usual worksites
Subject	The residents receive hands on training and experience in evaluating public health surveillance systems, investigating disease outbreaks, and conducting hypothesis-driven epidemiologic analyses that address priority public health issues at local or national levels.	Strengthening surveillance and enhancing early outbreak detection at sub-national levels of the public health system. (The target is to train at least 1 surveillance officer in each district by 2026.)
Participant	Trainees must be MoH employees. MoH pays salaries during the training. The November 2020 recruitment guidelines also target participants from the Africa CDC's Southern Africa region. *1	Trainees must be MoH employees.
Others	Those who have completed the program have a master's degree (MSc.)	

(Source) Kumar R, Kateule E, Sinyange N, et al. (2020) Zambia field epidemiology training program: strengthening health security through workforce development. Pan Afr Med J. 2020;36:323.
*1 ZNPHI (2020) Call for Applications for International Applicants for Advanced Zambia Field Epidemiology Training -2020 Intake
https://znphi.co.zm/news/call-for-applications-for-advanced-zambia-field-epidemiology-training-2020-intake-2/ (Accessed December 25, 2020)

Table 5-8. Overview of ZFETP graduates

Title	ZFETP-Advance			ZFETP-Frontline			
Year	2014	2016	2019	2015	2017	2018	2019
Ex-participants	6	8	10	13	16	21	21
Detail of ex-participants							
MD*1	3 (50%)	2 (25%)	4 (40%)	11 (79%)	6 (38%)	1 (5%)	4 (14%)
Public Health	1 (17)	4 (50%)	6 (60%)	2 (14%)	10 (62%)	15 (62%)	15 (62%)
Laboratory	0	1 (12%)	0	1 (7%)	0	2 (9%)	2 (9%)
Others*2	2 (33%)	1 (12)	0	0	0	0	0

(Source) Kumar R, Kateule E, Sinyange N, et al. (2020) Zambia field epidemiology training program: strengthening health security through workforce development. Pan Afr Med J. 2020;36:323.
*1 Those with MBBS, MB ChB, etc.
*2 Demographers, epidemiologists, nurses, etc.

5-2-4. Training conducted by ZNPHI and other organizations

The UTH and SVM-UNZA have experience in conducting various trainings in Zambia. ZNPHI has also hosted various training (courses). For example, in addition to the above ZFETP, they conduct the WHO-supported rapid response team training for Ebola virus disease,[25] COVID-19 response training for traditional healthcare professionals,[26] and other training on COVID-19 and AMR.[27,28]

[25] ZNPHI (2019) Zambia Undertakes Intense EVD Trainings for Rapid Response Teams
https://znphi.co.zm/news/zambia-undertakes-intense-evd-trainings-for-rapid-response-teams/
[26] WHO (2020) WHO Supports the Ministry of Health to train Members of the Traditional Health Practitioners' Association of Zambia on COVID-19
https://www.afro.who.int/news/who-supports-ministry-health-train-members-traditional-health-practitioners-association-zambia
[27] Africa Centre of Excellence for Infectious Diseases of Humans and Animals (ACEIDHA) (2020) ZNPHI Thanks ACEIDHA for the Support in COVID-19 Fight
https://aceidha.unza.zm/news/znphi-thanks-aceidha-support-covid-19-fight
[28] Various training scenes have been uploaded on ZNPHI's Twitter. https://twitter.com/search?q=%20ZMPublicHealth%20training&src=typed_query&f=live. At the time of this survey, the survey team was not able to directly interview ZNPHI officials, and ZNPHI Webpage does not always contain information on training implementation.

5-2-5. Current status and resources of ZNPHI and other organizations

(1) Implementation structure/Human resources

ZNPHI was established in 2015 as an affiliate of the Ministry of Health, which oversees the national public health sector. At that time, it was in the midst of an international trend of strengthening its capacity to respond to public health emergencies of international concern.[29] ZNPHI has two leading roles: coordinating surveillance operations nationwide for infection prevention and early detection in both human and animal health, and strengthening preparedness and efficient response to outbreaks in the country.[30] ZNPHI also analyzes surveillance data and conducts academic research and investigation, which is the basis of health policy.[31] The heads of each department of ZNPHI are the experienced public health administrators from the Ministry of Health, UTH, etc., and experts in infectious disease epidemiology.[32] According to the interviews with the persons concerned during this survey, many of the staff are administrative officers, and there are not necessarily many staff members who have doctoral degrees specialized in infectious diseases and can provide academic advice.

UTH, which is expected to be a cooperating organization of ZNPHI for JICA TCTP, is also the largest educational hospital and research center in the country and provides education and training for medical providers in the country and overseas. UTH conducts research to solve health problems and develop science and technology.[33] UTH also has experience in cooperating in telemedicine and distance education with 12 neighboring countries.[34]

Similar to UTH, SVM-UNZA, which is expected to be a cooperating organization, is a veterinarian training institution in Zambia established with the cooperation of Japan in the 1980s.[35] At the time of this survey, 28 professors were in office at 4 faculties (Biomedical science, Clinical Studies, Disease Control, and Para-Clinical Studies).[36] It also offers graduate education, offering 11 master's programs and 7 doctoral programs.[37] This includes two international Master of Science courses on the "One Health" approach (One Health Epidemiology (MSc OHAE) and One Health Food Safety (MSc OHFS).[38] It also has two diploma courses related to zoonotic diseases in distance education (lab diagnosis and management, and livestock health management and production in tropical regions).[39]

(2) Facilities/Equipment

Regarding the facilities and equipment of ZNPHI, the Africa CDC Investment Project of the World Bank is currently underway.[40] It is expected that the functions of laboratories and training facilities will be strengthened with this support.[41] According to an interview for this survey, ZNPHI constructed and is currently operating a simple prefabricated laboratory to respond to the spread of COVID-19. However,

[29] ZNPHI Webpage http://znphi.co.zm/about.html (Accessed December 25, 2020)
[30] See Footnote 28: ZNPHI Webpage
[31] See Footnote 28: ZNPHI Webpage
[32] ZNPHI Webpage Team http://znphi.co.zm/ (Accessed December 25, 2020)
[33] UTH Webpage http://www.uth.gov.zm/?page_id=89
[34] See Footnote 32: UTH Webpage
[35] JICA (1986) Report of the Technical Cooperation Program Meeting of the SVM-UNZA, Republic of Zambia
[36] SVM-UNZA Webpage https://www.unza.zm/schools/veterinary-medicine/about (Accessed December 25, 2020)
[37] See Footnote 35: the SVM-UNZA Webpage
[38] SVM-UNZA Webpage (Department of Disease Control) https://www.unza.zm/schools/veterinary-medicine/departments/disease-control (Accessed December 25, 2020)
[39] See Footnote 37: SVM-UNZA Webpage (Department of Disease Control) https://www.unza.zm/schools/veterinary-medicine/departments/disease-control
[40] World Bank (2020) Africa CDC Investment Project, Project Information Document
[41] Ministry of Health Zambia (2019) Press Statement: World Bank Approves Support for Africa CDC Regional Investment Financing Project (ACDCP) https://www.moh.gov.zm/?p=6327 (Accessed on December 25, 2020)

since there is no laboratory equipped with equipment and facilities for surveillance, and the diagnostic tests are outsourced to UTH and other laboratories to analyze the data. In September 2020, a new laboratory was opened on Levy Hospital's premises, and it is expected that public health testing functions will be transferred from the University of Zambia Teaching Hospital to this laboratory in the future.

UTH is equipped with educational facilities as a teaching hospital. Also, the Tuberculosis Lab, which JICA has cooperated with, has a BSL-3 laboratory. Furthermore, the Virology Lab is designated as the National Reference Lab for HIV/AIDS, Influenza and Measles, and has diagnostic capacities with equipment and facilities for infectious disease diagnosis.[42]

However, in the interviews for this survey, it was reported that UTH has only one device related to gene analysis (an ABI 3730 DNA Analyzer). There is a need to procure reagents, prepare computers for analysis, deploy next-generation sequencers, and conduct hands-on training on gene analysis.

Similarly, SVM-UNZA is also equipped as an educational institution. The Department of Disease Control, which JICA has cooperated with, has a BSL-2 lab for virology, bacteriology, public health biochemistry, pathology, and hematology parasitology. It also has a BSL-3 lab facility established by a project of the Hokkaido University Research Center for Zoonosis Control in 2008. The laboratory of the Department of Disease Control was highly evaluated as the only Ebola diagnostic institution in the country at the time of the outbreak of Ebola virus disease in 2014.[43] In the survey interview, it was reported that the lab owns several pieces of equipment related to gene analysis, including 4 sequencers (2 instruments for Sanger sequencing and 2 next-generation sequencers), 2 real-time PCRs, and 2 conventional PCRs. Training needs around handling this equipment were not identified. The identified needs are the large-scale computing machine required for bioinformatics training, data processing for gene analysis using the next-generation sequencers, and the electric power for that purpose.

[42] Responses in the online interview in this survey.
[43] See Footnote 37:

CHAPTER 6.
FEEDBACK FROM EX-PARTICIPANTS

6-1. Objectives and methods of collecting feedback on the training

The survey team conducted a self-administered questionnaire among 22 ex-participants of the TCTP course in Egypt to improve its course, "Research and Crisis management in combating emerging diseases in Africa" conducted in Egypt described in Chapter 5 and to extract lessons learned for future TCTP courses in Zambia.

The questionnaire consisted of three major items: (1) training contents utilized and not utilized, (2) training effectiveness, and (3) status of laboratories in each country. 11 respondents answered the questionnaire (response rate: 50%). Besides collecting the questionnaire responses, online interviews were conducted with eight respondents (Group A:5 and Group B:3) to collect supplementary information.

Table 6-1. Summary of the Training in Japan, "Ending TB in the Era of UHC"

Title	Ending TB and AMR in the Era of UHC
Training Organization	The Research Institute of Tuberculosis, Japan Anti-Tuberculosis Association (hereafter referred to as "RIT/JATA")
Period	Two months from early October to early December every year
Participant Country	Afghanistan, Cambodia, Kenya, Liberia, Myanmar, Philippines, Thailand (FY2018)
Participant	Clinical laboratory technicians or physicians in charge of tuberculosis treatment engage in tuberculosis bacteriology in developing countries. The capacity of participants: 8 persons.
Goal	Early detection and diagnosis of tuberculosis (TB) patients is vital to prevent the spread of infection, and a highly sensitive, highly specific, and rapid TB diagnostic method is required worldwide. This training course contributes to eradicating tuberculosis by strengthening the management of tuberculosis testing using genetic testing technology.
Training Objective	The lecture and practical training cover almost all Mycobacterium tuberculosis-testing methods, from microscopy to culture and genetic testing methods. The course includes leadership training on management and training methods to develop leaders in the laboratory testing area for tuberculosis control.
Class Topic	1) UHC in SDGs, End TB Strategy, examples of UHC, disease control and UHC, 2) Basic epidemiology and operational research methods, epidemiology of infectious diseases, monitoring and evaluation of disease control, molecular epidemiology, how to search and read articles, 3) UHC and public-private partnerships, measures for risk groups, patient-centered care, patient cost analysis, a Japanese version of DOTS/DOTS conferences, 4) Tuberculosis/HIV co-infection, TB, non-communicable diseases and smoking, pediatric TB, TB infection control and 5) Basics of TB diagnosis and EQA, Immunogenetics and immunodiagnosis, Treatment of multidrug-resistant TB, Genetic diagnosis, Management of multidrug-resistant TB treatment, 6) Analysis of TB control problems in different countries, Presentation skills.

(Source) The Research Institute of Tuberculosis, Japan Anti-Tuberculosis Association, Webpage https://jata.or.jp/outline_international.php
* RIT/JATA also implemented the Training in Japan, "Quality Laboratory Management for Tuberculosis in UHC -Applied for Global Threatening Disease Control-"

Table 6-2. Summary of the training in Japan
"Clinical Laboratory Technology: Clinical Microbiology for Proper Diagnosis of Infectious Diseases"

Title	Clinical Laboratory Technology: Clinical Microbiology for Proper Diagnosis of Infectious Diseases
Training Organization	Japan International Medical Technology Foundation (hereinafter referred to as "JIMTEF")
Period	September 29 - December 24, 2019 (FY 2018 - FY 2020)
Participant Country	Timor-Leste, Myanmar, Samoa, Iran, Kenya, Zambia, Gabon, Sierra Leone, South Sudan (planned for FY2020)
Participant	Clinical laboratory technicians, physicians, pharmacists, or nurses involved in microbiological testing can collaborate with national or regional key medical institutions or diagnostic departments and are responsible for disseminating the skills and knowledge acquired in training.
Goal	Trainees acquire skills and knowledge related to microbiological testing, standard testing methods, quality control of testing, and microbiology laboratories' management and operation. Those are indispensable for the appropriate diagnosis and treatment of infectious diseases. After returning to their home countries, they transfer the skills to critical medical institutions or laboratories in their home countries, thereby contributing to human resource development.
Training Objective	The objective is for the trainees to acquire and demonstrate highly accurate testing techniques (microbiological testing) and laboratory management and operation methods based on clinical laboratories' role in their home country's health system.
Class Topic	1) Biosafety and standard precautions in microbiology laboratories, quality control of tests and laboratory management, staff training and management, 2) Smear testing methods (rapid tests), testing methods by material, characteristics and usage of culture media, characteristics of medically critical bacterial communities, identification test, drug susceptibility testing methods and attributes of major drug-resistant bacteria, 3) Effective use of laboratory information in infectious disease treatment, the role of the microbiology laboratory in infection control (including Healthcare-Associated Infection), and 4) Laboratories and laboratory networks in health systems, epidemiology, and infectious disease surveillance, and trends in international infectious disease control.

(Source) JICA https://www.jica.go.jp/activities/schemes/tr_japan/summary/lineup2019/sector/ku57pq00002jvqff-att/201984432_j.pd,
JIMTEF Webpage https://www.jimtef.or.jp/work/study.html

Additionally, similar questionnaire surveys and online interviews were conducted with the training institutions and lecturers to inquire about the training's perceived effects and challenges. In addition, in order to obtain lessons learned on training programs targeting multiple countries, online interviews were conducted with officials of the JICA Training in Japan mentioned above.

This TCTP at the FOM/SCU has been conducted only once so far, and there is a lot of room for improvement. The training institution, Suez Canal University, has surveyed participants to determine their level of satisfaction with the training, as well as the issues that need to be addressed, and is now considering improvements for the second and subsequent training programs.

Also, the unexpected global spread of COVID-19 during the training course may have affected ex-participants to put their action plans into practice after the end of the TCTP.

6-2. Training contents utilized and not utilized

6-2-1. Training contents utilized by the ex-participants

Figure 6-1 shows a summary of responses to the question, "Have you ever used what you learned in the TCTP in your work?" Among the common subjects of Group A (mostly epidemiological statisticians, etc.,) and Group B (predominantly clinical laboratory technicians), "3. Introduction to emerging and re-emerging diseases", "4. Action plan design", "9. KAIZEN 5S", "13. 2019 COVID-19 outbreak", and "19. Rapid response and team training" were unanimously selected as "utilized in work."

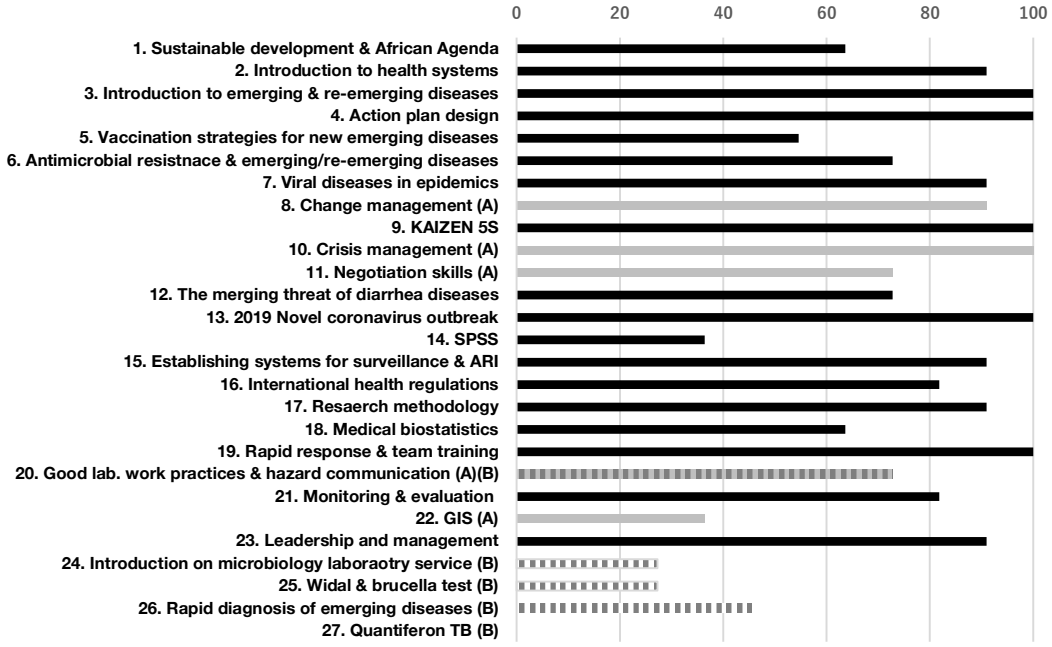


Fig. 6-1. Items utilized by ex-participants after the training (percentages of respondents who answered "utilized".)

Note 1: No symbol: items for both groups A and B, (A) ■: items for group A, (B) ▥: items for group B
However, for "20. Global laboratory work practices & hazard communication", Group A received theoretical training, and Group B received practical training.
Note 2: "27. QuantiFERON TB" could not be asked due to an error in preparing the questionnaire.

Another important question was, "What are the three most useful subjects in your work, and why?" The most popular responses were "4. Action plan design" (6 respondents, 54.5%), "19. Rapid response & team training" (4 respondents, 36.3%), "9. KAIZEN 5S" (3 respondents, 27.2%), "14. SPSS" (3

respondents, 27.2%), and "22. GIS" (3 respondents, 27.2%) etc. The main reasons were: "(1) strong relevance to their work" (13 out of 35 responses, 37.1%)," (2) new concepts and approaches" (6 out of 35 responses, 17.1%)," (3) satisfaction with learning and understanding" (6 out of 35 responses, 17.1%), and "(4) had never received systematic training before" (3 out of 35 responses, 8.5%).

(3) and (4) suggest that the training helped participants better understand the abilities and skills required in their work and strengthen their capacities. As for (2), many of the respondents brought up the learning needs that arose from a new job or post amid the global spread of COVID-19 or answered it as a reason for the 5S-KAIZEN.

6-2-2. Training contents not utilized by the ex-participants

As Figure 6-1 shows, among the items common to both Groups A and B, less than 60% of participants responded that they utilized "5. Vaccination strategies for new emerging diseases" (54.5%) and "14. SPSS" (36.3%). Figure 6-1 shows that the percentage of respondents who answered that they utilized the training afterward tended to be low because, for participants in different groups, the subjects targeted only for Group A or Group B had little relevance to their work.

In response to the question, "Which three subjects were the least useful for your work?" some ex-participants answered, "25. Widal & brucella test" (7 respondents, 63.6%), "24. Introduction on microbiology laboratory service" (6 respondents, 54.5%), "26. Rapid diagnosis of emerging diseases" (3 respondents, 27.2%), and "GIS" (3 respondents, 27.2%). For 24, 25, and 26, Group A responded that those subjects were irrelevant to their work. Group B also gave responses such as "tests not already in use" and "too basic," suggesting a discrepancy between the training content and the participants' ability and skill level. In terms of a discrepancy, some respondents indicated that they did not fully understand the information in "18. Medical biostatistics" and "14. SPSS."

In response to the question, "Which three subjects would you have liked to learn more?" the most common responses were, "10. Crisis management" (4 respondents, 36.3%), "17. Research methodology" (4 respondents, 36.3%), and "9. Medical biostatistics" (3 respondents, 27.2%). The reasons for wanting to learn varied, but the major responses were: "(1) there was not enough time, or the content was insufficient," "(2) it was necessary for my work, "and "(3) it was a technology that had not been fully introduced in my country." For example, those were the responses to "9. KAIZEN 5S" because it was a new concept, and they wanted to learn more about it and to know if it could be applied to their work. Although not included in the training program, some participants wanted to add "Incident management system approach," "Biosafety and biosecurity," "Molecular diagnostic analysis," and "Psychosocial session" to the training.

"8. Change management," "10. Crisis management," and "21. Monitoring & Evaluation" were subjects targeted at Group A. Still, more than 80% of the respondents answered that they used those skills after the training. These subjects could also be of high need and interest to the clinical laboratory technicians in Group B.

6-2-3. Matching the training needs of participants with the TCTP content

6-2-1 and 6-2-2 suggest that whether or not the training content in the TCTP is utilized after the training

depends on how well it matches the participants' job.

However, interviews with officials at the FOM/SCU indicated that there are some issues in selecting participants in their TCTP course, suggesting that there are challenges in matching the training content to the training participants' work. For example, some, but not all, of the training participants did not check the recruitment details and did not understand the course contents and training schedule before entering Egypt. Also, some participants had difficulty taking the course in English, even though it was stated that English proficiency is required for training. The recruitment of participants is done through the Egyptian diplomatic channels, and the participating countries' relevant institutions are notified in advance. Still, it is not always possible to spend adequate time on recruitment and selection. In the case of the TCTP course in Egypt, the Egyptian Ministry of Foreign Affairs is mainly responsible for coordinating the invitations of the training participants. JICA is not in a position to manage everything on its own. According to interviews with the JICA Egypt office, those are problems that the Training in Japan and other TCTP also face.

On the other hand, those that the survey team interviewed about the Training in Japan had devised ways to select participants. For example, for the training program of RIT/JATA, before choosing the participants, JICA headquarters distributes the recruitment information four months in advance. The RIT/JATA conducts telephone interviews with the candidates to confirm their work and English proficiency. Also, for the JIMTEF's training programs, the JIMTEF, its instructors, and cooperating training institutions that accept participants are involved in the selection process, and participants are selected from multiple perspectives. At the time of the survey, this approach enabled the training institutions to recruit participants whose work was more in line with the training content and who were sufficiently motivated to participate. It will also be possible to fill a training venue with a sense of unity and a positive atmosphere for learning. As a result, it is possible to provide training opportunities that are more responsive to the participants' needs. In the case of the Training in Japan, unlike the TCTP in Egypt, JICA has a mechanism to manage a series of comprehensively related procedures.

6-2-4. Matching between the competence/technical level of the participants and the TCTP contents

6-2-1 and 6-2-2 displays how the matching or mismatching between the training participants' competence/technical level and the training contents was also considered one of the contributing factors for whether or not training contents were utilized after the training.

Some people from the FOM/SCU responded, "It is challenging to create a curriculum that satisfies every participant." They shared the importance of adapting the training contents to the abilities of the participants. For example, some responded, "We tell the lecturers to cover basic to specialized topics according to the various participants' levels and encourage active learning. Especially in infectious diseases, Egypt's situation is different from the situation in African countries, so the participants must learn from each other. We provide them with the opportunity to do so." "Those who wish to take the course should read the GI carefully in advance and decide for themselves whether the training is necessary for them."

The responses suggest the importance of recruitment and selection and devising teaching methods to combine the training content with the participants' competencies. For example, in light of the training's

purpose and goals, several items can be considered around teaching methods, such as whether active learning is possible, combining lectures and practical sessions, and incorporating online classes.

The importance of active learning was also confirmed in an interview with the RIT/JATA. It has been adopted as a teaching method to promote effectiveness in adult education. It is not a method that forcibly matches the participants' competence/technical level with the training content in the TCTP, but rather a response based on the premise that participants with different experiences and backgrounds come together.

6-2-5. Need for practical sessions

Although not specific to any particular training subject, more than 60% (7 respondents, 63.6%) of the respondents gave reasons for why they used or did not use the training content, and suggestions for training subjects, such as; "it was practical," "it was not practical," and "it would be good if there were more opportunities to practice and see the sites of practice." For example, in the lecture that dealt with hospitals, they said, "A visit to an actual hospital is necessary." In the 5S-KAIZEN lecture, they said, "I cannot grasp the possibility of implementation and would like to see an actual site."

The lecturers also expressed similar opinions from the FOM/SCU and external lecturers. For example, "The fields of epidemiology, public health, health economics, and statistics should be used in the actual sites, and more preparation for the field should be done to increase the time for field exercises in the training." Some ideas include employing small-scale projects and case studies to implement the learning in the home country. "There is much more that can be done to enrich the curriculum and incorporate a practical approach." Practicum and experiential learning are also part of active learning in the broadest sense. The RIT/JATA also makes extensive use of discussions, workshops, exercises, and practical sessions.

6-3. Training effectiveness

6-3-1. Human resource development

From the responses to the questionnaire, it was confirmed that the participants acquired knowledge and skills through the training. The answers of the training participants can be broadly divided into three categories: (1) brushing up what was learned in the past, (2) systematically organizing the experience and knowledge gained in work, and (3) learning new concepts. Responses to (1) include, "I was able to look back on what I learned in the master's course once again." Responses to (2) include, "I used to conduct TB diagnosis in the dark, but now I am aware of where I should focus my efforts while looking at surveillance and survey results," and "I started to work with a log frame. etc. "Responses to (3), as mentioned earlier include, 5S-KAIZEN, etc.

On the other hand, some training participants mentioned the need for follow-up to sustain the effects of learning, and lecturers from the FOM/SCU also mentioned the importance of follow-up and challenges. For example, implementing the action plans that the training participants create during the training is essential in retaining learning content. Still, it is difficult to check the progress and respond to support implementation after participants leave the training. In the previous TCTP, the FOM/SCU conducted some follow-up activities by visiting one or two participating countries per year and holding workshops.

But the respondent said that the current training course does not provide this kind of support.

Those involved in the Training in Japan also reported the necessity of follow-up and its implementation difficulty. For example, the implementation rate of the action plan prepared by the participants in the JIMTEF training program is about 30%, which is a good situation compared to other training programs. Still, they cannot provide support to encourage participants to put the action plans into practice, as participants are busy with their daily work after returning home.

However, in the case of the RIT/JATA, when training instructors are dispatched to overseas sites, such as when RIT/JATA has projects in the country of the ex-participants, they work together with the participants and/or the ex-participants participate in the Training in Japan as facilitators several years after the training, which allows ex-participants to put their learning experiences into practice. There is also a JICA follow-up scheme that RIT/JATA encourages ex-participants to use as appropriate, which may have an impact on the retention and utilization of what they learned in training.

6-3-2. Regional collaboration

No specific effects or impacts were reported from the training participants' questionnaire responses or interview responses regarding regional collaboration. During the training period, a group was created using WhatsApp, a social networking service with many subscribers in the African region, where the participants of the training can interact with each other. However, it is still limited to greetings and informal exchanges. Several respondents (2 respondents) said that they were busy responding to the epidemic of COVID-19, and this led to a delay in contacting training participants in other countries. Hence, there was no significant change in regional cooperation. One respondent said that the possibility of regional collaboration was low because he was not at a central level.

However, several respondents (3 respondents) thought that there was a possibility of collaboration, such as information sharing and exchange of opinions with participants with different expertise, if necessary. One respondent said that he had started analyzing each country as a result of this training, and another respondent had begun exploring the possibility of border-to-border cooperation with other countries that were not training participant countries.

As for the effects and impacts of regional collaboration, no specific examples were confirmed from the FOM/SCU officials and or from the Japanese training institutions. However, the officials of FOM/SCU expressed their understanding of the possibility of regional cooperation. They hope for JICA's technical and financial cooperation in creating a platform for collaboration among the training participants. RIT/JATA regularly publishes newsletters (sharing information on new findings, etc., once a year) and holds reunions for former trainees at international conferences to create opportunities and venues for maintaining and developing connections among participants.

6-3-3. Health system strengthening

At the time of this survey, the survey team could not confirm whether or not the effects of individual learning and capacity building, described in 6-3-1, had any impact on strengthening the participants' institutions or on improving the health system. Still, the team confirmed the possibility of such impacts. Many of the training participants are managers in their departments and can influence their subordinates

and other colleagues through their daily work and discussions on policies and measures. Responses include, "I shared my learning findings with the Ministry of Health staff I supervise and support during our regular weekly meetings," and "After the training, I became the head of the rapid response team for COVID-19 and shared the learning with the team members." Similarly, some officials from the FOM/SCU said, "Many of the participants are in management positions at the Ministry of Health, etc. I believe that management, quality control, and organizational change will be utilized in the workplace," and "I have heard that some trainees have been promoted in their workplaces and or have been appointed to important positions in the government."

On the other hand, there are responses such as, "Due to busy schedules, I have not been able to share what I have learned," "The health system is a time-consuming process," and "I don't have the equipment and or financial resources to implement the learning." Similarly, a person from the FOM/SCU said, "It is difficult to change the organization to which they belong so that they can apply what they learned in training to the workplace. They need the empowerment of the participants." In some cases, even if the training content is suitable for the participants' posts and jobs, they cannot utilize what they have learned during the training due to a lack of facilities, equipment, and instruments in their home countries. Several obstacles have been indicated around the transfer of personal learning to organizations.

6-4. Other TCTP

In the field of infectious disease control in Africa, in addition to Egypt and Zambia, TCTP has been conducted in Ghana and Kenya.

6-4-1. TCTP in Ghana

Table 6-3 shows an overview of the Ghana TCTP course, "Enhancing Laboratory Skills for Infectious Diseases in West African Countries for Post Ebola," which is being conducted in Ghana for three years starting in FY2018. As the course title implies, this course aims to develop human resources for the public health crisis response in West Africa, especially in laboratory diagnosis, which was reviewed after the spread of Ebola virus disease in West Africa in 2014.

Table 6-3: Summary of TCTP in Ghana

Title	Enhancing Laboratory Skills for Infectious Diseases in West African Countries for Post Ebola
Training Organization	The Noguchi Memorial Institute for Medical Research (Ghana)
Period	Eight weeks (1st: January 7, 2019 - March 1, 2019; 2nd: January 13, 2020 - March 5, 2020)
Participant Country	1st: Liberia, Sierra Leone, Nigeria, Ghana 2nd: Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Liberia, Nigeria, Sierra Leone, Togo
Participant	Clinical laboratory technicians (1st: 12 participants, 2nd: 15 participants)
Goal	The quality of infectious disease diagnosis and the treatment and prevention capacities of clinical laboratory technicians will be strengthened, facilitating new technologies and contributing to networking among West African countries.
Training Objective	Clinical laboratory technicians will be trained to be responsible for continuously strengthening the quality of diagnosis, treatment, and prevention of infectious diseases and treating and preventing infectious diseases by acquiring reliable testing techniques for the diagnosis of infectious diseases.
Class Topic (2nd year)	Weeks 1 and 2: Lectures on cross-cutting soft skills as a standard module for the three program areas (Parasitology, Bacteriology, and Virology), including Biosafety, Biosecurity, Quality Management Systems (QMS), Standard Operating Procedures (SOP) development. Weeks 3 and 4 (Specialized field): Parasitology, Bacteriology, Virology

(Source) JICA (2020) Course Report on the Third Country Training/ In-Country Training Program in Republic of Ghana, JICA Project summary

6-4-2. TCTP in Kenya

Table 6-4 shows a summary of the TCTP "Strengthening Laboratory Preparedness for Building Resilience against Public Health Emergencies in Eastern Africa," which is being conducted in Kenya for five years from FY2018 to FY2023. The second TCTP is scheduled from November 2020 to March 2021 at several locations in Kenya.

Table 6-4. Summary of TCTP in Kenya (1st Year)

Title	Strengthening Laboratory Preparedness for Building Resilience against Public Health Emergencies in Eastern Africa
Training Organization	The Kenya Medical Research Institute
Period	October 1, 2019 - October 25, 2019
Participant Country	Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Tanzania, Uganda
Participant	14 clinical laboratory technicians
Goal	1. Inter-country collaboration network in outbreak response is established among trained course participants, and experiences in laboratory response to emerging infectious diseases in the target countries are shared. 2. Availability of highly trained specialists in selected countries is increased to better respond to infectious disease outbreaks. 3. Laboratory capacity in participating countries is improved through sharing skillsets and training personnel.
Training Objective	1. To equip participants from selected countries with laboratory knowledge, skills, attitude, and critical judgment in response to emerging and re-emerging infectious diseases. 2. To increase the critical mass of highly trained laboratory personnel in emergency preparedness and response to disease outbreaks. 3. To improve institutional laboratory capacity for disease surveillance and diagnosis. 4. To establish and operationalize partnerships, collaborations, and networks across the selected countries for improved preparedness and response under International Health Regulations (IHR) 2005 and Global Health Security Agenda (GHSA).
Class Topic	1. Network formation (distribution of emerging and re-emerging infectious diseases), an overview of lab preparation (infrastructure, personnel, equipment, skills, etc.), epidemiology, and research tools (case study exercise). 2. Outbreak response (role of One Health approach, Bio risk, Biosafety and Biosecurity, P3 training). 3. Strengthening laboratory capacity (role and response of laboratory in emergencies, laboratory diagnostic tests, molecular pathology diagnostics, and bioinformatics). 4. IHR strengthening (role of public health systems and emergency preparedness, national public health emergency response framework, roles of managers and decision-makers, action plans).

(Source)KEMRI, Course Report KEMRI TCTP for Strengthening Laboratory Preparedness for Building Resilience against Public Health Emergencies in Eastern Africa (2019) General Information on The Course "Strengthening Laboratory Preparedness for Building Resilience against Public Health Emergencies In Eastern Africa."

CHAPTER 7.
COOPERATION NEEDS

7-1. Infectious disease control and health crisis responses as cooperation needs

As mentioned in Chapter 2, although the number of deaths due to infectious diseases and DALYs are declining worldwide, outbreaks of various infectious diseases still occur in the African region, which is a heavy burden. The same is true in Southern Africa where rates of HIV/AIDS and tuberculosis, which were prevalent during the 2000s, have diminished but the number of people requiring NTD intervention is increasing. From the end of 2019, as the world faces the spread of COVID-19, infectious disease control, health crisis response, and the health system's strengthening need to be continuously addressed.

Under these circumstances, the Southern African countries have made efforts to comply with international and regional policies to strengthen their health system for infectious disease control and health crisis response by promoting the IDSR strategy and strengthening WHO's IHR core capacity. In addition, as mentioned in Chapter 3, strengthening infectious disease control and health crisis response is generally set as a priority issue in the development policies of each country. Therefore, it is consistent with these policies to continue working on infectious disease control, health crisis response, and health system strengthening for this purpose.

7-2. Detailed cooperation needs in infectious disease control and health crisis responses

7-2-1. Strategy for determining detailed cooperation needs

The cooperation needs were identified based on the contents of Chapters 2 to 6, the average score of IHR core capacity of each country in Southern Africa related to laboratories and surveillance, and the status of cooperation by other aid agencies shown in Table 7-1.

For the average score of IHR core capacity, the standard deviation is also shown in Table 7-1 for reference. Each country has different health systems and policies on infectious disease control and health crisis responses, and the situation is diverse. Since the TCTP is a scheme that provides training in a group, a significant consideration is needed to avoid neglecting each country's situation.

7-2-2. Areas of high cooperation needs

In Table 7-1, the average and standard deviation of the IHR core capacity scores for the Southern African region for different core capacities listed in Chapter 3 are shown. It indicates that the lower the average score, the more necessary it is to improve. Regarding detailed cooperation needs, it is determined that the following scores indicate as follows.

- If the average score is less than 2.0, the need is large.
- If the average score is 2.1 to less than 3.0, the need is medium.
- If the average score is 3.0 or more, the need is small.
-

Also, the situation of the cooperation of other development partners is taken into consideration as follows.

- If any development partner works for the development of the core capacities (o), the need is small.
- If no development partner works for the development of the core capacities (x), the need is large, regardless of the IHR core capacity score.

Table 7-1. Average and standard deviation of IHR core capacity scores for the Southern Africa region

IHR Core capacities	Scores of IHR core capacity		Cooperation of other development partners
	Average	Standard deviation	
Surveillance			
Indicator-based surveillance and event-based surveillance systems	3.1	0.57	○
A digitized real-time reporting system linked and combined	2.1	0.31	
Surveillance data integration and analysis	3.2	0.63	
Syndromic surveillance	3.6-3.75	0.43-0.70	
Laboratory capacity			
Laboratory tests for detection of priority diseases	3.8	0.80	○
Specimen referral/transportation system	3.1	1.10	
Modern POC testing and definitive laboratory diagnosis	2.6	0.50	
Laboratory quality management system	2.6	0.68	
AMR			
Detection of drug resistance	**1.9**	**1.10**	○
Surveillance of infection by drug-resistant pathogens	2.0	1.05	
Prevention and control of healthcare-associated infections	**1.8**	**0.92**	
Responsible activity for drug resistance	**1.4**	**0.68**	
One Health approach/zoonotic diseases			
Establishment of a surveillance system for zoonotic diseases and pathogens	3.2	1.03	○
Veterinarians and human resources related to animal health	3.6	0.70	
Establishment of mechanisms for responding to infectious and potentially zoonotic diseases	**1.9**	**0.99**	
Biosafety/biosecurity			
Establishment of government biosafety and security systems for humans, animals, and agricultural facilities	**1.7**	**0.67**	○
Biosafety and security training and practice	**1.6**	**0.68**	
Laboratory data management/reporting system maintenance status			
It is not included in the IHR core capacity index, or it is included in the above indicators.			○
Availability of laboratory materials and equipment			
It is not included in the IHR core capacity index, or it is included in the above indicators.			○
Education system for clinical laboratory technicians			
It is not included in the IHR core capacity index, or it is included in the above indicators.			×

(Source)From Chapter 2 of this report
Cooperation priority: **High**: Average score less than 2.0 (**bold**), Medium: Average score 2.0-3.0, Low: Average score: 3.0 or higher (gray)

From Table 7-1, the areas of cooperation needs are regarded are "AMR" and "Biosafety/biosecurity." Among the core capacities for "One Health approach/Zoonotic Diseases," which are closely related to "AMR" and "Biosafety/biosecurity," "Establishment of mechanisms for responding to infectious and potentially zoonotic diseases" has large cooperation needs and is refers to the establishment of multi-sectoral mechanisms needed for the One Health approach.

Regarding laboratories, there is not a great need for cooperation regarding "laboratory diagnostic capacity" such as "Laboratory tests for detection of priority diseases," but the cooperation needs can be recognized in the context with "AMR," "Biosafety/biosecurity," and "One Health approach/zoonotic diseases" which are the areas closely related to the laboratory.[1] In addition, as described in Chapter 3, the need for capacity development such as gene sequencing technology is increasing in the epidemics of COVID-19. Therefore, "Laboratory capacity" can be larger needs when combined with other areas and newly emerging needs.

Regarding "Laboratory data management/reporting system maintenance status," "Sufficiency of laboratory materials and equipment," and "Education system for clinical laboratory technicians," there are no indicators for IHR core capacity specialized in these areas. Therefore, the magnitude of cooperation needs

[1] As a benchmark for IHR's core capacity, strengthening laboratory functions and establishing systems (for example, setting lab standards and requirements for laboratory capacities) are listed in terms of strengthening surveillance of "AMR". Similarly, access to a laboratory with sufficient capacity for detecting pathogens of zoonotic diseases is required in "Establishing a mechanism for infectious and potential zoonotic diseases". "Biosafety / biosecurity" is an enhancement of the laboratory.

is not clear, but as shown in Chapter 3, there are some challenges in all areas. These are related to the operation and management of the entire laboratory, and considering the low utilization of SLIPTA's accreditation system, there is a lot of room for cooperation. Regarding the development of the "Education system for clinical laboratory technicians," no specific donor support was found in this survey. Therefore, the cooperation need is large.

7-2-3. Determining cooperation priority

After confirming the IHR core capacity index's cooperation needs, it is necessary to consider the cooperation priority and detailed cooperation contents. It is required to discuss the possibility, sustainability, and visibility of the cooperation effects. Regarding the possibility of the cooperation effect, for example, if the technical cooperation can change the situation only with additional inputs such as infrastructure development and financial situation improvement, it is considered that the possibility of the effects of the technical cooperation is low. Similarly, sustainability is evaluated to be high if the problems are resolved from multiple perspectives, such as policy/political environment, institutional and organizational arrangements, technologies, finance, etc., in the JICA project evaluation. Visibility of cooperation effects can be seen when it is easier to justify the changes of the situation by existing indicators or specific outputs/outcomes such as obtaining accreditation.

Problems and themes should be narrowed down in terms of possibility, sustainability, and visibility of the cooperation effects. Then, quantitative and qualitative information and data should be collected and analyzed for each country's following areas shown in Table 7-2. This is based on the idea that issues that do not require various resources to solve are easier to solve and that issues for which changes in the solution can be visualized have a higher priority for cooperation. Sufficient information and data could not be collected in this survey due to time constraints as well as because they are not quantified in an easy-to-understand manner like the IHR core capacity. Thus, this information and data are not included in this report.

Table 7-2. Examples of survey items that contribute to the determination of cooperation priorities

Survey Area	Survey Question	Example of Survey Item
Problems to be solved	Is the cause of the problem clear? Can changes in problem-solving be identified through indicators and deliverables?	1. Status of agreement among the stakeholders such as issues and factors, definition and scope in policy documents, etc. 2. Indicators collected by the health information system, etc. 3. Formulation status of documents related to policy measures, etc.
Policies and measures related to problem-solving	Is it possible to obtain policy support for the efforts necessary to solve the problem?	1. Priorities of policies and comparison of priorities of related policies and measures. (How vital is capacity building of laboratories in strengthening IDSR? How important is animal health in agricultural policies?) 2. Formulation status of documents related to policy measures, etc.
Resources required to solve problems (1) Human resources	Is it possible now and in the future to secure the human resources needed to carry out the efforts necessary to solve the problem? Or is it possible by improving something else?	1. Contents and trends of development policies for human resources. 2. Duties for human resources (contents specified in administrative documents, actual duties). 3. The number of human resources and placement/turnover status. 4. Implementation status and system for education/training for human resources, sufficient provision of resources required for implementation (human resources / facility / materials / equipment / finance / information management). 5. Relationships among authorities of health, animal health, and education. 6. Role of professional associations and involvement in human resource development, placement, employment, etc. 7. The situation of the private sector.
Resources required to solve problems (2) Facility /equipment	Is it possible now and in the future to secure the facilities, equipment, and materials necessary to solve the problems? Or is it possible by improving something else?	1. Policies for maintenance/development/procurement for facilities/equipment /materials. 2. Regulations and others for maintenance of related facilities, equipment, and materials. 3. Performance status of related facilities/equipment/materials

Survey Area	Survey Question	Example of Survey Item
/materials		(performance status of the above regulations, etc.) 4. Sufficient provision of materials/equipment/consumables (sufficiency based on the above regulations, etc.) 5. Maintenance system for facility/equipment/materials, and supply management system for consumables. 6. The situation of the private sector.
Resources required to solve problems (3) finance	Is it possible now and in the future to secure the financial resources required to solve the problems? Or is it possible by improving something?	1. Securing current and future financial resources, budget allocation, and budgetary request system. 2. Trends in concerned budgets (execution rate and ratio to the Ministry of Health budget, utilization status of external funds, budget availability for related facilities, etc.) 3. Budgetary management status and ability at related facilities.
Resources required to solve problems (4) Information	Is it possible now and in the future to secure the necessary information to solve the problems? Or is it possible by improving something?	1. Structure of concerning health information management system and trends. 2. Data collected by relevant health information management systems. 3. Reporting rate and data quality (accuracy) of the collected data. 4. Utilization status of collected data.

7-3. Needs for training and capacity development

[Capacity of laboratory diagnostic technology]

As mentioned in 7-1, there is a need to strengthen laboratory diagnostic technology in the areas for "AMR," "Biosafety/biosecurity," and "One Health approach/zoonotic diseases." Also, in the epidemic of COVID-19, it is required to strengthen the technology related to gene analysis equipment and data analysis operation. In addition to the shortage of laboratory technicians, there are limited opportunities for in-service training for laboratory technicians, so training needs are significant for them.

When focusing on "laboratory testing and diagnosis technology" and its quality assurance, Chapter 3 and IHR Joint External Evaluation reports in each country suggest that the infrastructures and capacity development of animal health laboratories tend to be behind in compared to human health laboratories. Therefore, animal health laboratories have more significant needs of human resource development and capacity development related to "laboratory testing and diagnosis technology."

[Laboratory management capacity]

As presented by SLIPTA, there is a need for human resources and capacity development for the management and operation of the laboratory, as a functional enhancement of entire laboratory activities beyond diagnostic technologies. "Biosafety/biosecurity," "Laboratory data management/reporting system maintenance status," "Sufficient laboratory materials and equipment," "Education systems for clinical laboratory technicians," etc., are all related to SLIPTA[2]. As shown in Chapter 6, support for improving the skills and knowledge necessary for cross-disciplinary organizational management and organizational reform for managers is also required.

5S-KAIZEN is also considered to have potential training needs as an approach to strengthening the laboratory management capacity. 5S-KAIZEN is one approach to the management of work environment and process, and as mentioned in Chapter 6, it is one of the "subjects utilized well after training."

[One Health approach/Zoonotic diseases]

[2] "Biosafety/biosecurity" is related to Section 12 of the SLIPTA checklist, "Laboratory data management/reporting system maintenance status" is related to Section 9, "Availability of laboratory equipment and materials" (including procurement and maintenance) is related to Sections 5, 7, and 12, and "Education system for clinical laboratory technicians" relates to personnel matters and is related to Section 3.

The efforts of the One Health approach in the African region vary from country to country. The Africa CDC has just announced a One Health approach framework at the end of October 2020. Although a one-size-fits-all approach should be avoided because the situation in each country is different, it is necessary to foster a common understanding of the valuable content for the African region. Under these circumstances, the framework for Africa CDC's One Health approach requires capacity development of personnel who understand the laboratory's role and position and can take leadership to promote it in each country to enable it.

[Capacity to formulate policies and design systems for human resource and capacity development in laboratories]

There are many issues regarding human resource development and capacity building for laboratories, including basic training and in-service training. For example, there is a lack of resources such as facilities, equipment, teaching materials, and teaching staff. In order to develop quality laboratory technicians in the resource-limited setting, it is necessary to enhance personnel skills and capacities involved in policy planning and system design for human resource development.

[Capacity development related to policymaking for laboratories]

Similar to human resource and capacity development for laboratories, there is a need for policy planning and institutional design for all of the above-mentioned "Biosafety/biosecurity," "Laboratory data management/reporting system maintenance status," and "Sufficient laboratory materials and equipment." A low IHR core capacity score in this area means that these policies and institutions are not well organized. It is necessary to develop human resources and strengthen their capacities involved in policymaking for laboratories.

[Disaster Risk (Crisis) Management]

Disease control has been incorporated as part of disaster risk management in the African region. Also, the disaster risk management is described in WHO/AFRO's IDSR Regional Strategy 2020-2030. Furthermore, the policies of some countries in the Southern Africa region mentioned the need for strengthening disaster risk management. Therefore, strengthening disaster risk management is one of the development needs.

CHAPTER 8.
RECOMMENDATIONS FOR JICA TCTP

8-1. Recommendations for TCTP (general)

[Attention to the spread of COVID-19]

As of January 2021, there is no prospect of suppressing the epidemic of COVID-19, which has been spreading since the end of 2019. For example, the epidemic, which was once momentarily suppressed in the middle of 2020, shows signs of re-emergence worldwide since the end of 2020, including the African region. More mutant strains have been discovered in South Africa and elsewhere. Although there is some bright news, such as the development of vaccines and the start of vaccination, various issues have been pointed out regarding the feasibility of increasing the African region's vaccination rate.

Therefore, there is a possibility that COVID-19 will continue to spread for an extended period, and it is considered that it should be addressed as one of the target diseases in the TCTP. Even if the spread of COVID-19 is rapidly suppressed, there are many lessons and reflections from the year 2020 regarding infectious disease control measures, health crisis response, health system issues, and the preparedness for the infectious diseases of unknown etiology in the future.

[Capacity development of laboratory testing and diagnostic capacities]

As mentioned in Chapter 7, when aiming to strengthen laboratory diagnostic capacities, "AMR," "Biosafety/biosecurity," "One Health approach/Zoonotic Diseases," and "Disaster risk management/Crisis management" should be combined and addressed with the laboratory area in the TCTP. Improving laboratory testing and diagnostic techniques for priority diseases alone does not necessarily provide value-added training that meets cooperation needs.

[Improving the potential effects from short-term training]

Because TCTP is a short-term training, at most about one month, and it is thought that efforts to make full use of the period are necessary to achieve effectiveness in terms of human resource development. The after-training follow-up system, which is necessary for improving the possibility of effective and sustained learning, is not always substantial.

To improve this situation, it is recommended to expand the follow-up mechanism after training by JICA or the training institutions and encouragement of participants to put the learnings into practice. With the spread of COVID-19, the use of online meetings is increasing, and it is conceivable to incorporate the follow-up programs using these technologies into the training plan. For example, two months after the training, an opportunity to review the training content and its utilization are provided online to motivate the establishment of learning content and implement the action plan created during the training.

Assuming that it is not easy to expand the after-training follow-up mechanism and put the learnings into practice, as an alternative to follow-up, training items should be devised for the training participants to utilize the training content in their work.

For example, as described in Chapter 6, the utilization of training contents after training largely depends on matching/mismatching with the work of the training participants. Therefore, it is necessary to give adequate consideration to this point.

Also, by narrowing down the training contents to areas where development needs are increasing, that is, where governments and various development partners tend to increase the activities and inputs, it is possible to enhance opportunities for ex-participants to utilize or to match the learning contents in their work. As of the end of 2020, due to the spread of COVID-19, the cooperation needs in the laboratory are increasing for the use of gene analysis technology and its equipment.

[Strengthening regional cooperation as a training effect]

Regarding the strengthening of regional cooperation as an effect of the TCTP, it is limited to the development of informal relationships among the ex-participants. At the time of this survey, it is not clear whether regional cooperation is expected as a training effect in the PREPARE concept, and if so, what kind of collaboration is expected is not very clear. Thus, we cannot make a judgment on the current situation about regional cooperation.

However, some of the TCTP courses currently underway include strengthening regional cooperation as one of the purposes. In the case of JICA or the training institutions evaluating the pros and cons of the achievement of regional cooperation in the future, it is necessary to clarify the pathways of the effectiveness of the TCTP leading to regional collaboration. At the time of this clarification, it is necessary to consider the strategic strengthening of the coordination between the TCTP and the Training in Japan.

[Health system strengthening as a training effect]

Suppose the TCTP aims to strengthen the health system through ripple effects such as the capacity development of other health workers and improvement of policy system in participating countries beyond ex-participants' capacity building. In that case, persons in managerial positions or positions involved in policymaking should be selected as training participants. Also, to connect the action plan formulated during the TCTP into health system strengthening, the participants should have collaborators rather than practicing his/her action plan alone. Therefore, multiple training participants should be selected from the same country as much as possible, and their superiors should also participate in the formulation of these action plans.

In addition, there is a history concerning laboratories that have not been emphasized in the health system. There is a possibility that policies, budget, human resource development, etc., for laboratories, are not necessarily priorities in the health system strengthening. Training should be designed with this in mind. For example, select participants who are in a position to be involved in health system strengthening, include in the training a discussion of ways to mainstream labs in the health system and promote the use of test results in surveillance, and so on.

[Strengthening collaboration among JICA Cooperation national core laboratories]

Chapter 6 also touched on the Training in Japan and the TCTP courses in Ghana and Kenya. There are knowledge and lessons cultivated in all training. Since these may be hints for improving all training courses, it is necessary to exchange opinions among JICA Cooperation's national core laboratories that conduct the TCTP courses, to strengthen collaboration. For this purpose, it is also essential to build a shared understanding and consensus among the JICA Cooperation national core laboratories, JICA offices, and JICA headquarters regarding the training's objectives, i.e., the PREPARE concept and other JICA initiatives. For example, JICA headquarters may hold semi-annual online meetings to strengthen cooperation and foster shared understanding and consensus-building. As mentioned earlier, it is also possible to discuss strategic differentiation and coordination among the TCTP courses and between the TCTP and the Training in Japan.

[Understanding the overall picture of health systems strengthening]

As indicated by the IHR Core capacities, various capacities need to be strengthened to build effective infectious disease control and health crisis responses. The governments, ministries of health, ministries of agriculture, and other organizations are making various efforts to strengthen these capacities, and development partners are cooperating in a wide range of areas. Furthermore, the governments and development partners are trying to respond flexibly to new needs that have emerged since the epidemic of COVID-19.

To plan and implement the TCTP effectively in the complex and changing situation, it is necessary to continually strive to understand the overall picture of health systems strengthening. For example, it is necessary for the TCTP to provide opportunities for sharing the training content and exchanging opinions not only within the training organizations but also with other stakeholders, research institutions such as universities, and the development partners from the planning stage. Also, since the status of laboratory diagnosis and community surveillance at primary facilities that serve as contact points for residents may be overlooked in the strengthening of national core laboratories, the participation of persons familiar with these situations should be considered for the planning stage of the training.

8-2. Recommendations for the Third Country Training Program in Egypt

[Strengthening the linkage between laboratory and crisis management]

In the Southern African region, the strengthening of laboratories and crisis management is one of the development needs of strengthening and expanding IDSR.

In this TCTP, the linkage between laboratory and crisis management should be strengthened more. For example, the laboratory's role should be emphasized in the classes on crisis management, and the laboratory issues should be used as a case for practical training and exercises. Similarly, classes on organizational management could be offered to laboratory technicians. This arrangement increases the number of contacts between "groups led by clinical laboratory technicians" and "groups led by epidemiological statisticians,

etc.,” thereby deepening understanding among those who are not directly engaged in laboratories and contributing to the awareness of the necessity of laboratories in crisis management among laboratory technicians.

[Selection of participants with experience of working with laboratories and crisis management]

In the eligibility requirements of the recruitment guidelines known as General Information (hereinafter referred to as “GI”), two candidates who have already worked together as an epidemiological statistician and a clinical laboratory technician are required to participate as a set in each country, but in some countries, candidates are not being recruited as intended.

To promote the above, selecting “a group led by epidemiological statisticians, etc.,” should be conditional on having sufficient experience in working and a high interest in working with laboratories. For example, it can be requirement that “participants have or will have experience working with laboratory experts as leaders of rapid response teams for infectious disease outbreaks.” For the “group led by clinical laboratory technicians,” it is desirable to select people who have experience in crisis management and disaster management, and a clear awareness of the issues, such as “those who have been involved in rapid response teams as clinical laboratory technicians.” As a result, in addition to the above-mentioned linkages, more training items will be related to the work of the training participants and will be useful in the field of practice, increasing the significance of the training and the possibility of its effectiveness.

In addition, JICA’s involvement in selecting candidates for the TCTP is limited because the distribution of the GI and the nomination of candidates are made through the diplomatic channels of the third country (Egypt in this case). It has been reported that there are cases where candidates cannot be selected as required in the GI and the situation where the only choice is to select from among the available candidates in a limited time is more difficult to rectify than the similar situation in the Training in Japan. To prevent this problem, the selection process needs to be improved. For example, the selection process period could be extended, and online interviews with candidates could be conducted during the selection process. This will make it easier to select highly motivated participants according to the GI, which can lead to creating a more favorable training environment.

[Strengths as a regional university]

The Suez Canal University is a regional university located in the Suez Canal region, about 100 km away from the capital city of Cairo. It is also an educational institution that actively collaborates with communities. These are things that the TCTP institutions in Zambia, Kenya, and Ghana do not have. Therefore, The Suez Canal University can differentiate itself from other training courses using these features in its TCTP contents.[1]

[1] Narrowing down the target region and country : Since the training in Egypt can be differentiated in this respect, the survey team finds that there is not a great need to narrow down the target region and country, as was the case with the training courses in Kenya and Ghana. However, it is expected that the discussion will be deepened between the JICA headquarters and the JICA Egypt office and the exchange of opinions among the stakeholders involved in each training course as mentioned in the

For example, training on the management of rapid response teams, specimen collection and delivery, and information management should focus on the sub-national level while taking advantage of regional universities' strengths (e.g., collaboration with local governments and communities). As stated in the WHO/AFRO IDSR Regional Strategy 2020-2030, rapid response teams need to be established and strengthened at the national (central) and sub-national levels.[2]

[Others: Utilization of strengths as a university educational institution]

Although this is not a recommendation for the TCTP, the expertise, knowledge, and experience related to medical education, which are the Suez Canal University's strengths, can improve laboratory technicians' basic education and university education in the Southern African region, where resources are limited, and there are many challenges, through the TCTP.

[Dispatch of Third Country Experts from the National Institute of Biomedical Research (hereinafter refereed to as INRB) (Democratic Republic of Congo: DRC)]

As described in Chapter 6, the professors and officials of the Suez Canal University visited the INRB in February 2020 and discussed third country experts' dispatch.

Currently, the INRB is the implementing agency for the SATREPS research project of the epidemiological research on zoonotic virus infections in Africa for strengthening the capacity of Zambia and the DRC to respond to viral zoonotic diseases. After the Ebola virus disease outbreak in West Africa in 2014, INRB conducted regional training on Ebola virus disease preparedness under the Ministry of Health of DRC from 2015 to 2016.[3] In FY2020, due to the global spread of COVID-19, the TCTP itself was postponed, so the dispatch of third-country experts has yet to be realized and is expected to be implemented in the future (including cooperation in webinars, etc.).

8-3. Recommendations for the Third Country Training Program in Zambia (under planning)

[Approaches to foster understanding of the need for cooperation in the region]

To promote understanding and participation in the countries concerned, an approach that broadens each country's knowledge in the region should be adopted, based on a clear policy of long-term involvement of JICA and training agencies in the issues covered by the TCTP.

As indicated in Chapter 3, Zambia's laboratory and surveillance situation are not superior to other countries in all aspects of the Southern African region. Regional collaboration among laboratories in each country is not clear. However, Japan's technical and financial cooperation has strengthened the UTH and SVN-UNZA,

section "Strengthening collaboration among JICA Cooperation hub laboratories."

[2] WHO (2019) WHO: Regional strategy for integrated disease surveillance and response: 2020-2030

[3] JICA Webpage, September 14, 2015 article [Health] Confronting the threat of Ebola virus disease by using the experience of the DRC https://www.jica.go.jp/senegal/office/information/event/150914.html

especially in the area of laboratory diagnosis. If this is the only basis for using Zambia as a training base, there is a risk that it will not lead to sustainable cooperation with neighboring countries.[4]

Under these circumstances, to promote understanding and participation in the TCTP among the countries concerned, it is necessary to clarify what issues should be jointly addressed in the training program, whether existing laboratory networks should be used or not, and how the TCTP can contribute to their development.

[Zambia National Public Health Institute as a center for promoting the One Health approach]

As mentioned in Chapter 6, there are various approaches among countries when it comes to implementing the One Health approach in the African region. The Africa CDC has just released a framework for the One Health approach at the end of October 2020. It is necessary to develop a shared understanding of what the African region should aim to conduct.

In light of these circumstances, the ZNPHI, the expected TCTP implementing agency, should design training so that the Africa CDC can become the driving force for implementation in line with the Framework for a One Health approach. To this end, it is necessary, for example, to plan training contents that are consistent with the goals of strengthening laboratory functions as outlined in the framework for the One Health approach, to regularly exchange opinions and information with the Africa CDC, OIE, WHO, etc., and to request dispatch of lecturers and other cooperation from these organizations.

[Capacity building of clinical laboratory technicians related to animal health]

As described in Chapter 6, when focusing on "laboratory testing and diagnostic techniques" and their quality assurance, the training needs are considered more significant in laboratories for animal diseases.

The SVM-UNZA, which will likely be the cooperating training institution, has been expanding its laboratory diagnosis technology capacity over a long period through cooperation mainly with Hokkaido University Research Center for Zoonoses Control. Considering this, the training should include personnel engaged in animal health-related laboratories (laboratory technicians, administrators, etc.) as beneficiaries.

This arrangement helps differentiate the TCTP courses from those in Kenya, Ghana, Egypt, etc., which targets personnel working in laboratories related to human diseases.

[Organizing JICA's implementation system of the TCTP]

JICA's Zambia office, which has been involved in cooperation in veterinary medicine for an extended period, has sufficient understanding, knowledge, and experience of the issues involved in implementing this TCTP. On the other hand, JICA has not implemented any animal health-related projects in neighboring

[4] JICA (2008) Handbook on Modality and Implementation of Regional Cooperation or Transboundary Issue (in Japanese) Quote: "Even if the development of regional cooperation is easily envisioned simply because of the high capacity of the organization receiving Japanese cooperation, there is a risk that it will not lead to sustainable regional cooperation because the countries concerned will not understand the actual situation. Even when JICA and its partner countries start cooperation, it is necessary to draw up a long-term scenario for dealing with the issues, gradually raise awareness of the issues among neighboring countries, encourage their active participation in dealing with them, and build a regional cooperation mechanism that can be managed by each country in the region itself."

countries and has not established relationships with concerning organizations that send out training participants, therefore have a limited understanding of the issues. As a result, the selection of training participants and follow-up after the training may be affected.[5] To improve this situation, it is necessary to organize JICA's implementation mechanism for the TCTP before and during its implementation. JICA headquarters also needs to conduct orientation for country offices that are passive towards the TCTP and prepare tools such as explanatory materials for partner organizations and Q&A.

[5] See the Footnote 5: JICA (2008) Quote: "In the past, they have mainly provided bilateral cooperation to the country of appointment, and it is not easy for them to consider multi- and bi-lateral cooperation to the country of appointment from the perspective of the interests of the entire region. For these offices, regional cooperation on cross-border issues is an add-on to their traditional work. Therefore, It is difficult for these offices to understand as a mainstream form of assistance to the country of appointment.

APPENDIX

Appendix 1. Schedule of online interviews

The detailed schedule of the online interviews is as shown below.

Date		Activities (online interviews, etc.)
Nov. 8	Sun.	
9	Mon.	
10	Tue.	17:00 Meeting with a field coordinator (Zambia)
11	Wed.	
12	Thu.	16:00 Meeting with a field coordinator (Egypt)
13	Fri.	
14	Sat.	
15	Sun.	
16	Mon.	10:00 Meeting with JICA Egypt Office 15:30 Meeting with a field coordinator (Mozambique) 21:00 Interview to UTH (Zambia)
17	Tue.	11:00 Interview to Hokkaido University Center for Zoonosis Control (Japan) 16:00 Interview to SVM-UNZA (Zambia)
18	Wed.	16:00 Interview to Ministry of Health (Zambia)
19	Thu.	17:00 Interview to U.S. CDC (Zambia) 18:30 Meeting with a field coordinator (Zimbabwe)
20	Fri.	20:30 Interview to EU delegation to Zambia (Zambia) 22:20 Interview to PHD, England (Zambia)
21	Sat.	
22	Sun.	18:00 Interview to FOM/SCU (Egypt)
23	Mon.	
24	Tue.	15:30 Meeting with a field coordinator (Malawi) 17:00 Interview to Department of Veterinary Services, Ministry of Agriculture and Rural Development (Mozambique)
25	Wed.	19:30 Interview to Institute of Agricultural Research, Mozambique (Instituto de Investigação Agrária de Moçambique)(Mozambique) 21:00 Interview to National Institute of Health (Instituto Nacional de Saúde) (Mozambique)
26	Thu.	
27	Fri.	15:30 Meeting with a field coordinator (Angola)
28	Sat.	
29	Sun.	18:00 Interview to FOM/SCU (Egypt)
30	Mon.	16:00 Interview to U.S. CDC (Mozambique) 17:00 Interview to Ministry of Health and Child Care (a person in charge of quality control) (Zimbabwe) 20:30 Interview to Ministry of Health and Child Care (a person in charge of laboratory) (Zimbabwe) 22:00 Interview to Ministry of Health and Child Care (a person in charge of surveillance) (Zimbabwe)
Dec. 1	Tue.	18:45 Interview to Central Veterinary Laboratory (Zimbabwe) 22:00 Interview to Ministry of Lands, Agriculture, Water, Climate, and Rural Resettlement (Zimbabwe)
2	Wed.	17:00 Interview to National Microbiology Reference Laboratory (Zimbabwe) 21:00 Interview to EU delegation to Mozambique) (Mozambique)
3	Thu.	
4	Fri.	15:00 Interview to USAID (Mozambique) 17:00 Interview to EU delegation to Zimbabwe (Zimbabwe)
5	Sat.	
6	Sun.	19:00 Interview to MRI, Alexandria University (Egypt)
7	Mon.	
8	Tue.	
9	Wed.	15:00 Interview to Central Veterinary Laboratory (Malawi) 18:00 Interview to USAID (Zimbabwe)
10	Thu.	
11	Fri.	17:00 Meeting with JICA Zambia Office
12	Sat.	
13	Sun.	
14	Mon.	20:00 Interview to Public Health Institute, Malawi (Malawi)
15	Tue.	
16	Wed.	
17	Thu.	
18	Fri.	18:00 Interview to OIE Africa Regional Collaborating Centre
19	Sat.	
20	Sun.	
21	Mon.	
22	Tue.	
23	Wed.	

Date		Activities (online interviews, etc.)
24	Thu.	
25	Fri.	
26	Sat.	
27	Sun.	
28	Mon.	
29	Tue.	
30	Wed.	
31	Thu.	
Jan. 1	Fri.	
2	Sat.	
3	Sun.	
4	Mon.	
5	Tue.	
6	Wed.	
7	Thu.	
8	Fri.	
9	Sat.	
10	Sun.	
11	Mon.	
12	Tue.	17:00 Interview to Ministry of Agriculture and Fisheries (Angola) 18:00 Interview to Ministry of Health and Population (Malawi)
13	Wed.	
14	Thu.	17:00 Interview to National Institute of Health Research (Instituto Nacional de Investigação em Saúde (Angola)
15	Fri.	17:00 Interview to Institute of Public Health, Malawi (Malawi)
16	Sat.	
17	Sun.	
18	Mon.	20:00 Interview to Ministry of Agriculture, Irrigation, and Water Development (Malawi)
19	Tue.	19:00 Interview to Ministry of Health (Angola)
20	Wed.	
21	Thu.	
22	Fri.	
23	Sat.	
24	Sun.	
25	Mon.	
26	Tue.	
27	Wed.	
28	Thu.	
29	Fri.	
30	Sat.	
31	Sun.	
Feb.1	Mon.	
2	Tue.	
3	Wed.	17:00 Interview to National Institute of Veterinary Research (Instituto de Investigação Veterinária (Angola)

*Weekend: Friday and Saturday in Egypt
Saturday and Sunday in Angola, Malawi, Mozambique, Zambia, and Zimbabwe

Appendix 2. List of interviewees

The list of interviewees is as shown in below. The countries are listed in the order in which the online interviews were initiated.

<Zambia>

Dr. Davy Nsama	Ministry of Health	Deputy national coordinator for laboratory
Dr. Mwaka Monze	UTH	Director of virology laboratory
Dr. Edgar Simulundu	SVM-UNZA	Lecturer
Ms. Karolina Lagiewka	EU delegation to Zambia	Project manager
Mr. Joseph Pett	Department of Public Health, England	Senior public health advisor
Dr. Jonas Hines	U.S. CDC	Surveillance advisor
Dr. Samuel Yingst	U.S. CDC	Chief laboratory advisor

<Egypt>

Prof. Soha Younes	FOM/SCU	Director of TCTP
Dr. Omar Dessouki	FOM/SCU	Co-director of TCTP
Dr. Maha Emad	FOM/SCU	Technical coordinator of TCTP
Dr. Amany Ahmed	Faculty of Medicine, Kasr Al-ainy University	Technical coordinator of TCTP
Dr. Tamer Saied	U.S. CDC	Infectious disease control advisor
Prof. Gamal Elswaf	MRI, Alexandria University	Former director
Prof. Mohammed Sami Afifi	MRI, Alexandria University	Laboratory manager on biosafety
Dr. Nabil Dewedar	MRI, Alexandria University	Program manager on health governance

<Mazambique>

Dr. Sofia Viegas	National Institute of Health (Instituto Nacional de Saúde)	Director of Public Health Laboratory
Mr. Américo Manuel Conceição	Department of Veterinary Services, Ministry of Agriculture and Rural Development	Director
Dr. Olga Faftine	Institute of Agricultural Research, Mozambique (Instituto de Investigação Agrária de Moçambique	Director
Dr. Carlos Quembo	Institute of Agricultural Research, Mozambique (Instituto de Investigação Agrária de Moçambique	Epidemiologist/ veterinary doctor
Dr. Pertina Nhavene	Institute of Agricultural Research, Mozambique (Instituto de Investigação Agrária de Moçambique	Laboratory staff
Dr. Jessina Masamha	U.S. CDC	Laboratory advisor
Ms. Sara Piccoli	EU delegation to Mozambique	Humanitarian aid advisor (nutritionist)
Ms. Monique Mosolf	USAID Mozambique	Director of Health Office

<Zimbabwe>

Dr. Steve Banda	Ministry of Health and Child Care	Director of policy planning
Dr. Arnold Mukaratirwa	Ministry of Health and Child Care	Director of laboratory services
Dr. Sekesai Mtapuri Zinyowera	National Microbiology Reference Laboratory	Medical microbiologist
Dr. Josphat Nyika	Ministry of Lands, Agriculture, Water, Climate, and Rural Resettlement	Chief veterinary officer
Dr. Samuel Swiswa	Division of Veterinary Technical Services Central Veterinary Laboratory, Ministry of Lands, Agriculture, Water, Climate, and Rural Resettlement	Acting Deputy Director (Diagnostics & Research Division of Veterinary Technical Services
Mr. Basil Mugweni	EU delegation to Zimbabwe /FAO Zimbabwe Office	SAFE Project Coordinator
Dr. Ruth Tembo	USAID Zimbabwe	Health specialist
Dr. Lucia Gumbo	USAID Zimbabwe	Integrated health specialist

<Malawi>

Mr. Arone Ganizani	Department of preventive health services Ministry of Health and Population	Deputy director
Dr. Benson Chilima	Public Health Institute, Malawi	Director
Dr. Mabvuto Chiwaula	Public Health Institute, Malawi	Acting Director
Dr. Patrick Chikungwa	Department of Animal Health and Livestock Development, Ministry of Agriculture, Irrigation, and Water Development	Director
Dr. Gladson Kamwendo	Department of Animal Health and Livestock Development, Ministry of Agriculture, Irrigation, and Water Development	Epidemiologist/veterinary doctor
Dr. Joseph Nkhoma	Department of Animal Health and Livestock Development, Ministry of Agriculture, Irrigation, and Water Development	Veterinary doctor
Dr. Julius Chulu	Department of Animal Health and Livestock Development, Ministry of Agriculture, Irrigation, and Water Development	Deputy director on veterinary research and investigations

<Angola>

Dr. Eusebio Manuel	Department of Public Health, Ministry of Health	Director
Mr. Joltin	National Institute of Health Research	Labo technician
Dr. Henrique Gimi	Department of veterinary services, Ministry of Agriculture and Fisheries	Deputy Director
Dr. Capitão Cabonde	Department of veterinary services, Ministry of Agriculture and Fisheries	Veterinary doctor
Dr. Susana Camungondo	Luanda Laboratory National Institute of Veterinary Research	Director
Dr. Isabel	Luanda Laboratory National Institute of Veterinary Research	A person in charge of quality control
Dr. Maria	Luanda Laboratory National Institute of Veterinary Research	A person in charge of vaccine production

＜OIE＞

Dr. Karim Tounkara	OIE Africa Regional Collaborating Centre	Representative
Dr. Moetapele Letshwenyo	OIE Southern Africa sub-Regional Collaborating Centre	Representative

Appendix 3. JICA cooperation for infectious disease control and health crisis responses in the Southern African countries

Table A3-1. JICA cooperation for infectious disease control and health crisis responses in the Southern African region from 2013 t0 2020 (technical cooperation, general grant aid, emergency grant aid, etc.)

Angola		
(1) Emergency Grant Aid in response to Yellow Fever Outbreak (Angola and DRC)		
Scheme: Emergency grant aid	Decision date: Jul. 29, 2016	Amount: 3.5 million USD (incl. DR Congo)
Summary：In response to the cross-border outbreak of yellow fever confirmed in Angola in December 2015, the aid aims to provide technical assistance to prevent further outbreaks, equipment for vaccination campaigns, and support for community awareness campaigns strengthening border control capacity.		
(2) Economic and Social Development Programme (aid for infectious disease control and health system strengthening)		
Scheme: General grant aid	E/N Date: Sep.11, 2020	Amount: 300 million JPY
Summary: Providing health and medical equipment such as small ambulances in Angola, where treatment facilities for patients with COVID-19 are limited only to urban areas, and access to medical services is insufficient, especially in rural areas where there are many poor people. The support contributes to the control of infectious diseases and strengthening the country's health and medical system.		
Botswana		
(1) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: In-country training	Period: Jan. 2013 - Jan. 2016	Amount: No information available
Summary: In Botswana, functional monitoring evaluation system for HIV/AIDS control in Southern Africa will be strengthened by improving the individual and organizational capacities (knowledge, skills, etc.) of monitoring evaluation implementers and managers, thereby contributing to the establishment of an effective HIV/AIDS control system.		
(2) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: In-country training	Period: Aug. 2016- Mar. 2018	Amount: No information available
Summar: In Botswana, the continuous development of human resources for monitoring evaluation at the educational institutions strengthens the monitoring evaluation system for HIV/AIDS, thereby strengthening the evidence-based multi-sector HIV/AIDS control measures.		
(3) Economic and Social Development Programme (aid for infectious disease control and health system strengthening)		
Scheme: General grant aid	E/N Date: Jun. 12, 2020	Amount: 300 million JPY
Summary: By providing health care equipment such as thermography and automatic external defibrillator (AED) in Botswana, where the financial income drops significantly due to the spread of COVD-19, it is difficult to secure a budget in the health field. The support contributes to the strengthening of infectious disease control and health/medical systems in the country.		
Eswatini		
(1) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: In-country training	Period: Jan. 2013～Mar. 2016	Amount: No information available
Summary: In Eswatini, by improving the individual and organizational capacities (knowledge, skills, etc.) of monitoring and evaluation implementers and managers, functional monitoring evaluation system for HIV/AIDS control in Southern Africa will be strengthened, and the support contributes to the establishment of an effective HIV/AIDS control system.		
(2) System strengthening plan for effective disaster risk management		
Scheme: General grant aid	E/N Date: May 17, 2013	Amount: 92 million JPY
Summary：This plan is to provide equipment and technical assistance to the government, local governments, and communities in Eswatini, which is vulnerable to natural disasters, to provide early warning, control, and response capacities to disasters. This support protects life and property and reduces damage to the infrastructure.		
(3) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: Expert	Period: Aug. 2016- Mar. 2018	Amount: No information available
Summary: In Eswatini, continuous development of human resources for monitoring evaluation at the educational institutions strengthens the monitoring evaluation system for HIV/AIDS and contributes to strengthening the evidence-based multi-sector HIV/AIDS control measures.		
(4) Economic and Social Development Programme (aid for infectious disease control and health system strengthening)		
Scheme: General grant aid	E/N Date: Jul. 30, 2020	Amount: 100 million JPY
Summary：By providing equipment such as the blood gas analyzers and defibrillators in Eswatini, one of Africa's most infected countries with COVID-19 per 10,000 population and surrounded by South Africa, the highest COVID-19 infected country in Africa, the support contributes to the control of infectious diseases and the strengthening of the health and medical system in Eswatini		
Lesotho		
(1) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: In-country training	Period: Jan. 2013 - Jan 2016	Amount: No information available
Summary: In Lesotho, by improving the individual and organizational capacities (knowledge, skills, etc.) of monitoring and evaluation implementers and managers, functional monitoring evaluation system for HIV/AIDS control in Southern Africa will be strengthened, thereby contributing to the establishment of an effective HIV/AIDS control system.		
(2) Training for Rescue Techniques		
Scheme: Training in Japan	Period: Jul. 2014 -Mar. 201	Amount: No information available
Summary: The emergency rescue skills acquired through the training will be shared with the staff of the Disaster Management Authority, and action plans such as improvement measures will be implemented, which contributes to the improvement of the immediate response		

capacity of the Lesotho Kingdom Police in the event of a disaster.		
(3) Economic and Social Development Programme (aid for infectious disease control and health system strengthening)		
Scheme: General grant aid	E/N Date: Aug. 13, 2020	Amount: 100 million JPY
Summary: By providing medical equipment such as blood gas analyzers in Lesotho, where many people have weakened immunity due to malnutrition, food shortages, and prolonged drought, and a landlocked country surrounded by South Africa, where the number of people infected with COVID-19 is the highest in Africa. The support contributes to the strengthening of the country's infectious disease control and health/medical system.		
Malawi		
Japan Society for the Promotion of Science (JSPS)- Vector Research Project Detects a Virus in Mosquitoes		
Scheme: Expert - Japan Society for the Promotion of Science (JSPS)	Period: May 2011- May 2013	Amount: No information available
Summary: By developing the Malawi University laboratory's infrastructure and implementing technical guidance from mosquito collection to virus detection, the project developed survey methods and tools to monitor virus-borne mosquitoes and re-emerging infectious diseases in Malawi. The project contributed to the construction and operation of a surveillance system for monitoring mosquito-borne viral infections.		
(2) Economic and Social Development Programme (aid for infectious disease control and health/medical system development)		
Scheme: General grant aid	E/N Date: Jul. 22, 2020	Amount: 300 million JPY
Summary: After the first confirmation of COVID-19 on Apr. 2, new infections continued, especially after July, the number of infected people increased rapidly, and the Human Development Index ranked 172th out of 189 countries in the world in 2019, and a severe budget deficit makes it challenging to allocate additional budget to the health care sector. The support contributes to the country's infectious disease control and strengthening of the health and medical system by providing health and medical equipment.		
Mozambique		
Project for strengthening capacities of NPCS for HIV responses in Gaza province		
(1) Scheme: Technical Cooperation Projects	Period: Mar. 2012 - Mar. 2015	Amount: No information available
Summary: The National AIDS Control Board (NPCS) capacity for HIV-related services has been strengthened in Gaza by creating IEC teaching materials on AIDS prevention that meet the region's needs. The project helps reduce the number of new HIV infections in Gaza.		
(2) Advisor for Strengthening HIV/AIDS Response System in Mozambique		
Scheme: Expert	Period: Sep. 2015 - Sep. 2018	Amount: No information available
Summary: By strengthening the Nampula Provincial AIDS Council (NPCS) coordination capacity, the project contributes to enhancing each Provincial AIDS Council's ability in Mozambique.		
(3) Economic and Social Development Programme (aid for infectious disease control and health/medical system development)		
Scheme: General grant aid	E/N Date: Aug. 3, 2020	Amount: 500 million JPY
Summary: In Mozambique, where the number of people infected with COVID-19 is increasing, infectious disease control has a significant impact on economic activities, and the risk of further infection spread is exceptionally high due to the originally fragile medical system, by providing health and medical equipment such as small ambulances, intensive-care-unit beds, etc., it contributes to infectious disease control and strengthening of the health and medical system in the country.		
South Africa		
(1) HIV Community-based Care (HCBC) Monitoring and Evaluation Advisor		
Scheme: Expert	Period: Jan. 2012 - Jan. 2014	Amount: No information available
Summary: In South Africa, which has the highest number of people with HIV/AIDS in the world, the HCBC monitoring, and evaluation system strengthens the capacities of the government agencies and HCBC service providers at all levels. The project contributes to improving the quality of HCBC services in South Africa.		
(2) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: Expert	Period: Jan. 2013 -Mar. 2016	Amount: No information available
Summary：In South Africa, by improving the individual and organizational capacities (knowledge, skills, etc.) of monitoring evaluation implementers and managers, the functional monitoring evaluation system for HIV/AIDS control in Southern Africa will be strengthened, and the support contributes to the establishment of an effective HIV/AIDS control system.		
(3) Project for Establishment of an Early-Warning System for Infectious Diseases in Southern Africa Incorporating Climate Predictions		
Scheme: SATREPS	Period: May 2014 - May 2019	Amount: 250 million JPY
Summary: As a pioneer of application in the southern African region, the project developed an infectious disease epidemic prediction model that adds various environmental factors to the climate change prediction model, mainly for malaria, pneumonia, cholera, etc., where the climate affects the outbreak of epidemics. The project supported the construction of an early warning system for implementing infectious disease control, thereby contributing to the reduction of the number of affected people through preventive measures for high-risk periods and areas.		
Namibia		
(1) Laboratory Quality Control Support Project		
Scheme: Collaboration Program with the Private Sector for Disseminating Japanese Technology	Period: Feb. 2017 - Nov. 2018	Amount: No information available
Summary: By providing blood analyzers, online maintenance management systems, and training manuals for the National Namibia Institute of Pathology (NIP), the project built a quality management system for medical laboratories that conforms to international standards and Improved the provision of medical care.		
(2) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: In-country training	Period: Jan. 2013-Jan. 2016	Amount: No information available
Summary: In Namibia, by improving the individual and organizational capacities (knowledge, skills, etc.) of monitoring evaluation implementers and managers, functional monitoring evaluation system for HIV/AIDS control in Southern Africa will be strengthened, and		

the support contributes to the establishment of an effective HIV/AIDS control system.		
(3) Economic and Social Development Programme (aid for infectious disease control and health/medical system development)		
Scheme: General grant aid	E/N Date: Sep. 2, 2020	Amount: 300 million JPY
Summary: In Namibia, where the medical system is becoming tight due to the spread of COVID-19, and there is concern about the risk of spread of infection due to operational logistics with neighboring Southern African countries through the provision of health and medical equipment such as portable ultrasonic diagnostic imaging equipment, etc. contributes to the control of infectious diseases and the strengthening of the health and medical system in Namibia.		
Zambia		
(1) Establishment of Rapid Diagnostic Tools for Tuberculosis and Trypanosomiasis and Screening of Candidate Compounds for Trypanosomiasis		
Scheme: SATREPS	Period: Nov. 2009 - Nov. 2013	Amount: 340 million yen
Summary: Research and development capacity of Zambia research institutes for rapid diagnostic tools and screening of candidate compounds for new drugs for trypanosomiasis are improved through collaborative research activities with Japanese research institutes.		
(2) The Project for Scaling Up of Quality HIV/AIDS Care Service Management		
Scheme: Technical cooperation project	Period: Nov. 2009 - Nov. 2015	Amount: 420 million yen
Summary: By promoting the mobile ART services in the county health department, through the improvement of the management capacity of the Ministry of Health headquarters, Provincial and District Medical Offices to expand high-quality ART services, the project contributed to improving access to high-quality ART services in the rural areas.		
(3) Community Mobilization for TB Diagnosis and Treatment Support in Lusaka, Zambia		
Scheme: Grassroots Technical Cooperation Projects	Period: Apr. 2012 - Apr. 2015	Amount: 91 million JPY
Summary：Focusing on human resource development and activity management capacity building in the community in Lusaka district, early detection of tuberculosis patients, treatment, improvement of X-ray photography, diagnostic technology, and tuberculosis data management by tuberculosis volunteers. The project contributed to building the diagnostic and therapeutic support system in the target area.		
(4) Project for Surveillance of Viral Zoonoses in Africa		
Scheme: SATREPS	Period: June 2013 - May 2018	Amount: 410 million JPY
Summary: Through the joint research with Hokkaido University, the capacity of surveillance and research towards viral zoonosis is enhanced in the Zambian Research Institute.		
(5) Project for Expansion of the Cold Chain concluded with the United Nations Children's Fund		
Scheme: General grant aid	E/N Date: Jul. 19, 2013	Amount: 221 million JPY
Summary: In Zambia, the number of children dying from vaccine-preventable diseases is still high, and there is an urgent need to improve the cold chain system to promote immunizations for newly-born children. The project provided 570 refrigerators for vaccine storage and conducted a training course on the maintenance of cold chain system for technical staff at the district level.		
(6) Training course for Rescue Techniques		
Scheme: Training in Japan	Period: July 2014 - Mar. 2015	Amount: No information available
Summary: The emergency rescue skills acquired through the training will be shared with the staff of the Disaster Management Authority, and action plans such as improvement measures will be implemented, which contribute to the improvement of the rapid response capacity of the Disaster Management and. Mitigation Unit under the President's Office.		
(7) Collaboration Program with the Private Sector for Disseminating Japanese Technology for Anti-Infection Paint		
Scheme: Collaboration program with the private sector for disseminating Japanese technology	Period: Nov. 2017 - Nov. 2019	Amount: No information available
Summary: By applying a functional paint that repels mosquitoes to ordinary households (400 households) in malaria-infected areas in Zambia, the project aimed to reduce the burden of infectious diseases and to contribute to the eradication of malaria, a national health goal.		
(8) Economic and Social Development Programme (aid for infectious diseases control)		
Scheme: General grant aid	E/N Date: Dec. 19, 2018	Amount: 500 million JPY
Summary: Infectious diseases are the top causes of death, and most of the infectious diseases are zoonotic diseases such as influenza and viral hemorrhagic fever. Strengthening measures against infectious diseases in both humans and animals is a challenge In Zambia. By updating medical equipment at the School of Veterinary Medicine, the project improves research and clinical capacities for infectious disease control and develops high-quality human resources and contributes to early detection and response to infectious diseases in Zambia.		
(9) Project for Epidemiology of Zoonotic Virus Infections in Africa		
Scheme: SATREPS	Period: Jun. 2019 – Jun. 2024	Amount: 410 million JPY
Summary: Encompassing research and surveillance capacity for viral zoonosis is strengthened in Zambia through collaborative studies between Zambian and Japanese research institutes. The project contributes to enhancing the capacity to respond to public health crises in Central and Southern Africa and Sub-Saharan Africa.		
(10) Economic and Social Development Programme (aid for the improvement of community health situation)		
Scheme: General grant aid	E/N Date: Aug. 27, 2019	Amount: 300 million JPY
Summary: In Zambia, where infant mortality and maternal mortality rates are high and infectious diseases are significant inhibitors on socio-economic development, this project aims to improve the survival rate and growth of infants in rural areas by providing health kids containing essential medicines such as antibiotics and painkillers for health improvement through prevention and treatment, thereby contributing socio-economic development.		
(11) Infectious Disease Control Advisor		
Scheme: Expert	Period: Jan. 2020 - Jan 2022	Amount: No information available
Scheme: ZNPHI is working to strengthen the infectious disease surveillance capacity against emerging infectious diseases such as		

Ebola virus infection and new influenza virus infection and re-emerging infectious diseases such as malaria and cholera. The experts on infectious disease control contribute to strengthening the surveillance capacities of ZNPHI.		
(12) Economic and Social Development Programme (aid for infectious disease control and health system development)		
Scheme: General grant aid	E/N Date: Aug. 20, 2020	Amount: 200 million JPY
Summary: In Zambia, where the spread of COVID-19 has a more severe impact on the country's socioeconomics, the project provides health and medical equipment such as portable ultrasonic diagnostic imaging equipment and mobile X-ray imaging equipment, thereby contributing to the infectious disease control and strengthening of Zambia's health system.		
(13) Clinical Studies Enhancement Project for School of Veterinary Medicine, University of Zambia		
Scheme: Technical cooperation project	Period: Jan. 2021 - Dec. 2023 (Tentative)	Amount: No information available
Summary: Support to improve lectures and practical classes, and to strengthen the teaching capacity of the staff in clinical studies at the School of Veterinary Medicine, University of Zambia, as well as to formulate a management strategy for the University Veterinary Clinic to provide better, sustainable education services. The project aims to contribute to generating veterinarians responsible for early detection and proper management of livestock diseases.		
Zimbabwe		
(1) Expert on PMTCT through strengthening integrated Maternal and Child Health Service		
Scheme: Expert	Period: Nov. 2012 - Oct. 2014	Amount: No information available
Summary: The project creates, tests, and implements the PMTCT and MNCH integrated Supervision models/systems/tools in Masvingo Province and strengthens the Provincial Health Department's operational and implementation capacities. It contributes to reducing the mortality rate of pregnant women and infants caused by HIV and the decline of the number of new HIV infections caused by mother-to-child transmission.		
(2) Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: In-country training	Period: Jan. 2013 - Jan. 2016	Amount: No information available
Summary: In Zimbabwe, by improving the individual and organizational capacities (knowledge, skills, etc.) of monitoring evaluation implementers and managers, functional monitoring evaluation system for HIV/AIDS control in Southern Africa will be strengthened, and the support contributes to the establishment of an effective HIV/AIDS control system.		
(3) Expert on Strengthening Monitoring and Evaluation Capacity for HIV/AIDS Response Programmes		
Scheme: Expert	Period: Jul. 2016-Mar. 2018	Amount: No information available
Summary: In Zimbabwe, enhanced capacity for data analysis and utilization at the state and county health office levels improves the quality of data reported to the Province and District health office levels. The monitoring and evaluation system contributes to providing appropriate information to policymakers for HIV/AIDS control by promoting analysis and utilization.		
(4) Economic and Social Development Programme (aid for infectious disease control and health system development)		
Scheme: General grant aid	E/N Date: Oct. 26, 2020	Amount: 400 million JPY
Summary: In Zimbabwe, where the number of infected people increased rapidly after the first person infected with COVID-19 was confirmed on Mar. 20, the spread of COVID-19 has caused the collapse of the medical system. The project contributes to strengthening infectious disease control and health/medical procedures by providing various X-ray equipment and electrocardiographs.		

Appendix 4. Grant assistance for grass-roots human security projects for infectious disease control and health crisis responses in the Southern African countries

Table A4-1. Grant assistance for grass-roots human security projects from 2013 to 2020

Project Title	Year
Mozambique	
(1) Project for improvement of Digital X-ray system in Beira city in the city of Beira in Sofala Province*	2016
South Africa	
(1) Project for Renovation of St. Francis Care Center, in Boksburg, Gauteng Province*	2015
(2) Project for Procurement of HIV Testing Vehicles for" Show Me Your Number"*	2016
(3) Project for Procurement of HIV/AIDS Outreach Vehicles for Maboloka HIV/AIDS Awareness Group, Madibeng, North West Province*	2018
(4) Project for Procurement of HIV/AIDS Outreach Vehicles for PHS, Khayelitsha, Western Cape Province *	2018
(5) Project for Procurement of TB Outreach Vehicles, Limpopo Province*	2018
(6) Project for Improvement of Preventive Equipment of Malaria Control Centres, Limpopo Province*	2018
(7) Project for Procurement of Mobile Clinic Vehicle for Hoedspruit Training Trust*	2020
Zambia	
(1) Project for Construction of New Community Clinic in Massmedia, Lusaka City*	2016
(2) Project for Improvement of X-ray equipment at Monze Mission Hospital, Southern Province*	2015
(3) Project for Improvement of X-ray equipment at Beit Cure Hospital, Lusaka City*	2016
(4) Project for Improvement of X-ray equipment at Mutendere Mission Hospital, Chirundu, Lusaka Province*	2019
Zimbabwe	
(1) Project for Improvement of X-ray equipment at Chidamoyo Christian Hospital, Hurungwe*	2017
(2) Project for Improvement of X-ray equipment at the Chikbomedi Mission Hospital, Chiredzi*	2018
(3) Project for Improvement of X-ray equipment at Mashoko Christian Hospital, Bikita District *	2020

*Official project name in English was not confirmed in this survey. The project titles above were translated from official Japanese title.

Appendix 5. Grant aid for Japanese NGO's projects and IPPF Japan Trust Fund for infectious disease control and health crisis responses in the southern African countries

Table A5-1. Grant Assistance for Japanese NGO Projects/IPPF Japan Trust Fund from 2013 to 2020

Eswatini		
(1) Sexual and reproductive health (SRH) and HIV services (official project title in English could not be confirmed in this survey)		
Scheme: IPPF Japan Trust Fund	Period: 2012-2015	Amount: No information available
Summary: The project contributes to expanding the sexual and reproductive health and rights of women living with HIV.		
Lesotho		
(1) The Morning Star project (official project title could not be confirmed in this survey)		
Scheme: IPPF Japan Trust Fund	Period: 2011- 2013	Amount: No information available
Summary: The project contributes to empowering sex workers with the information and skills necessary to help them make informed decisions about their sex work and their reproductive health, reducing sexual and reproductive health vulnerabilities, including HIV		
Malawi		
(1) The establishment of the comprehensive rural healthcare support model in Lilongwe District		
Scheme：Grant assistance for Japanese NGO project	Period: 1st Phase Dec. 2012 ~Dec. 2013 2nd Phase Dec. 2013 ~Dec. 2014	Amount: 1st Phase: 420 million JPY 2nd Phase: 360 million JPY
Summary: In Malili, Lilongwe Province, where the epidemics of infectious diseases such as malaria, schistosomiasis, HIV/AIDS, and lack of access to health facilities are severe, the project will support community-based education on prevention of infectious diseases, maternal and child health care activities, improvement of sanitation and hygiene including the construction of wells and toilets, mobile clinics, and improvement of access to medical facilities by ambulance bicycles, thereby contributing to the establishment of a sustainable community-based health care model that is led by local health personnel and residents.		
(2) Support for sexual/Reproductive Health and HIV services in clinics and community (official project title could not be confirmed in this survey)		
Scheme: IPPF Japan Trust Fund	Period: 2016 - 2018	Amount: No information available
Summary: To reduce the risk of HIV infection in Malawi, where adolescent girls and young women are at exceptionally high risk of HIV infection, the project targeted young women and girls in the fishing village of Mangochi and established a Youth Life Center to ensure that young people have access to reproductive health services without stigma or discrimination.		
Mozambique		
(1) Project for protecting rights (official project title could not be confirmed in this survey)		
Scheme: IPPF Japan Trust Fund	Period: 2019 - 2020	Amount: No information available
Summary: the project aims to support women's comprehensive health programs in adolescent and young-adult-friendly service centers (SAAJ), thereby promoting access to non-discriminatory and highly needed health services.		
South Africa		
(1) Project on Participatory HIV/AIDS Prevention and Care, and Support for PLWHA		
Scheme：Grant Assistance for Japanese NGO Projects	Period: 1st Phase: 2012 - 2013 2nd Phase: 2013 - 2014 3rd Phase: 2014 - 2015	Amount: 1st Phase: 280 million JPY 2nd Phase: 270 million JPY 3rd Phase: 280 million JPY
Summary: In South Africa, there is no end to the number of children who lose their parents to AIDS, and it has been reported that there are approximately 2.5 million AIDS orphans. In response to this situation, the project aims to strengthen the support mechanism for people affected by AIDS, including people and children with HIV, by fostering local volunteers who provide daily home care, raising awareness of prevention, and creating vegetable gardens to support people's lives, in cooperation with local NGOs in poor rural areas in South Africa where health facilities and personnel are insufficient.		
Zambia		
(1) Project for sexual/reproductive health and HIV (formal project title was unknown)		
Scheme: IPPF Japan Trust Fund	Period: 2012 - 2015	Amount: No information available
Summary: The project aims to contribute to the delivery of comprehensive sexual and reproductive health and HIV/AIDS information and services to young women, thereby contributing to reducing their vulnerability to sexual and reproductive health issues, including HIV.		
(2) HIV / AIDS Project in Kafue District		
Scheme: Grant assistance for Japanese NGO projects	Period: 1st Phase: 2013 - 2014 2nd Phase: 2014 - 2015 3rd Phase: 2015 - 2016	Amount: 1st Phase: 700 million JPY 2nd Phase: 620 million JPY 3rd Phase: 584 million JPY
Summary: The project aims to strengthen antiretroviral therapy (ART) services, a modern treatment method using antiretroviral drugs that is considered essential for people with HIV, in Kafue, Republic of Zambia, by developing a system for providing the services, training medication support volunteers engaged in ART, and strengthening cooperation among local health facilities.		
(3) Comprehensive TB and HIV control with strengthened community participation in a rural area in Chongwe District, Zambia		
Scheme: Grant assistance for Japanese NGO projects	Period: 1st Phase: Dec. 2015 - Dec. 2016 2nd Phase: Dec. 2016 - Dec. 2017 3rd Phase：Dec. 2017 - Dec. 2018	Amount: 1st Phase: 410 million JPY 2nd Phase: 540 million JPY 3rd Phase: 490 million JPY
Summary: In Chongwe, where tuberculosis (TB), an opportunistic infection caused by HIV/AIDS, is remarkably widespread, the project will contribute to the dissemination of knowledge about TB and HIV/AIDS, promotion of access to health facilities, and development of treatment support such as an accurate diagnosis by fostering TB volunteers, strengthening the capacity of health personnel (doctors, associate doctors, nurses, laboratory technicians, and X-ray technicians), and providing advanced medical equipment and training.		
(4) Strengthening access to quality of integrated TB prevention, management in high TB/HIV burden community in Lusaka, Zambia		
Scheme: Grant assistance for Japanese	G/C Date: 1st Phase: Feb. 28, 2019	Amount: 1st Phase: 660 million JPY

NGO projects	2nd Phase: Mar. 5, 2020	2nd Phase: 620 million yen
Summary: The project will be implemented for three years in seven health facilities in Chipata and Chelston of Lusaka County. The project will contribute to strengthening the capacity of the target communities in TB prevention, early diagnosis, treatment, and support for TB patients by providing training on the maintenance of the GeneXpert and X-ray equipment provided and training for TB volunteers, thereby supporting the Zambian government's systematic and rapid response to TB and other infectious diseases.		

Appendix 6. Health system performance indicators

In Chapter 3, "Table 3-5. Health system performance in Southern African countries," we have included indicators for health system performance presented in four main perspectives: access, quality, demand, and resilience. These values, which range from 0 to 100, are calculated on a country-by-country basis based on indicators that are generally available from World Bank and WHO databases, as shown in Figure A6-1 below.

Fig. A6-1. Detailed indicators for health system performance

（出所）WHO/AFRO (2020) Report on the performance of health system in the WHO African region

Appendix 7. Photographs of laboratories

Photographs of the laboratories in Egypt, Zambia, Zimbabwe, Malawi, and Angola are shown below. Note that the field coordinator could not take photos inside the laboratoriesof the National Institute of Health and the Institute of Agricultural Resaerch in Mozambique during this survey.

A7-1 Egypt

(1) Auditorium of FOM/SUC (1)

(2) Auditorium of FOM/SUC (2)

(3) Practice room of FOM/SUC (1)

(4) Practice room of FOM/SUC (2)

(5) BSL-3 Laboratory of MRI, Alexandria University (under construction)*

(6) BSL-3 Laboratory of MRI, Alexandria University (under construction)*

*Excerpt from a video provided by MRI, Alexandria University

A7-2 Zambia

(1) Virology laboratory of UTH

(2) Gene sequencer of Virology laboratory, UTH

(3) Corridor of Virology Laboratory, UTH

(4) Laboratry of SVM-UNZA(1)

(5) Laboratry of SVM-UNZA(2)

(6) Laboratry of SVM-UNZA(3)

A7-3 Zimbabwe

(1) National Microbiology Reference Laboratory (exterior)

(2) National Microbiology Reference Laboratory (interior)

(3) National Microbiology Reference Laboratory (diagnostic equipment PCR)

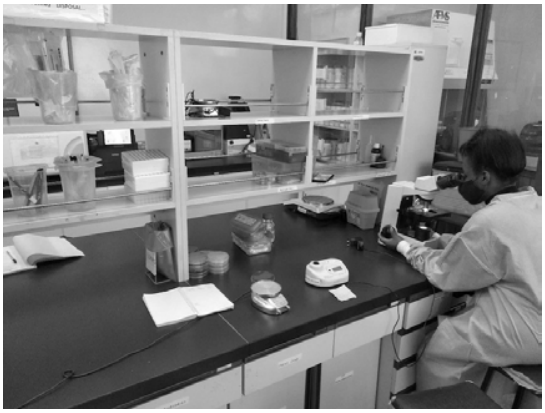
(4) Central Veterinary Laboratory (exterior)

(5) Central Veterinary Laboratory (interior)

(6) Central Veterinary Laboratory (diagnostic equipment PCR)

A7-4 Malawi

(1) Public Health Institute, Malawi
(exterior)



(2) Public Health Institute, Malawi
(microbiology laboratory)

(3) Public Health Institute, Malawi
(Clean cabinet for COVID-19)

(4) Central Veterinary Laboratory
(Bacteriology laboragtory)

(5) Central Veterinary Laboratory
(Virology laboratory)

(6) Central Veterinary Laboratory
(Virology laboratory)

A7-5 Angola

(1) National Institute of Health Research (exterior)

(2) National Institute of Health Research (microbiology laboratory)

(3) National Institute of Health Research (molecular biology laboratory)

(4) Veterinary Laboratory, Luanda province (exterior)

(5) Veterinary Laboratory, Luanda province (microscope and reagents)

(6) Veterinary Laboratory, Luanda province (incubators)