# Infectious Disease Detection Capabilities of Southeast Asian Countries: A Landscape Analysis of Surveillance Systems and Stakeholders

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Vital Strategies

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# Abbreviations

| | |
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| ACPHEED | ASEAN Centre for Public Health Emergencies and Emerging Disease |
| AMS | ASEAN Member States |
| APEC | Asia-Pacific Economic Cooperation |
| APSED | Asia Pacific strategy for emerging diseases and public health emergencies |
| ASEAN | Association for Southeast Asian Nations |
| COVID-19 | SARS-CoV-2 virus disease |
| CHS | Indo-Pacific Centre for Health Security |
| DFAT | Australian Department of Foreign Affairs |
| DTRA | U.S. Defense Threat Reduction Agency |
| EU | European Union |
| EWARS | Early Warning and Response System |
| FETP | Field Epidemiology Training Program |
| GHS | Global Health Security |
| GHSA | Global Health Security Agenda |
| GHS Index | Global Health Security Index |
| HIV | Human Immunodeficiency Virus |
| IHR 2005 | International Health Regulations |
| JEE | Joint External Evaluation |
| JICA | Japan International Cooperation Agency |
| MDB | Multilateral Development Bank |
| MSF | Medecins Sans Frontiers |
| NAPHS | National Action Plan for Health Security |
| NGO | Non-governmental Organization |
| ODA | Official Development Assistance |
| OUCRU | Oxford University Clinical Research Unit |
| SDG | Sustainable Development Goals |
| SEARO | Southeast Asia Regional Office |
| TB | Tuberculosis |
| UHC | Universal Health Coverage |
| U.K. | United Kingdom |
| U.S. | United States |
| USAID | U.S. Agency for International Development |
| WHO | World Health Organization |
| WPRO | Western Pacific Regional Office |

# Glossary

The terms below have been adapted from several sources.

| | |
|---|---|
| Acute public health event | Any event that represents immediate threat to human health and requires implementation of control and/or mitigation measures to protect the health of the public. |
| Collaborative Surveillance | The systematic strengthening of capacity and collaboration among diverse stakeholders, both within and beyond the health sector, with the goal of enhancing public health intelligence and improving evidence for decision-making. |
| Early warning and response | The organized mechanism to detect as early as possible any abnormal occurrence or any divergence from the usual or normally observed frequency of phenomena. |
| Event-based surveillance | The organized collection, monitoring, assessment and interpretation of mainly unstructured ad hoc information regarding health events or risks, which may represent an acute risk to human health. |
| Field Epidemiology Training Program | A program that builds capacity in health service agencies (for example, ministries of health or national public health institutes) by training the public health workforce in field epidemiology and other public health competencies in the context of health delivery systems. |
| Genomic surveillance | The process of constantly monitoring pathogens and analyzing their genetic similarities and differences. |
| Global health security | The activities required, both proactive and reactive, to minimize the danger and impact of acute public health events that endangers people's health across geographical regions and international boundaries. |
| Global Health Security Agenda | A global effort launched in 2014 and reaffirmed in 2018 to strengthen the world's ability to prevent, detect, and respond to infectious disease threats. |
| Global Health Security Index | A health security benchmarking tool developed by the Nuclear Threat Initiative, John's Hopkins University, and Economist Impact that assesses countries using publicly available information. |
| Health systems | A health system consists of all the organizations, institutions, resources and people whose primary purpose is to improve health. |
| Indicator-based surveillance | The systematic (regular) collection, monitoring, analysis and interpretation of structured data, i.e., of indicators produced by a number of well-identified, mostly health-based, formal sources. |
| International Health Regulations | A legally binding agreement of 196 countries to build the capability to detect and report potential public health emergencies worldwide. |
| Joint External Evaluation | A voluntary tool under the IHR Monitoring and Evaluation Framework to assess and test IHR capacities. |
| One Health | A unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. |





# Executive Summary

This report was commissioned by the Temasek Foundation to study the landscape of infectious disease detection capabilities and the stakeholders supporting the development of these capabilities in six Southeast Asian countries: Brunei, Indonesia, Malaysia, Philippines, Thailand, and Vietnam. The types of detection activities examined in this report include those that support surveillance and early warning systems, laboratory systems, reporting systems, human resources, physical infrastructure, regulatory infrastructure, and supply chains. Some of the sub-themes we looked at were uptake of genomic surveillance, data access, and transparency issues (e.g., activities to improve interoperability of data systems within and across systems in different sectors, data sharing, and data security), training programs and systems to improve in-country ability to analyze and utilize data captured through surveillance, personnel and physical infrastructure at the primary care level needed to support the surveillance, laboratory, and reporting systems, and how regulatory and supply chain bottlenecks were being addressed by countries and stakeholders.

## Stakeholders

There are several stakeholders and stakeholder initiatives at the regional and national levels to support building stronger systems to detect, identify, analyze, and utilize surveillance data. Apart from the national governments, stakeholders we looked at included other governments providing bilateral support, multilateral organizations including those in the UN system and banks, philanthropes and other non-governmental organizations, academia, and private industry.

At the national level, a lot of support comes from bilateral government activities, particularly the governments of Australia and the United States. The support is typically in the form of technical assistance or capacity building (i.e., training) and some resource and infrastructure development support. There are many capacity building projects where individuals are being trained to conduct surveillance and investigations and surveillance systems are being built to be more integrated/interoperable across sectors in response to calls for a One Health approach. Support from Australia for detection and

health system activities has predominantly been through its Indo-Pacific Centre for Health Security funded by Australia's Department of Foreign Affairs and Trade. Support for detection and health system activities from the United States is primarily through the U.S. Centers for Disease Control and Prevention, the U.S. Agency for International Development, and the Department of Defense. Canada, the EU, Germany, Japan, the United Kingdom, and to a lesser extent several other European nations, also provide support to countries in the region.

The World Health Organization (WHO) has a strong regional presence and provides funding support, technical assistance, training and capacity building, and some policy/advocacy support. However, its support to the upper-middle income and high income economies like Malaysia and Thailand has transitioned to a more advisory and convener capacity.

Multilateral development banks including the World Bank, Asian Development Bank, and to a lesser extent Asian Investment Infrastructure Bank provide support to countries nationally with financial support (loans and grants) as well as through technical assistance to build health system infrastructure. All are active and important funding sources for countries in the region.

Bill and Melinda Gates Foundation, Wellcome Trust, Temasek Foundation, and Rockefeller Foundation support activities that build surveillance capabilities and capacities through regional approaches as opposed to specific bilateral support. Examples include surveillance activities they support through academic institutions such as Duke-National University of Singapore (Asia Pathogen Genomics Initiative) and Mahidol University. Other philanthropical organizations work in the region on disease-specific activities such as the Global Fund (HIV and TB) and Fleming Fund (antimicrobial resistance) whose work contributes to building stronger surveillance, laboratory, and reporting systems.

There are a handful of non-governmental organizations (NGO) that have portfolios related to strengthening surveillance and healthcare systems. For example, PATH, which is mainly active in Vietnam, is helping to build digital surveillance systems and data collection and reporting platforms. Medecins Sans Frontier (mainly active in Indonesia) does work that supports data management. The Clinton Health Access Initiative is now doing more work around supply chain issues given the experience and support they provided to address access to medical products including medical oxygen during COVID-19.

At an academic level, many institutions are working mainly as implementing partners in each country, helping donors/funders build and support surveillance systems. Importantly, each country has academic alliances such as the Indonesia One Health University Network, Philippines One Health University Network, and Vietnam One Health University Network, that are active and geared to building integrated one health disease surveillance capacity.

From the private industry side, organizations with private industry representation like the US-ASEAN Business Council and EU-ASEAN Business Council, are interested in addressing regulatory and supply chain issues in the region, including removing regulatory bottlenecks that reduce access to vaccines, therapeutics, and diagnostics. There are also companies like Illumina and Thermofisher that are manufacturers of equipment and diagnostics who have important roles to play in maintaining equipment and supporting the usage of equipment through, for example, training, access to supplies, and potentially in-kind support.

## Observations and Recommendations

The six Southeast Asian countries in this analysis- Brunei Darussalam, Indonesia, Malaysia, Philippines, Thailand, and Vietnam- have a good detection/surveillance capability compared to the global average, as indicated by the Joint External Evaluation and Global Health Security Index scores. Malaysia and Thailand have surveillance capabilities ranked among the best in the world and are mostly self-sufficient in funding these activities. Brunei also has a good surveillance system and is self-sufficient in terms of funding, but due to its small population size and the threats it faces, its system and workforce is not as extensive as countries like Malaysia and Thailand, and it benefits from external technical support. Indonesia, Philippines, and Vietnam are improving their detection capabilities as they become more economically prosperous. Stakeholders are more engaged in supporting detection capacities in the latter three countries.

In reviewing detection capacities and capabilities in the region, we identified three main areas for stakeholders to further explore for engagement with countries within Southeast Asia. These areas are not intended to be all-encompassing. They are guided by the following considerations: (1) areas that appear to be of growing importance to the region, (2) applicability to all six countries- even those with already "high surveillance capacity", and (3) actionable in the near-term:

In reviewing detection capacities and capabilities in the region, we identified three main areas for stakeholders to further explore for engagement with countries within Southeast Asia.

### 1. Improved sharing of samples and data for early warning, risk assessment, and decision-making

- **Data integration and interoperability:** Within the region, countries have many surveillance systems targeting different diseases that have been in place for years. Each system provides valuable data. If these data can be brought from the various systems to a central place, data can be triangulated for more meaningful analysis. This challenge to integrate data exists within and across sectors. Stakeholders can work with countries and other partners to support existing data integration efforts as well as future data integration efforts as countries move some of the ongoing ad hoc surveillance activities (e.g., pathogen genomic surveillance and wastewater surveillance) to more formal national surveillance efforts.
- **Data inclusivity:** While surveillance systems are in place, some countries face challenges with obtaining data from certain populations (e.g., rural populations in Indonesia and Vietnam and migrant populations in Thailand). To understand what is going on at the local and national levels, it is necessary to ensure the inclusion of all populations in data collection efforts. Additionally, within the region, while attempts are being made to integrate data from the human and animal sectors under a One Health approach, the environmental sector is often not represented even though there is value to its inclusion (e.g., wastewater surveillance during COVID-19 were shown to supplement clinical surveillance and aid in the identification of hotspots and provide early warnings for a resurgence in cases).
- **Genetic sequence databases and biorepositories:** During the COVID-19 pandemic, the sharing of pathogen sequence data took place through genetic sequence databases like GenBank and GISAID. A challenge with utilizing different databases is that they operate under varying rules such as handling intellectual property rights, how the data can be used for commercial purposes, and dealing with the acknowledgment of the original data providers. They also have different file formats, limited analytic capabilities, and different metadata submission requirements. Utilizing data from these systems, therefore, is a time and resource-intensive process. Exploring how to share and utilize data from genetic sequence databases is an area that warrants more attention in the region. Additionally, there is limited national biorepository infrastructure within the region that can provide access to high-quality, well-characterized biospecimens and reagents

that are critical for enabling research and development of diagnostics, therapeutics, vaccines, and other countermeasures. As countries explore developing and improving their biorepository infrastructure, they need to consider the legal and regulatory factors that will facilitate the downstream use of specimens and sharing of related data.

- **Blockchain:** This is a technology that can be explored to address some of the concerns that prevent or delay the sharing of data and specimens such as concerns around where data goes, how data are used, and data attribution. Work needs to be done to assess whether such technology is fit for purpose and how it could be applied in the Southeast Asian context to support data sharing objectives.
- **Policy and regulatory environment to facilitate data and specimen sharing:** As demonstrated during the COVID-19 pandemic, all six countries embraced the use of digital tools to communicate with the public and collect data to inform contact tracing and other epidemiological investigations. As countries develop and utilize technology to store, share, and analyze healthcare information, consideration must be given as to how to ensure the right type of data are being collected for surveillance purposes, data provenance is maintained, and sufficient data privacy and security protections are in place.

### 2. Incorporation of digital technologies into systems to provide real-time data modeling and analysis for early warnings, risk assessment, and decision-making

Risk assessments, which assign a level of risk to human health to any event based on hazards, exposure, and context, are performed at the national level in these countries. However, there is value in making risk assessment more applicable to the local context for local decision-making needs such as assessing disease risk of an area/city/zone during an outbreak based on population, vaccination rates, etc. This requires granular and better triangulation of data from different sources. Additionally, if the data analysis and/or modeling is automated and provides real-time feedback, it allows for its timely application within and across all administrative levels where public health decisions need to be made. Stakeholders can explore how to incorporate such tools including the use of artificial intelligence in data collection, modeling, and epidemiological investigations to improve efficiencies.

### 3. Improved access to diagnostics for better pathogen identification and tracking

- **Decentralizing diagnostic capacity:** A common theme among the countries in Southeast Asia is the dependence on one (or a handful) of reference laboratories that can conduct some of the "gold-standard" testing. During COVID-19, some of these countries (e.g., Malaysia and Thailand) were able to decentralize COVID-19 diagnostic testing capacity by outsourcing it to trained laboratories at the sub-national level, reducing the time to turnaround testing. Consideration can be given as to how to make this capability more sustainable by, for example, supporting laboratory accreditation efforts that enable laboratory surge capacity and improve their data quality output.
- **Use of novel diagnostics that feed into existing surveillance systems:** Current gold-standard detection techniques, such as culture-based assays and nucleic acid amplification tests, can be time-consuming and require specialized laboratories. Investing and moving toward the use of novel diagnostic technologies that are suitable for use at point-of-care or in low-resource settings can be explored. However, the results of these tests must be still captured through existing surveillance systems.
- **Strengthening the diagnostic supply chain**: Countries in the region are sensitive to shifts in the diagnostic supply chain due to their heavy reliance on imports of laboratory supplies and equipment. As countries consider bigger policy decisions about whether and how to build national and regional diagnostic production capacity, some activities that can be done in the near term to help strengthen supply chain resilience include exploring how to improve transparency of the supply chain and build national and regional diagnostic supply stockpiles.
- **Strengthening regulatory mechanisms:** Within the region, regulatory authorities and policymakers need to work together to put in place regulatory mechanisms to quickly authorize/approve the use of unapproved tests and plans for addressing shortfalls in accessing diagnostic supplies and equipment. During COVID-19, regulatory authorities were faced with lots of questions such as how to use alternative kits on diagnostic systems that they weren't approved for, authorizing the test of new diagnostic tests. To improve efficiencies during future emergencies, regulatory authorities, and private industry can work together to determine whether improvements can be made to the current legal and regulatory mechanisms.

## Purpose

The purpose of this landscape analysis is to (1) produce a summary of ongoing stakeholder activities within Southeast Asia that are strengthening country health system capacities to detect and surveil infectious diseases so countries can respond efficiently and rapidly to public health emergencies and (2) identify areas where further investment- be it in the form of funding, technical assistance, resources, infrastructure, advocacy/policy support- is needed to enable investors, policymakers, and other stakeholders to coordinate, collaborate, and make informed decisions.

## Scope

Given the Temasek Foundation's regional priorities, six Southeast Asian countries- Brunei, Indonesia, Malaysia, Philippines, Thailand, and Vietnam- were selected for this stakeholder analysis.

This report looks at the traditional detection capacities as guided by the Global Health Security Agenda (GHSA), World Health Organization (WHO) Joint External Evaluation (JEE), and Global Health Security (GHS) Index as well as aspects of the health system that are necessary to support strong detection/investigative capacities and capabilities. This includes surveillance systems, laboratory systems, reporting systems, the trained personnel needed to surveil, investigate, and analyze data (e.g., epidemiologists, laboratory workforce, primary healthcare workers), physical infrastructure related to providing healthcare and laboratory services, the regulatory infrastructure that supports surveillance and investigative activities, and supply chains.

The primary stakeholders of interest external to the national government agencies are those whose work is done in coordination or collaboration with the national governments or in-country partners and/or have significant national influence as conveners at the national level. These include:

- Government agencies providing bilateral support to the countries of focus
- Philanthropes
- Private industry
- Multilateral organizations
- Associations/Societies
- Academia/ Research institutes

# Background

Southeast Asia is a hot spot for emerging and reemerging infectious diseases and, in part due to rapid economic growth, increased trade, urbanization, mobile populations, and health impacts of climate change, it is a region that faces high health security risk region. The global health security landscape covers technical areas and capacities that are typically grouped in the following categories: "Prevent", "Detect", and "Respond". "Prevent" relates to activities that prevent and reduce the likelihood of outbreaks regardless of whether they occur naturally, are accidental, or are intentional. "Detect" relates to activities that allow identification of events so action can be taken. Finally, "Respond" activities are those that facilitate rapid and effective response to public health threats.

Countries within Southeast Asia have been working to strengthen health security within their nations for several years now as demonstrated by their commitment to global frameworks for strengthening health security such as the International Health Regulations (IHR) and Global Health Security Agenda as well as participation in region-specific frameworks such as the Delhi Declaration and Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies [APSED]).

The COVID-19 experience saw global disruption to economies, health services, and general daily life. Countries had to quickly develop and/or procure diagnostics, scale up testing capabilities, strengthen reporting structures, and surge their workforce to protect and care for their populations. This has reinvigorated the need for countries and development partners to assess where contributions can be made to improve country preparedness and response capacities and capabilities.

## Areas of Focus

There are a multitude of areas that require further investment both globally and nationally in each of the Southeast Asian countries to improve country preparedness and response for public health events. For this assessment, we focus on areas related to strengthening detection and surveillance capacities within national health systems given how foundational effective national surveillance is for global health security.

Southeast Asia is a hot spot for emerging and reemerging infectious diseases and, in part due to rapid economic growth, increased trade, urbanization, mobile populations, and health impacts of climate change, it is a region that faces high health security risk region.

Detect capacities, as used in the Global Health Security space, relate to the laboratory, surveillance, early warning, and reporting systems that enable early detection of an acute public health event and provide an opportunity for health officials to apply interventions to control the event. The data gathered during surveillance and case investigations help to inform risk assessments and disease modeling which are valuable tools to assist decision-making. The ability to detect, investigate, analyze, interpret, and act on the collected surveillance data at all levels of government is dependent on a strong health system with good primary healthcare and laboratory infrastructure; a trained cadre of healthcare professionals ranging from those providing primary healthcare (e.g., nurses and physicians) to laboratory scientists/technicians, epidemiologists, bioinformaticians, and social scientists; regulatory mechanisms; and supply chains.

### Infrastructure and Human Resources

Having strong primary care capabilities and infrastructure is necessary to detect the initial cases of an outbreak. This includes having qualified healthcare professionals who are astute to identify and refer suspicious cases for onward testing or referral. The structuring of healthcare delivery also has an impact on a country's ability to detect and report cases. For example, many countries deliver healthcare through public and private systems which enables wide healthcare coverage. However, if the public and private healthcare systems are not well integrated, where private institutions do not report to national systems, it can affect a country's ability to surveil for diseases.

Having a strong public health workforce, including field epidemiologists, is also vital for improving a county's ability to detect and respond to threats. Programs such as the Field Epidemiology Training Program (FETP) are needed at the national level to create and maintain a cadre of well-trained public health professionals to gather and analyze critical data and support decision-making.

### Surveillance, Laboratory, and Reporting Systems

Most countries conduct different types of surveillance (e.g., event-based and indicator-based surveillance) to detect and provide a comprehensive picture of the risk factors and evolution of the disease. However, there is also global recognition of the need to build national genomic surveillance capability as emphasized in the 2022 WHO's Genomic Surveillance Strategy. Genomic surveillance aids in the identification of new strains and informs the development of medical countermeasures such as vaccines and diagnostics. It was an area of huge importance during the COVID-19 response. Globally, only a handful of countries have extensive sequencing capability (e.g., the United Kingdom and the United States), and is a new area of interest for countries to develop this capability.

Laboratories provide vital support and facilitate the initiation and monitoring of appropriate clinical (e.g., used for diagnosis and treatment of individuals) and public health interventions (e.g., used for surveillance). Laboratories must have the necessary equipment, qualified personnel to conduct and interpret testing, and biosafety/biosecurity measures in place.

Open and timely access to samples and data, including data sharing of surveillance and pathogen sequences, is essential for improved risk assessment and decision-making, and to accelerate research and development of medical countermeasures. Furthermore, bringing together and analyzing data from different surveillance systems can make data more meaningful. This requires having integrated or interoperable surveillance systems. Data integration refers to translating data from different systems into one new system, while data interoperability refers to a concept where different systems utilize the same data standards or "speak the same language." Both make the cross-system sharing of data and information easier, enabling intelligence exchange among diverse stakeholders and communities.

Having strong primary care capabilities and infrastructure is necessary to detect the initial cases of an outbreak. This includes having qualified healthcare professionals who are astute to identify and refer suspicious cases for onward testing or referral.

There are calls to integrate data within and across the human, animal, and environment sectors in a One Health Approach. During the COVID-19 pandemic, bringing data from human and animal sectors helped to understand, for example, transmission dynamics and animal reservoirs. Wastewater surveillance was able to supplement clinical surveillance of COVID-19, enabling the detection of potential hotspots or areas of disease resurgence with lower resource usage (e.g., time and tests) compared to typical clinical surveillance.

Integration and interoperability are necessary to advance the WHO-developed collaborative surveillance concept, which is defined as "the systematic strengthening of capacity and collaboration among diverse stakeholders, both within and beyond the health sector, with the ultimate goal of enhancing public health intelligence and improving evidence for decision-making." It aims to strengthen surveillance across:



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- systems (e.g., aggregate data; case-based, event-based, sentinel, syndromic, laboratory, and genomic surveillance; health service usage data; population health surveys),
- sectors (e.g., human, animal, environment),
- emergency cycles (e.g., monitoring and emergency surveillance objectives throughout the cycle of prevention, preparedness, response, and recovery), and
- geographies (e.g., subnational, national, cross-border, regional, and global administrative levels).
- Advancing collaborative surveillance supports the need to put accurate, timely information into the hands of decision-makers for effective responses to public health emergencies.

Bringing together and analyzing data from different surveillance systems can make data more meaningful. This requires having integrated or interoperable surveillance systems.

### Diagnostic Access

Access to diagnostics for clinical and surveillance needs is essential for a well-functioning surveillance system. During COVID-19, countries had to either develop their in-house diagnostic kits (i.e., build the primers and assemble reagents) or acquire commercial diagnostic kits. The ability to build, acquire, and roll out both these laboratory-developed kits and commercial diagnostic kits is dependent on a strong regulatory system that can make determinations on, for example, the appropriateness of in-house built kits for clinical and/or surveillance purposes, and import and use of diagnostic toolkits from the private sector. In addition, a regulatory agency may have to determine which laboratories can offer new testing which could depend on, for example, the complexity of testing, laboratory accreditations/certifications, availability of resources and expertise, and urgency of the situation.

Access to the reagents, equipment, and other supplies needed to run diagnostic testing is also critical. This is heavily dependent on supply chains and government and private sector procurement mechanisms.

## Tools for Analyzing the Strengths and Gaps of Detection Capacities

The World Health Organization's (WHO) JEE tool and the Global Health Security Index (GHS Index) are two complementary tools that aid in identifying and prioritizing the areas within a country that can or should be strengthened for enhanced emergency preparedness, detection, and response. In addressing these areas, countries are better able to meet their obligations under the IHR (2005). The JEE is a primary data collection driven effort led by WHO at the invitation of a country where a country's health capacities related to the prevention, detection, and response to health threats are assessed by independent external evaluators at the behest of that country. The GHS Index on the other hand utilizes publicly available information to score countries on various indicators for several domains and considers additional indicators not covered by the JEE.

Most countries in Southeast Asia (and all of interest in this analysis) have completed a JEE: Brunei (2020), Indonesia (2017), Malaysia (2019), Philippines (2018), Thailand (2017)[1], and Vietnam (2016). Despite most being completed almost five years ago, which can be considered outdated, the JEEs still provide insight into areas that may be of high priority for national action and where stakeholders may have heavy activity. Indonesia, Thailand, and Vietnam have also developed National Action Plans for Health Security (NAPHS) to strengthen their IHR (2005) core capacities based on the findings of their respective JEEs. Scores for the GHS Index were released in 2019 and most recently in 2021.

1 Note that Thailand completed its second JEE in 2022, but the report was unavailable at the time of writing this report.





For the Southeast Asian countries, their detection/surveillance capability is one of the areas where they are quite strong as indicated by their JEE and GHS Index scores (see Fig 1 and Fig 2 which give the JEE and GHS Index scores for the "detect" related indicators, and Appendix A for more detailed scores). From these scores, Malaysia, and Thailand tend to score better on average across all the detect-related indicators. Areas that appear to need strengthening include reporting systems (including data access and transparency), laboratory supply chains, and human resources (e.g., the epidemiology workforce).

As countries build on the momentum at the global (e.g., WHO CA+), regional (e.g., SEARO, WPRO, ASEAN commitments), and national levels to make reforms in policies and systems to improve preparedness, it is informative to take stock of ongoing stakeholder activities. Mapping where these stakeholders work will aid development partner stakeholders to leverage resources, help to fill in remaining gaps, and build more sustainable programs.

### Figure 1 JEE Scores for Detect Capacities

**JEE Scores for DETECT Capacities and Capabilities by Country**
(Scored 1-5 where 1 = no capacity and 5 = sustainable capacity)

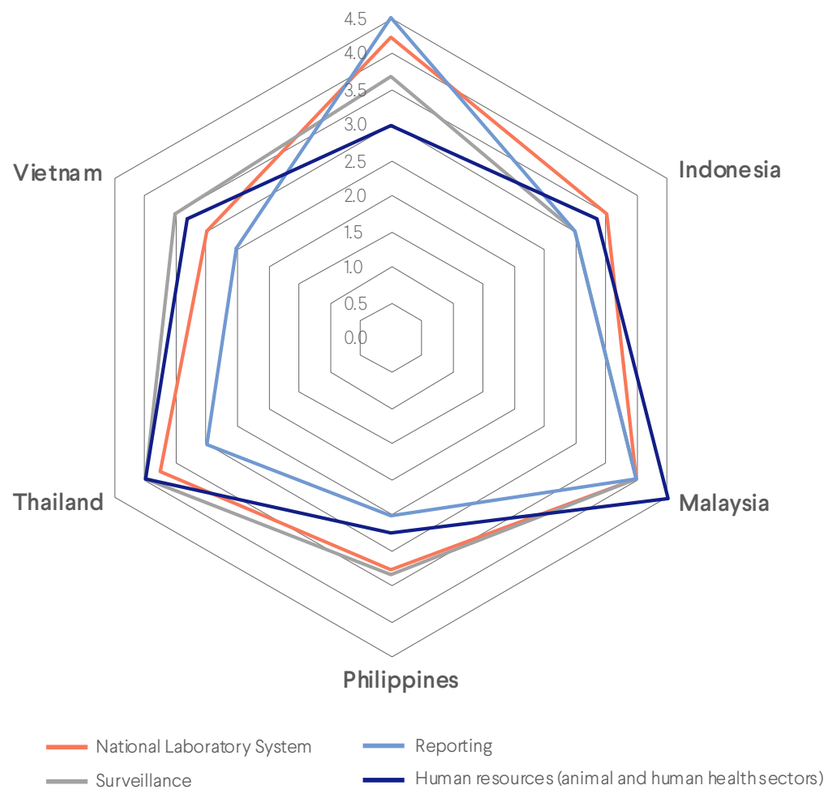
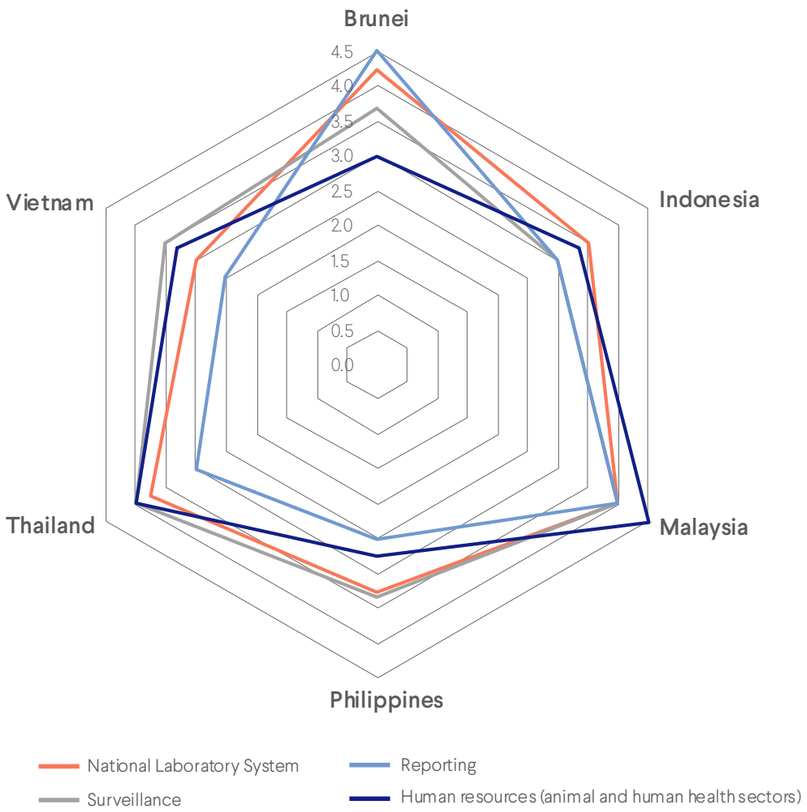


Figure 2 Global Health Security Index Scores for Detection Capacities




# Methods

## Desk Review

A desk review was conducted to:

- Review white papers, reports, and peer-reviewed journal articles to gather data on lessons learned, gaps, and opportunities from responses to COVID-19 focusing on country experiences from Southeast Asia.
- Compile a database of stakeholder activities implemented in Brunei, Indonesia, Malaysia, Philippines, Thailand, and Vietnam, focusing on ongoing activities.

Data on national and regional stakeholder activities was gathered from:

- Review of annual and fiscal reports, websites, and press releases from governments and organizations with ties to ASEAN including Australia, Canada, Japan, United States, United Kingdom, World Health Organization, Asia Development Bank, Bill and Melinda Gates Foundation (BMGF) and Wellcome Trust.
- PubMed searches for the period 2019 to 2023.



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## Analysis

Information was synthesized at the country and regional levels to uncover areas in the detection capacities that need to be bolstered and the areas where stakeholder activity is heavy. Stakeholders were mapped by the type of development support they provided:

- Funding (covers provision of financial capital, for example in the form of grants or loans, directly to the national government for them to execute)
- Technical guidance/capacity building
- Resources and infrastructure
- Research (relates to academic contributions)
- Policy/advocacy/legislative support

# Stakeholder Overview

## Financing in the Region

Throughout Southeast Asia, health security activities are predominantly funded by national governments and led by the health sector (i.e., respective ministries of health). Except for Brunei, the remaining countries — Indonesia, Malaysia, Philippines, Thailand, and Vietnam- are eligible for Official Development Assistance (ODA).

## Bilateral Government Partners

Australia and the United States (U.S.) provide substantial bilateral government support to countries within Southeast Asia for health security activities, especially to enhance detection capacities and capabilities. Canada, the European Union (EU), Germany, Japan, and the United Kingdom, are also big contributors of development assistance globally but have smaller portfolios that support health security in Southeast Asia in comparison to Australia and the U.S.

### Australia

The Australian Government has committed to strengthening health security within the Indo-Pacific Region. Through its Department of Foreign Affairs and Trade (DFAT)-supported Indo-Pacific Centre for Health Security (CHS), it supports activities that inform evidence-based planning, help prevent avoidable epidemics, strengthen early detection capacity, and support rapid, effective national and international outbreak responses across the region including Indonesia, Malaysia, Philippines, Thailand, and Vietnam. CHS has invested AUD 300 million (approx. USD 200 million) over five years (2017-2022) and is in discussions to determine priorities for future investments in regional health security. Australia has also developed health security partnerships with some countries, notably the Australia Indonesia Health Security Partnership (AIHSP), which is a 5-year program (2020-2025) that aims to increase national health security in Indonesia and reduce the risk of emerging infectious diseases within the community.

### U.S.

The U.S. does health work in the region through several of its departments, including the U.S. Department of Health (through the U.S. Centers for Disease Control and Prevention, CDC), the U.S. Agency for International Development (USAID), and the U.S. Department of Defense. Both the U.S. CDC and USAID have objectives to strengthen global health security and combat infectious disease threats. They work in close technical collaboration with the respective national governments and have institutional strengthening activities that aim to curb the spread of HIV and TB as well as global health security activities that aim to build sustainable systems for preventing, detecting, and responding to public health needs. They both have a physical in-country presence in several Southeast Asian countries. The U.S. CDC has an in-country presence in Thailand, Indonesia, Philippines, Vietnam, and Cambodia, as well as a regional Southeast Asia Regional Office headquartered in Vietnam; and USAID has an in-country presence in

Indonesia, Thailand, and Vietnam. The U.S. Department of Defense has a regional presence through its Armed Forces Research Institute of Medical Sciences based physically in Thailand, its Naval Medical Research Unit – Asia based in Singapore, and Naval Medical Research Unit Two – Phnom Penh based in Cambodia and is engaged in surveillance and surveillance capacity building activities within the region. The DoD Defense Threat Reduction Agency also has several projects in the region, particularly relating to building biosafety and biosecurity.

### Japan

Japan, through its development agency, Japan International Cooperation Agency (JICA), is a big contributor of aid to the Southeast Asia region though most of the aid supports activities such as maritime cooperation, connectivity, the sustainable development goals (SDG), and the economy. JICA's global health objectives aim to improve access to affordable healthcare. It does this through the provision of loans, grants, and technical assistance that support the strengthening of diagnosis and treatment capacity of core hospitals, including improving infectious disease control and testing and strengthening health financing systems.

## Philanthropes

There are a handful of philanthropic agencies that are engaged in building regional surveillance/diagnostic capabilities through local partners. These include the Bill and Melinda Gates Foundation, Wellcome Trust, Rockefeller Foundation, and The Global Fund (though global fund work is primarily in Laos and Cambodia) and their implementation partners are typically academic organizations (e.g., Duke-NUS University and Mahidol University).

## International Organizations

WHO has country offices in Malaysia (this office also works with Brunei and Singapore), Indonesia, Philippines, Thailand, and Vietnam. They have Country Cooperation Plans with each of the host nations where they have country offices.

## Development Banks

World Bank, Asia Development Bank, and Asia Investment Infrastructure Bank are all important multilateral development bank stakeholders that are supporting countries within the region to build their health systems to better respond to health security threats. Their support is typically in the form of financing through loans or grants, and occasionally through technical assistance.

## Multilateral Fora

The Association of Southeast Asian Nations (ASEAN) comprising ten ASEAN Member States (AMS)- Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Singapore, Thailand, and Vietnam – is active in strengthening public health preparedness and response in the ASEAN region. Specific activities of relevance include the Regional Public Health Laboratories Network in ASEAN, which aims to strengthen regional laboratory capacity by providing expertise and technical support to AMS' laboratories; data sharing through the ASEAN Emergency Operations Centre Network, the ASEAN Network for Drugs, Diagnostics, Vaccines, and Traditional Medicines Innovation and ASEAN Diagnostics Initiative which promote the self-reliance on diagnostic tools; and ASEAN BioDiaspora, which has been developed to build regional capacity in big data predictive analytics that strengthens ASEAN's epidemic and pandemic preparedness. Importantly, ASEAN is establishing the ASEAN Centre for Public Health Emergencies and Emerging Diseases (ACPHEED), which will serve as a center of excellence to strengthen ASEAN's regional capacity in preventing, detecting, and responding to public health emergencies and emerging diseases, and be a critical stakeholder for moving health security activities forward within the region. Notably, Japan committed funding and technical support to operationalize ACPHEED.

The Asia-Pacific Economic Cooperation (APEC) is a regional economic forum with 21 members including all six countries in this analysis. APEC has a health workstream through the APEC Health Working Group, which, for the period 2022-2030, is working toward strengthening "health systems including capacity building for human resources for health, resilient supply chains, and the promotion of regulatory convergence, to support universal health coverage and improved health emergency preparedness, detection, response, and recovery systems for public health emergencies in the APEC region."

Both ASEAN and APEC have political will and commitment to the activities outlined in their respective workplans related to health security, making them important stakeholders and partners, particularly in regional activities related to detection.

## Private Industry

The U.S- and EU-ASEAN Business Councils are organizations with membership from multinational companies representing a diverse range of industries with a vested interest in enhancing trade, commerce, and investment between their home countries and ASEAN. They regularly meet with leadership from ASEAN to advocate for changes in policies, rules, and regulations so businesses from the U.S. and EU can invest and grow within ASEAN. For example, the EU-ASEAN Business Council has been advocating for the enhancement of diagnostics capability across the ASEAN region to prevent or limit the impact of life-threatening health conditions and enhance the detection of emerging infectious diseases.

There are also many biotechnology companies that have a vested interest in improving access to detection and analytical tools in the region such as Illumina, Thermofischer Scientific, and Roche.

## Academia

All the countries have strong academic partners, but the density of academic partners who work on health security issues, and specifically research aspects relevant to surveillance and detection, is higher in Malaysia and Thailand. There are also several Australian, U.S., and U.K.-based university partners that are active in the region.



**Infectious Disease Detection Capabilities of Southeast Asian Countries:** A Landscape Analysis of Surveillance Systems and Stakeholders

## Notable Regional Programs that Contribute(d) to Building Regional Detection Capacities and Capabilities

Note the following projects include those that are ongoing, or have recently concluded

| Initiative | Target Countries | Description | Implementing Partner(s) | Sponsor/funder |
|---|---|---|---|---|
| Infectious Disease Detection and Surveillance (IDDS) | 22 countries in Africa and Asia including Indonesia, Philippines, Thailand, and Vietnam | Works with partner countries and with in-country, regional, and global organizations to strengthen the ability of health systems to quickly detect, track, and respond to priority infectious diseases. | ICF (Consortium Lead); Path (Primary Implementer); FHI 360; and Abt Associates | USAID |
| PREDICT (concluded) | 30 countries in Africa and Asia including Indonesia, Malaysia, Thailand, and Vietnam | Initiated in 2009 to strengthen global capacity for detection of viruses with pandemic potential that can move between animals and people. | UC Davis One Health Institute; EcoHealth Alliance; Smithsonian Institution; Metabiota; Wildlife Conservation Society | USAID |
| Fleming Fund | Supports countries in West Africa, East and Southern Africa, South Asia, and South-East Asia | Aims to improve laboratory capacity and diagnosis as well as data and surveillance of AMR at a country level through a One Health approach, covering human health, animal health, and the environment. It contributes to broader work on health systems strengthening by supporting improvements to diagnosis, surveillance, and use of quality health data in decision making. | Mott MacDonald | UK Department of Health and Social Care (DHSC) |
| Greater Mekong Subregion Health Security Project | Cambodia<br>Lao PDR<br>Myanmar<br>Vietnam | Strengthen health systems and promote cross-country cooperation aimed at improving both national and international health security through loans and grants. | | ADB |
| Asia Pathogen Genomics Initiative | Countries in South and Southeast Asia | A coordination and capacity development platform that aims to accelerate genomic pathogen sequencing for infectious disease surveillance and public health utility across South and Southeast Asia. | Duke-NUS Centre for Outbreak Preparedness | BMGF |
| Build Genomic Surveillance Capacity | Thailand and ASEAN countries | Strengthen genomic surveillance facilities. | Mahidol University | Rockefeller Foundation's Pandemic Preventive Institute |
| Indo-Pacific Centre for Health Security | Pacific and Southeast Asian Countries | Build strong and resilient health systems through several areas including disease surveillance and modeling, laboratory strengthening, workforce development, health information systems, and diagnostics and other medical countermeasures. | Several including Doherty Institute, Southeast Asia Lab Network, and CSIRO (Australia's National science agency) | Australia's Department of Foreign Affairs and Trade |
| Wellcome Africa-Asia Sequencing Consortium | Includes Indonesia and Vietnam | | Oxford University Clinical Research Unit (OUCRU) in Vietnam and Indonesia (among others). | Wellcome |
| Connecting Organizations for Regional Disease Surveillance (CORDS) | | Catalyze collaboration amongst regional disease surveillance networks across the world in order to improve their capacity to detect and control the spread of epidemics. | | Ending Pandemics |
| Enhancing Regional Capacity in Big Data Analytics and Visualization | Brunei Darussalam; Cambodia; Indonesia;<br><br>Lao People's Democratic Republic; Malaysia; Myanmar;<br><br>Philippines; Singapore; Thailand;<br><br>Vietnam | Build regional big data analytics. | | Canada |



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# Brunei Darussalam

| |
|---|
| World Bank FY23 classification: High income economy |
| Population: 445,373 (2021) |
| Urban population: 79% (2021) |
| UHC Coverage Index: 77% (2019) |
| General government spending on health as % of general government expenditure: 6.78% |
| Physicians per 1,000 pop.: 1.6 (WB, 2017) |
| Nurses per 1,000 pop.: 5.8 (WB, 2018) |
| Hospital beds per 1,000 pop.: 2.9 (WB, 2020) |
| FETP: Est. 2019 (frontline) |

## Background

From the 2021 GHS Index Scores, Brunei scored 43.5 overall (above the global average of 38.9 and ranked 64 of 195 countries) and 44.7 for detection and reporting (a global average of 32.3). From the JEE completed in July 2020, the average score for detection was 3.9.

### Healthcare Infrastructure and Human Resources

Brunei is a small high income economy with a relatively small population and has a good healthcare delivery system in place consisting of mostly public and a handful of private healthcare institutions. All Brunei citizens receive public healthcare either for free or at a highly subsidized rate through the national social insurance plan. When the public hospitals are unable to provide specific services to Brunei citizens locally, the government coordinates and pays for Brunei citizens to be sent overseas- typically to Malaysia, Singapore, or Thailand – for treatment.

The Ministry of Health aims to grow the health sector by recruiting a highly skilled workforce, offering specialized medical services, and investing in infrastructure, research, medical technology, and digital transformation. It is building workforce capacity for skilled field epidemiologists, public health physicians, veterinarians, information specialists, and biostatisticians and ensuring the existing workforce is trained to report unusual events through the appropriate channels, enhancing laboratory and epidemiological surveillance.

### Surveillance, Laboratory, and Reporting Systems

Brunei has indicator, syndromic, and event-based surveillance systems in place. Its indicator-based system is linked to the Brunei Darussalam Healthcare Information and Management System (Bru-HIMS), an electronic notification system where data are reported from the national and sub-national levels. Clinical and laboratory data are monitored in real-time for over 50 infectious diseases. It is a good example of a platform where data from different systems (e.g., laboratory, billing, clinical care, pharmaceutical) is integrated in one place. However, this is specific to human health within the public healthcare system. Data from the private healthcare sector as well as from other sectors (e.g., animal health) is not integrated into this platform.

The national laboratory system has a strong regional and international laboratory network with external quality assessment in place for any confirmation, genotyping, and virus characterization. The national reference laboratory conducts most testing, however, it has limited capability to handle testing of dangerous pathogens. For a small percentage of samples, Brunei leverages its international laboratory relationships to support testing needs.

Genomic surveillance capability in Brunei is also still limited. Only after a donation to the Brunei Ministry of Health of a genetic sequencer, bioinformatics analysis software, reagents, and other supplies during the COVID-19 pandemic, did Brunei begin sequencing SARS-CoV-2 samples. Otherwise, samples were being sent to Singapore and Hong Kong for sequencing.

### Data Access and Transparency in Surveillance

Brunei has good digital surveillance systems in place where data can be accessed, however, it depends on ad hoc multi-agency arrangements at the technical and operational level for sharing information based on interpersonal relationships, as was noted during the COVID-19 response. Brunei is taking steps to remedy this by putting in place mechanisms for interagency communication for surveillance and notification of zoonotic diseases, which are outlined in the Joint Preparedness and Response Framework to Zoonotic Diseases of Public Health Concern.

To improve data access, transparency, and build intelligence for decision-making, the Brunei Ministry of Health, in coordination with a private sector company (Singapore-based EVYD Technology), has launched the MOH Intelligence Hub which currently brings together the Disease Control Division's Epidemic Intelligence and Response Unit, which functions as the nation's disease surveillance center; the Climate Change Adaptation and Resilience Unit; and the Digital Health Unit. This intelligence hub will be responsible for automating national disease surveillance and response activities. Brunei has also established a Digital Health Unit to coordinate digital health transformation across healthcare services, which manages, for example, the COVID-19 mobile-health application BruHealth, which facilitates contact tracing and detection of early cases of infectious disease.

### Access to Diagnostics, Equipment, and Other Laboratory Supplies

Brunei imports most of its diagnostic tests, equipment, and laboratory supplies and has the regulatory infrastructure to do so efficiently. It maintains a small medical stockpile for emergencies, but it is limited to personal protective equipment and selected medication. It is not suited for large-scale emergencies. During the COVID-19 pandemic, Brunei benefitted from donations of diagnostics and related supplies and equipment from other countries (e.g., Singapore and China) and corporate social responsibility programs (e.g., Siemens).

## Stakeholders

Brunei, due to its relative self-sufficiency has low involvement from bilateral government stakeholders unlike the other countries considered in this analysis.

### National Government Stakeholders

| Ministry | Department |
|---|---|
| Brunei Darussalam AMR Committee (BDAMRC) | |
| Brunei Darussalam Medicines Control Authority | |
| Ministry of Finance and Economy (MOFE) | |
| Ministry of Health | Health Services |
| Ministry of Health | Medical Services |
| Ministry of Health | Disease Control Division |
| Ministry of Health | BruHealth |
| Ministry of Health | Health System and Infrastructure Strategy Management Unit |
| Ministry of Health | Department of Laboratory Services |
| Ministry of Health | Department of Scientific Services |
| Ministry of Health | Brunei Health Information Management System (Bru-HIMS) |
| Ministry of Health | Department of Pharmaceutical Services |
| Ministry of Health | Department of Administration and Finance (DAF) |
| Ministry of Health | Department of Environmental Health Services |
| Ministry of Primary Resources and Tourism (MPRT) | Department of Agriculture & Agrifood (DoAA) |
| Ministry of Primary Resources and Tourism (MPRT) | Livestock, Industry and Veterinary Services Division |
| RIPAS hospital | |
| Royal Brunei Armed Forces (RBAF) | |

### Development Partners

| Organization or Department | Stakeholder type | Type of activity | | | | |
|---|---|---|---|---|---|---|
| | | Funding | Technical assistance/ Capacity Building | Resources and Infrastructure | Research | Policy/ Advocacy/ Legislative Support |
| Institute of Technology Brunei (ITB) | Academia | | | | ● | |
| Centre for Strategic and Policy Studies | Academia | | | | ● | ● |
| PAPRSB Institute of Health Sciences, Universiti Brunei Darussalam | Academia | | | | ● | ● |
| Universiti Brunei Darussalam | Academia | | | | ● | |
| Thailand Ministry of Public Health | Bilateral government support | | ● | | | |
| US CDC | Bilateral government support | | ● | | | |
| Borneo Genomics Innovation | Private Industry | | ● | ● | ● | |





## Observations and Areas of Potential Engagement

Brunei has a good healthcare delivery and surveillance system in place. Given its relatively small population, access to financial resources, and centralized national government, it doesn't run into the same kinds of challenges that countries with larger populations encounter such as poor geographical coverage to reach the whole population. It is also more agile and able to rapidly implement, for example, new mass testing protocols, enhanced surveillance, and contact tracing.

Its access to data, especially patient-level data, is good. However, robust surveillance capacity depends on more than digital systems for human health. Brunei can benefit from enhancing its national and regional data sharing arrangements. At the national level, better integrating data from private healthcare institutions and other sectors into their national system and working at the regional level with ASEAN to share data in formats that enable comparisons across countries can help. Brunei may also benefit from leveraging existing digital systems to automate aspects of data analysis and alert functions to enhance timely detection, risk assessment, and decision-making.

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# Indonesia

## Background

Indonesia has taken an active role in addressing health security since the inception of the Global Health Security Agenda in 2015. From the 2021 GHS Index Scores, Indonesia scored 50.4 overall (above the global average of 38.9 and ranked 45 of 195 countries) and 55.4 for detection and reporting. Its average JEE score for detection was 3.2.

### Healthcare Infrastructure and Human Resources

Healthcare in Indonesia is provided through a mix of public and private healthcare centers. The public healthcare system is decentralized with administration happening at the central, provincial, and district/municipal government levels. This structure has an impact on the functioning of the health system as well as detection and reporting activities.

Indonesia faces challenges with its healthcare infrastructure and workforce due to a low number of hospital beds (1.04 beds per 1,000 population, World Bank, 2017), an inadequate physician-to-population ratio (0.62 per 1,000 population, World Bank, 2020), maldistribution of physicians, and generally a shortage of healthcare workers. Indonesia's healthcare infrastructure, particularly in rural areas, was inadequate to handle the surge in demand for healthcare services during the pandemic, particularly with the shortages of hospital beds, medical equipment, and healthcare workers.

### Surveillance, Laboratory, and Reporting Systems

Indonesia has a national early warning alert and response system (EWARS) administered under the Ministry of Health called Sistem Kewaspadaan Dini dan Respon or SKDR. Data are collected routinely every week for several disease syndromes from public health centers. The data also go into a One Health information-sharing platform called System for Zoonotic and Emerging Infectious Disease (SIZE), which facilitates data sharing and communication among human and animal health (livestock and wildlife) systems. With technical support and guidance, Indonesia has also developed tools to support the conduct of risk assessments and joint planning using these data.

**World Bank FY23 Classification: Upper-middle income economy**

**Population: 273,753,191 (WB, 2021)**

**Urban population: 57% (WB, 2021)**

**UHC Coverage Index: 59% (WB, 2019)**

**General government spending on health as % of general government expenditure: 10.1% (WHO, 2020)**

**Physicians per 1,000 pop.: 0.6 (WB, 2020)**

**Nurses per 1,000 pop.: 2.3 (WB, 2020)**

**Hospital beds per 1,000 pop.: 1.04 (WB, 2017)**

**FETP: Est. 1982 (frontline, intermediate, advanced)**

A major challenge encountered by EWARS and similar surveillance systems across sectors is the limited number of qualified personnel, particularly at the subnational level, who have the expertise and ability to contribute to the system. This is particularly true for rural Indonesia where they are understaffed and have high turnover rates, leading to a lack of continuity in program support and knowledge transfer. Limited internet and mobile communication infrastructure in remote/rural regions are also challenges that impact participation and reporting from all areas of the country. Additionally, limited funds for investigating outbreaks, examining specimens, and traveling to remote areas, cause difficulties in verifying information.



**Infectious Disease Detection Capabilities of Southeast Asian Countries:** A Landscape Analysis of Surveillance Systems and Stakeholders

Indonesia, to cover its wide area, has many laboratories. This includes 1,200+ public health laboratories and around 13,000 laboratories at the lowest level. Diagnostic testing is available for 23 diseases in peripheral reference laboratories and further capacity is available in the central referral laboratory, however, there is reliance on referral to a single reference laboratory (for the human sector, the Balitpanges laboratory, and for the animal sector, BPMSPH Jakarta—both of which have BSL3 facilities), which causes delays in diagnosis. It also appears that Indonesian laboratories are siloed. For example, there are TB and HIV laboratories and laboratory networks, but these are not capturing or integrated well systems that capture data on antimicrobial resistance or other infectious diseases.

On the genomics side, Indonesia is beginning to grow its genomics surveillance capability. In 2022, the Ministry of Health launched the Biomedical and Genome Science Initiative (BGSi)- Indonesia's first national biomedical initiative geared to improve precision medicine. For pathogen genomic surveillance, a National Genomic Sequencing Consortium was established by Indonesia during COVID-19 to increase the number of strains sequenced and reduce the amount of time in which those strains were sequenced. However, there isn't a formal pathogen sequence surveillance mechanism in place. Academia within Indonesia has also conducted a proof-of-concept wastewater epidemiological surveillance, but there is still no national wastewater surveillance effort.

### Data Access and Transparency in Surveillance

From a data sharing and health communications standpoint, there is a national health information system (SIKNAS) that links to district-level health information systems (SIKDA). However, the decentralized system has made it a challenge to ensure complete, timely, and accurate data as each sub-national level government interprets reporting requirements differently. Since 2018, Indonesia has been rolling out a "generic" SKIDA application intended to streamline data collection and enable data and information exchange between data/information managers in the region and the Ministry of Health. However, it is unclear how SKIDAS is being utilized at present to improve communications with healthcare staff. There is also a need to ensure laboratory information systems are interconnected with the primary database in ISIKHNAS.

### Access to Diagnostics, Equipment, and Other Laboratory Supplies

Obtaining reagents and other laboratory supplies was noted as a challenge when Indonesia was surging its COVID-19 diagnostic capabilities, as most supplies are imported. Pre-COVID, Indonesia was attempting to improve transparency and access to medical devices through its online procurement system for medical products used by the national public health insurance system that allows public and private hospitals and clinics to purchase medical equipment at a pre-negotiated price without a national or hospital public tender. While this can reduce costs for hospitals, the lack of supplier choice can result in delays in obtaining necessary supplies. There is room to improve the visibility and efficiency of the medical product and laboratory supply system.

# Stakeholders

## National Government Stakeholders

| Ministry | Department |
|---|---|
| Coordinating Ministry for Human Development and Cultural Affairs (Kemenko PMK) | |
| Government Agency for Procurement of Goods (Lembaga Kebijakan Pengadaan Barang/Jasa Pemerintah "LKPP") | |
| Health Social Insurance Administration Agency (BPJSK) | National Health Insurance |
| Indonesian Food and Drug Authority (Badan Pengawas Obat dan Makanan, or Badan POM) | |
| Ministry of Agriculture | Livestock and Animal Health Services |
| Ministry of Health | Agency of Health Human Resources Development and Empowerment (PPSDM) |
| Ministry of Health | Biomedical and Genome Science Initiative (BGSi) |
| Ministry of Health | Directorate General of Communicable Disease Control and Environmental Health |
| Ministry of Health | Directorate General of Pharmaceutical and Medical Devices |
| Ministry of Health | Health Policy Agency |
| Ministry of Health | Indonesia Health Services (SATUSEHAT) |
| Ministry of Health | National Institute for Health Research & Development (NIHRD) |
| Ministry of Health | Pharmaceuticals and Devices |
| Ministry of Health | Research and Development Agency |
| Ministry of Home Affairs | |
| Ministry of Marine Affairs and Fisheries (MOMAF) | |
| Ministry of National Development Planning/ National Development Planning Agency | Directorate for Health and Community Nutrition |
| Ministry of Research and Technology | |
| National Agency of Drug and Food Control (BPOM) | |
| National Agency of Drug and Food Control (NADFC) | NRASFF (Indonesia Rapid Alert for Food and Feed) |
| National Disaster Management Agency (BNPB) | |
| National Health System (SKN) | |
| National Research and Innovation Agency | Eijkman Institute for Molecular Biology |
| National Research, and Innovation Agency (BRIN) | Genomics facility at the Cibinong Science Center |
| Pertamedika IHC (Indonesia Health Corp) | |





## Development Partners

| Organization or Department | Stakeholder type | Type of activity | | | | |
|---|---|---|---|---|---|---|
| | | Funding | Technical assistance/ Capacity Building | Resources and Infrastructure | Research | Policy/ Advocacy/ Legislative Support |
| Center for Health Policy and Management, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada | Academia | | | | ● | ● |
| Eijkman-O●ford Clinical Research Unit, Jakarta, Centre for Tropical Medicine and Global Health, University of O●ford | Academia | | | | ● | |
| Indonesia Medical Education and Research Institute, Faculty of Medicine Universitas Indonesia | Academia | | | | ● | |
| Indonesia One Health University Network (INDOHUN) | Academia | | ● | | | ● |
| Universitas Respati Yogyakarta | Academia | | | | ● | |
| Asia Partnership on Emerging Infectious Diseases (APEIR) | Association/Society | | ● | | | |
| Indonesia Hospital Association (PERSI) | Association/Society | | | | | ● |
| Indonesian Private Hospitals Association (ARSSI) | Association/Society | | | | | ● |
| Indonesian Public Health Association (IAKMI) | Association/Society | | | | | ● |
| Indonesian Society for Clinical Microbiology | Association/Society | | | | | ● |
| Australia Department of Foreign Affairs and Trade (DFAT) | Bilateral government support | ● | ● | ● | | ● |
| Canada | Bilateral government support | | ● | | | |
| Chinese National Health Commission, Chinese Center for Disease Control and Prevention | Bilateral government support | ● | ● | | | |
| U.S. Defense Threat Reduction Agency | Bilateral government support | | ● | ● | | |
| European Commission | Bilateral government support | | ● | | | |
| Fleming Fund Partnership | Bilateral government support | | ● | | | |
| Germany | Bilateral government support | | ● | ● | | |
| Indo-Pacific Centre for Health Security | Bilateral government support | | ● | | | |
| Japan International Cooperation Agency (JICA) | Bilateral government support | | ● | ● | | |
| Partnership for Australia-Indonesia Research (PAIR) | Bilateral government support | | | | | ● |
| U.S. Agency for International Development | Bilateral government support | | ● | ● | | ● |
| U.S. CDC | Bilateral government support | ● | ● | ● | | |
| UK Department of Health and Social Care of the United Kingdom of Great Britain and Northern Ireland (DHSC) | Bilateral government support | | ● | | | |
| Asia Development Bank | Multilateral | ● | | ● | | |
| Asia Infrastructure Investment Bank | Multilateral | ● | | | | |
| WHO Indonesia | Multilateral | ● | ● | | | |
| World Bank | Multilateral | ● | | | | |
| Association of Public Health Laboratories (APHL) | NGO | | ● | | | |
| Centre for Indonesia's Strategic Development Initiatives | NGO | | | | | ● |
| FIND | NGO | | ● | | | |
| Indonesia Red Cross | NGO | | ● | | | |
| International Decision Support Initiative (iDSI) | NGO | | | | | ● |
| PATH | NGO | | | ● | | |
| East Ventures | Private Industry | | | | | ● |

## Observations and Areas of Potential Engagement

Indonesia receives a lot of technical support from external stakeholders for improving its detection capabilities, particularly in the areas of surveillance systems and training for individuals. Indonesia has a strong partnership with Australia for all aspects of health security particularly through the Australia Indonesia Health Security Partnership (AIHSP) and with the U.S. through CDC, USAID, and Department of Defense. Areas where there is less involvement from external stakeholders and development partners (apart from multilateral development banks) is in strengthening healthcare infrastructure (e.g., supporting development of rural infrastructure) and ameliorating the regulatory and supply chain constraints around diagnostic tools.

Indonesia is taking steps to improve data transparency both on the detection and health system side. In 2019, Indonesia announced a move toward a "one data" policy, which intends to harmonize data obtained by each ministry and agency and improve transparency, participation, innovation, accountability, and inclusion. Specific to detection activities, there is ongoing work at the national level to strengthen the interoperability of surveillance systems across sectors particularly with a One Health lens. However, given the challenges with collecting data from all levels of governments and healthcare facilities during the COVID-19 response, there is room to improve data collection and ensure integration/interoperability of that data. For example, exploring novel methods for collecting surveillance data from understaffed regions, facilitating the deployment of national data collection systems to local levels of government, and deploying data analytic software to more localized levels so individuals submitting data can utilize the data for local decision-making, can contribute to ongoing detection strengthening efforts.

Indonesia and its partners are leveraging digital platforms to improve health (e.g., telemedicine platforms, communications applications, and platforms that improve transparency and efficiency with the use of electronic health records). The uptake of digital platforms for health offers opportunities to collaborate and collate data from a wide variety of platforms that can generate useful data for surveillance, policy, and decision-making.

The existing digital tools to manage the supply chain for the health system (medical products and laboratory supplies) can be strengthened to improve visibility and allow flexibility. Additionally, working in close concert with the national government and public-private partners, there are opportunities to the current system for stockpiling can be leveraged to address ongoing medical and laboratory supply chain issues.





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# Malaysia

## Background

From the 2021 GHS Index Scores, Malaysia scored 56.4 overall (ranked 27 of 195 countries) and 72.5 (ranked 7 of 195 countries) for its detection and reporting capability. Malaysia's average JEE score (2019) for detection capacity was 4.1.

### Healthcare Infrastructure and Human Resources

The national public healthcare system in Malaysia has an extensive network of primary care centers and is estimated to serve around 65% of the population. It is also "administratively centralized" unlike some of the other countries in the region like Indonesia and the Philippines, where the Ministry of Health directly oversees service delivery by their district offices, hospitals, and centers.

The public healthcare system faces high demand and long wait times in part due to an inadequate supply of health professionals and inability to keep pace with population growth in urban areas. To alleviate this strain on the healthcare system, it is putting in place measures, such as increasing training capacity and opportunities, to produce and retain doctors, nurses, pharmacists, and other healthcare professionals within the system. It is also looking into improving public-private partnerships to overcome resource constraints.

### Surveillance, Laboratory, and Reporting Systems

Since SARS and avian influenza, the Malaysian government has invested in building its surveillance and early response capabilities to infectious disease outbreaks. There are several electronic reporting systems for indicator and event-based surveillance. These systems include the eNotifikasi system where notifications of communicable diseases can be entered at the clinic or district level, verified, and then reported to state and national levels; the e-Waback system, which is an event-based system; and "Vekpro" which is used for reporting vector-borne disease, and a real-time reporting of surveillance information by public health laboratories around the country. Malaysia has mechanisms that enable visibility into different surveillance systems, and there is some sharing of surveillance information among animal, human, and wildlife authorities under Malaysia's One Health framework.

| |
|---|
| **World Bank FY23 Classification: Upper-middle income economy** |
| **Population: 33,573,974 (2021)** |
| **Urban population: 78% (2021)** |
| **UHC Coverage Index: 76% (2019)** |
| **General government spending on health as % of general government expenditure: 8.61% (WHO, 2020)** |
| **Physicians per 1,000 pop.: 2.3 (WB, 2020)** |
| **Nurses per 1,000 pop.: 3.4 (WB, 2019)** |
| **Hospital beds per 1,000 pop.: 1.88 (WB, 2017)** |
| **FETP: Est. 2002 (basic and advanced)** |

Malaysia has an extensive laboratory system; however, the majority are privately owned. The Institute for Medical Research serves as the primary national reference laboratory and provides training to laboratory professionals. In fact, as part of Malaysia's plans to surge diagnostic testing capacity early in the pandemic, the Institute of Medical Research had a critical role in providing training during the COVID-19 pandemic to other laboratories and is a good example for the region on how to scale up testing.

Pathogen genomics surveillance is conducted in Malaysia and bioinformatics is slowly being built. During the COVID-19 pandemic, a network of laboratories consisting of the Genome and Vaccine Institute along with several university laboratories was assembled to conduct genomic sequencing of SARS-COV-2. However, most interest in the genomic sequencing capability comes from its applications in medicine. The Genome and Vaccine Institute, a non-profit organization previously under the Ministry of Science and Technology serves as a hub for genomics, conducting discovery research through genome sequencing, comparative genomics, and molecular biology.

During COVID-19, a couple of wastewater surveillance activities were conducted as proof of concept, but this type of surveillance activity is not being conducted routinely.

### Data Access and Transparency in Surveillance

Malaysia uses electronic health records (EHR); however, its use is mainly limited to public hospitals in Malaysia. There are efforts to encourage wider adoption of EHRs across both public and private healthcare providers and bring the records into a single data management system, the Malaysian Health Data Warehouse (MyHDW), established in 2017. The purpose of this data warehouse is to provide quality healthcare data for queries and analyses. Among the features embedded in the warehouse are statistical and predictive analytic tools, a geographic information system, and a data security service. Some of the ongoing challenges with integrating records into the warehouse include improving participation of healthcare institutions which may be hindered by policies that do not allow sharing data from one system to another, lack of awareness, or lack of personnel/resources to dedicate to the integration effort.

### Access to Diagnostics, Equipment, and Other Laboratory Supplies

During the COVID-19 pandemic, Malaysia drastically increased its diagnostic capacity by optimizing the diagnostic test based on the early release of the SARS-CoV-2 genetic sequence and increasing the number of laboratories capable of conducting COVID-19 testing. It went from six laboratories to 43 in less than five months.

There is some local diagnostic manufacturing capability in Malaysia, but there is a heavy reliance on imported tests, equipment, and supplies. During COVID-19, access to RNA extraction kits, primers, and probes (all needed to perform the gold standard PCR test) was a challenge.

## Stakeholders

Malaysia generally does not receive significant bilateral aid for health. As Malaysia has built its capacities and resources for improving health and access to healthcare, the WHO Country Cooperation Strategy has shifted to a supportive function, doing more information sharing.

### National Government

| Ministry | Department |
|---|---|
| Malaysian Administrative Modernisation and Management Planning Unit | |
| Malaysian Medical Council | |
| Ministry of Agriculture and Agro-based Industry (MOA) | Department of Veterinary Services |
| Ministry of Defense | National Security Council |
| Ministry of Health | Crisis Preparedness and Response Centre |
| Ministry of Health | Communicable Diseases Surveillance Section |
| Ministry of Health | Food Safety and Quality Division |
| Ministry of Health | Medical Device Authority (MDA) |
| Ministry of Health | National Institutes of Health, Institute for Medical Research (IMR) |
| Ministry of Health | National Public Health Laboratory (Makmal Kesihatan Awam Kebangsaan – MKAK) |
| Ministry of Higher Education | |
| Ministry of Natural Resources, Environment, and Climate Change | Department of Wildlife and National Parks |
| Ministry of Science, Technology and Innovation (MoSTI) | National Institute of Biotechnology Malaysia |
| National Registration Department | |
| Public Service Commission | |

### External Development Partners

| Organization or Department | Stakeholder type | Type of activity | | | | |
|---|---|---|---|---|---|---|
| | | Funding | Technical assistance/ Capacity Building | Resources and Infrastructure | Research | Policy/ Advocacy/ Legislative Support |
| Centre for Bioinformatics Research, Universiti of Kebangsaan Malaysia; | Academia | | ● | | ● | |
| Integrative Pharmacogenomics, Universiti Teknologi Mara (UiTM) | Academia | | | | ● | |
| Malaysia One Health University Network | Academia | | | | | ● |
| Institute of Health and Community Medicine of the Universiti Malaysia Sarawak; | Academia | | | | ● | |
| Tropical Infectious Diseases Research & Education Centre (TIDREC), Universiti Malaya | Academia | | | | ● | |
| UKM Medical Molecular Biology Institute, Universiti Kebangsaan Malaysia (UKM) | Academia | | | | ● | |
| Universiti Kebangsaan Malaysia (UKM), UKM Medical Molecular Biology Institute | Academia | | | | ● | |
| Universiti Malaya, Tropical Infectious Diseases Research & Education Centre (TIDREC) | Academia | | | | ● | |
| Universiti Malaysia Sarawak, Institute of Health and Community Medicine | Academia | | | | ● | |
| Association of Private Hospitals of Malaysia (APHM) | Association/ Society | | | | | ● |
| US National Institutes of Health | Bilateral government support | | ● | | ● | |





## Observations and Areas of Potential Engagement

Malaysia has good public healthcare infrastructure, which is affordable for the population given the low cost to the user. However, it struggles with capacity constraints, particularly with long wait times, necessitating increasing the number of healthcare workers.

Malaysia also has a good surveillance system in place. It already uses many web-based surveillance systems, has nation-wide digital policies, and has implemented an integrated surveillance system for human health. However, like all the countries in the region, Malaysia would benefit from further integration and interoperability of its many surveillance systems, particularly across sectors. This would aid in faster analysis and improved real-time risk assessment.

Based on Malaysia's detection capabilities and experiences over the years and during COVID-19, Malaysia can serve as a good partner to share expertise and lessons learned with others in the region.

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# Philippines

## Background

From the 2021 GHS Index Scores, the Philippines scored 45.7 overall (above the global average of 38.9) and 52.6 for its detection and reporting capability.

### Healthcare Infrastructure

Healthcare in the Philippines is delivered through both state and private facilities. In the state-run system, healthcare is decentralized, with provinces managing community and provincial hospitals and municipalities running rural health units and barangay health stations. Of all health facilities (37,000+), 82% are government-owned.

The quality of healthcare facilities and services is variable between urban versus rural facilities and state-owned versus private facilities. Urban and private facilities tend to be better equipped and offer a wider range of services. Even though all Filipino citizens have access to national health insurance (PhilHealth) which includes preventive, promotive, curative, and rehabilitative healthcare services, many Filipinos still struggle to access adequate healthcare, especially if they are poor or live in rural or remote areas. Healthcare workers are also in short supply, and access to care in rural areas is exacerbated by the maldistribution of healthcare workers where healthcare workers are concentrated in urban areas (only 10 percent of the country's health workers serve in rural areas, leaving some municipalities without an adequate health workforce).

### Surveillance, Laboratory, and Reporting Systems

The Philippines operates electronic surveillance systems at both the national and sub-national levels through the Philippine Integrated Disease Surveillance and Response (PIDSR) and the Event-Based Surveillance and Response (ESR) system. At the sub-national level, surveillance information

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| **World Bank FY23 Classification:** Lower-middle Income economy |
| **Population:** 113,880,328 (WB, 2021) |
| **Urban population:** 48% (WB, 2021) |
| **UHC Coverage Index:** 55% (WB, 2019) |
| **General government spending on health as % of general government expenditure:** 8.65% (WHO, 2020) |
| **Physicians per 1,000:** 0.8 (WB, 2020) |
| **Nurses per 1,000 pop.:** 4.6 (WB, 2019) |
| **Hospital beds per 1,000 pop.:** 0.99 (2010) |
| **FETP:** Est. 1981 advanced) |

is consolidated by Disease Surveillance Coordinators from physical forms submitted by Disease Reporting Units; both hard and electronic copies of the consolidated information are submitted to respective Provincial Epidemiology Surveillance Units and Disease Surveillance Officers. While both systems consolidate information electronically; there are still issues with data management. While there are processes to identify and report cases through electronic systems, there is still a reliance on manual systems until cases are reported into the online system, which can take several days, limiting the availability of real-time data.

Six hospital laboratories serve as national reference laboratories and together with other government and private laboratories form what is now being called the Philippine Health Laboratory System (PHLS) as it is being reformed post-COVID. During COVID-19, the Department of Health's Research Institute for Tropical Medicine (RITM), which is one of the national reference laboratories that developed diagnostic assays for COVID-19, headed the COVID-19 diagnostic quality assurance program, and supported the Department of Health's laboratory licensing effort for laboratories to become





COVID-19 testing laboratories. Some of the initial challenges encountered by RITM were access to reagents for diagnostic test development, surging testing capacity, reducing the turnaround time for testing (and sequencing), and developing data systems to manage the vast amounts of data generated by RITM.

The laboratory information system developed by RITM during COVID-19 to track COVID-19 samples transmitted data to the Department of Health Epidemiology Bureau. However, it is unclear how day-to-day laboratory data are transmitted for surveillance purposes. It is also unclear if formalized plans for surging laboratory and testing capacity are in place and if the existing data systems are interoperable.

On the genomics side, RITM is building large-scale real-time sequencing capacity within RITM and local sequencing capacity across its subnational laboratories. The Philippines Genomics Centre at the University of the Philippines is a leading institution in the country for omics research and conducted most of the COVID-19 sequencing efforts given its partnership with the Ministry of Health. There are other ongoing efforts to integrate whole genome sequencing into existing surveillance platforms such as influenza and antimicrobial resistance. In building such sequencing capacity, a notable area of importance is the need to build genomic epidemiology and bioinformatics capability within the country to analyze and interpret genomic data.

### Data Access and Transparency in Surveillance

In the Philippines, standardized reporting systems are not always used to provide health updates from the municipal level to the central level, leading to communication gaps. Within the laboratory system, there is a need to harmonize the data entered into the system to create a functional and efficient referral system across different laboratory facilities, making the system more responsive to medical and public health diagnosis and surveillance data needs.

The Philippines is encouraging more widespread use of electronic health records. The Department of Health is promoting use of the Philippine Health Information Exchange, a platform for secure electronic access and efficient exchange of health data and/or information among health facilities, health care providers, health information organizations, and government agencies in accordance with national standards in the interest of public health. However, its use is not widespread and there aren't data standards in place to allow for interoperability.

Additionally, inadequate data sharing and lack of digital health interoperability have contributed to weak accountability and performance management systems.

### Access to Diagnostics, Equipment, and Other Laboratory Supplies

The Philippine Government Electronic Procurement System is available to government entities to procure medical and laboratory supplies. However, a major challenge faced by the laboratory system is the provision of diagnostic services in rural areas due to poor infrastructure to house, power, and maintain diagnostic equipment and logistical challenges with obtaining diagnostic equipment and reagents.

# Stakeholders

## National Government

| Ministry | Department |
|---|---|
| Department of Health | Food and Drug Administration |
| Department of Health | Bureau of Quarantine |
| Department of Health | Disease Prevention and Control Bureau |
| Department of Health | Epidemiology Bureau |
| Department of Health | Health Facility and Services Regulatory Bureau |
| Department of Health | Health Facility Development Bureau |
| Department of Health | Health Human Resource Development Bureau |
| Department of Health | Research Institute for Tropical Medicine (RITM) |
| Department of Science and Technology | |
| Department of Environment and Natural Resources (DENR) | Biodiversity Management Bureau (BMB) |
| Ministry of Agriculture | |

## External Development Partners

| Organization or Department | Stakeholder type | Type of activity | | | | |
|---|---|---|---|---|---|---|
| | | Funding | Technical assistance/ Capacity Building | Resources and Infrastructure | Research | Policy/ Advocacy/ Legislative Support |
| Center for Informatics, University of San Agustin Iloilo | Academia | | ● | | | |
| Philippines One Health University Network | Academia | | ● | | | ● |
| University of Philippines | Academia | | ● | | ● | |
| Field Epidemiology Training Program Alumni Foundation, Inc. Philippines (FETPAFI) | Association/ Society | | ● | | | |
| South Asia Field Epidemiology and Safety Network (Safetynet) | Association/ Society | | ● | | | |
| Canada | Bilateral government support | | ● | | | |
| EU | Bilateral government support | ● | ● | ● | | |
| Medical Research Council as part of the United Kingdom (UK) Research and Innovation | Bilateral government support | ● | ● | ● | | |
| Netherlands Enterprise Agency (RVO) | Bilateral government support | | ● | | ● | |
| Republic of Korea | Bilateral government support | | | ● | | |
| Spain | Bilateral government support | | | ● | | |
| U.S. Agency for International Development | Bilateral government support | | ● | ● | | |
| U.S. Centers for Disease Control and Prevention | Bilateral government support | ● | ● | ● | ● | |
| UK Government | Bilateral government support | | ● | | | |
| US Department of State Biosecurity Engagement Program | Bilateral government support | ● | ● | ● | | |
| Asia Development Bank | Multilateral | ● | ● | ● | | |
| Asia Development Bank | Multilateral | ● | ● | ● | | ● |
| WHO | Multilateral | | ● | | | ● |



**Infectious Disease Detection Capabilities of Southeast Asian Countries:** A Landscape Analysis of Surveillance Systems and Stakeholders

# Observations and Areas of Potential Engagement

As with Indonesia and Vietnam, the Philippines has challenges with obtaining information from rural areas due to poor rural healthcare infrastructure and trained personnel. Given the challenges in rural areas, exploring different tools and systems for obtaining data from those locations is needed.

The Philippines can benefit from the digitization of reporting systems and streamlining information sharing and reporting processes (i.e., enforcing standardized data collection). This has the potential to improve the reliability and volume of information and reduce the time it takes to detect and confirm cases. Furthermore, as the Philippines has instituted a push toward the use of electronic medical records with the hope of making the healthcare system more efficient and responsive to patient needs, consideration should be given to how to integrate and leverage this data for surveillance purposes. Overall, the different surveillance and reporting systems need to be made interoperable within and across sectors so at the national level, there is a better view of the situation.

Currently, accreditation of national and regional reference laboratories is varied. Laboratory surge capability for future emergencies can be improved by encouraging laboratories to obtain accreditation.

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# Thailand

From the 2021 GHS Index Scores, Thailand scored 68.2 overall (ranked among the top 5 in the world) and 91.5 for its detection and reporting capability (ranked highest in the world). Its average JEE score for detection (from 2017) was 3.7.

Thailand has positioned itself as a leader in global health security as demonstrated by their National Global Health Strategy 2016–2020 and leadership within GHSA and other regional initiatives.

## Background

### Healthcare Infrastructure and Human Resources

Thailand achieved universal health coverage (UHC) in the early 2000s through a publicly financed system (mainly through three main government insurance and welfare schemes). It is affordable for the whole population and less than 0.5% of the population currently lack health insurance and health protection coverage. The healthcare system consists of both public and private healthcare facilities, 72% of which are private facilities that are typically smaller clinics providing primary healthcare. Over the years, Thailand has decentralized its public healthcare system, transferring the authority of healthcare facilities to local levels of government (e.g., provincial hospitals to provincial government).

The quality of care offered in public healthcare settings is good, but like most public healthcare systems around the globe, individuals can face long wait times. Thailand is self-reliant in healthcare workforce production and is making incremental changes to the workforce numbers. It has also made progress in addressing the maldistribution of healthcare workers and services with a 2019 study showing there is greater equity in the distribution of healthcare facilities and healthcare workers due to policies implemented over 20 years ago. From an epidemiology and public health front, it has a longstanding Field Epidemiology Training Program aimed at building and maintaining epidemiological capacity and is viewed as a leader in the field within the region.

**World Bank FY23 Classification: Upper-middle income economy**

**Population: 71,601,103**

**Urban population: 52% (2021)**

**UHC Coverage Index: 83% (2019)**

**General government spending on health as % of general government expenditure: 13.23% (WHO, 2020)**

**Physicians per 1,000 pop.: 1.0 (2020)**

**Nurses per 1,000 pop.: 3.1 (2019)**

**Hospital beds per 1,000 pop.: 2.1 (2010)**

**FETP: Est. 1980 (frontline, intermediate, advanced)**

### Surveillance, Laboratory, and Reporting Systems

The Ministry of Public Health has a robust system for monitoring and tracking diseases and extensive national and subnational laboratory systems. Surveillance data on notifiable diseases are reported from private and other public hospitals to the appropriate local and national authorities. Thailand utilizes an Electronic Integrated Disease Surveillance System (EIDSS) to collect ongoing disease surveillance data of humans and animals from relevant agencies and laboratories, but still has surveillance systems that are siloed by disease and sector.

The laboratory system consists of public laboratories, private laboratories, public regional laboratories that can conduct most microbiological testing, and a national reference laboratory. The laboratories within the system are internationally accredited. The laboratory information system feeds into integrated surveillance systems, but better laboratory integration has been noted as an area for improvement.





The main driver for building genomics capability in the country is interest in its application to precision medicine which is led by Genomics Thailand, a collaborative human genome research network in Thailand. There is some pathogen genomics surveillance conducted by the Ministry of Public Health, but not as a formal surveillance system under a national program. Pathogen genomic surveillance is primarily undertaken within academia, similar to wastewater surveillance and other newer surveillance methods.

### Data Access and Transparency in Surveillance

During COVID-19, Thailand utilized a national health database platform called "Co-Lab (COVID-19 infection tracker) and Co-Ward (COVID-19 hospitalization data)," for data collection, diagnoses, treatment, and treatment reimbursement. This platform integrated data from multiple sources across the health system. Thailand also worked quickly and efficiently across ministries to develop tools that would support data gathering, risk assessment, and decision-making. This includes the "Thai Chana" and "Mor Chana" web applications which were used for tracking and screening.

Thailand's ability to work across sectors to put together new data systems in place is a result of data sharing mechanisms outlined in the "Action Plan for the MoU in Regard to One Health Action for National Health Security, 2017-2021". However, Thailand does still face challenges with data integration and interoperability because of the different systems being used. More effective mechanisms for information sharing between sectors are required at the national and sub-national levels are needed to improve efficiencies for disease response.

### Access to Diagnostics, Equipment, and Other Laboratory Supplies

Thailand was able to quickly surge diagnostic testing capacity going from 80 laboratories with testing capability in April 2020 to 230 laboratories within six months. The laboratory turnaround time for providing results was within 24 hours and later with the establishment of PCR testing in at least one laboratory per province, aimed to turn results around within 3-4 hours. Collaboration between government and private sectors made this rapid expansion of the COVID-19 laboratory network possible.

Thailand has a national procurement system in place that can be used for the purchase of laboratory supplies and diagnostics. However, it is unclear from publicly available information if this system can meet diagnostic supply needs, particularly during an emergency.

## Stakeholders

Thailand is a regional hub for many development organizations so the engagements they have with Thailand (which is self-reliant on several health security topics, including surveillance) is not as extensive.

### National Government

| Department | Bureau |
|---|---|
| Department of Livestock Development | |
| Department of National Parks Wildlife and Plant Conservation | |
| Digital Economy and Society (DES) Ministry | |
| Government Pharmaceutical Organization | |
| Health Systems Research Institute (HSRI) | |
| Healthcare Accreditation Institute | |
| Ministry of Digital Economy and Society | |
| Ministry of Public Health | Bureau of Health Policy and Strategy |
| Ministry of Public Health | Department of Medical Sciences |
| National Health Commission Office | |
| National Health Security Office | |
| National Statistical Office | |
| Thai Health Promotion Foundation | |
| The Medical Council of Thailand | |
| The National Science and Technology Development Agency (NSTDA) | |
| The Thailand Center of E●cellence for Life Sciences (TCELS) | |

### External Development Partners

| Organization or Department | Stakeholder type | Type of activity | | | | |
|---|---|---|---|---|---|---|
| | | Funding | Technical assistance/ Capacity Building | Resources and Infrastructure | Research | Policy/ Advocacy/ Legislative Support |
| Chiang Mai University | Academia | | | | ● | |
| Khon Kaen University | Academia | | | | ● | |
| Mahidol University | Academia | | | | ● | |
| Chulalongkorn University | Academia | | | | ● | |
| Prince of Songkla University | Academia | | | | ● | |
| Thailand One Health University Network | Academia | | ● | | | ● |
| AFRIMS | Bilateral government support | | ● | | ● | |
| Indo-Pacific Centre for Health Security | Bilateral government support | | ● | | | |
| U.S. Centers for Disease Control and Prevention | Bilateral government support | ● | ● | ● | ● | |
| U.S. Defense Threat Reduction Agency (DTRA) | Bilateral government support | ● | ● | ● | | |
| U.S. National Institutes of Health | Bilateral government support | | | | ● | |
| USAID | Bilateral government support | | ● | ● | | |
| WHO | Multilateral | | ● | | | |
| EcoHealth Alliance | NGO | | ● | | ● | |
| Pandemic Action Network | NGO | | | | | ● |
| South Asia Field Epidemiology and Safety Network (Safetynet) | NGO | | ● | | | |
| Thai Red Cross Emerging Infectious Diseases Health Science Centre | NGO | | ● | | ● | |
| Ending Pandemics | Philanthrope | | ● | ● | | |
| Rockefeller Foundation | Philanthrope | ● | | | | |





## Observations and Areas of Potential Engagement

The detection system in Thailand is advanced and is one of the few countries where progress has been made in equitable distribution of healthcare infrastructure across provinces, making surveillance data more representative of the situation at the local level.

Even with its high-capacity surveillance system, the country continues to face challenges with data integration and interoperability. Since it has taken a One Health approach with many of their surveillance activities, they have more experience with the challenges of integrating data and making systems more interoperable. Thailand would be a reliable, knowledge partner when working with others in the region on their respective integration efforts.

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# Vietnam

## Background

From the 2021 GHS Index Scores, Vietnam scored 42.9 overall (above the global average of 38.9 and ranked 65 of 195 countries) and 55.1 for its detection and reporting capability. Its average JEE score (2016) for detection was 3.1.

### Healthcare Infrastructure and Human Resources

Vietnam's health system transitioned in the 1990s from a purely state-run system to state- and private-health care. The national healthcare system includes central hospitals (managed by the Ministry of Health), provincial and district-level hospitals, and health centers at the district and commune levels. Private healthcare facilities are mainly based in urban areas.

All healthcare establishments of the national healthcare system are funded by the Social Health Insurance institution. Healthcare in rural communities is provided at commune health centers (CHC), which provide basic preventative care, diagnoses, and treatments, and refer people to hospitals. However, they are not always funded well, are ill-equipped, and are not well staffed. To make quality healthcare more accessible to lower-income populations, Vietnam has led initiatives to strengthen community-level primary care infrastructure though distance for people living in remote areas can still be a barrier to access. However, an ongoing challenge, is that even with a well-established medical education system and training programs in most public health specialties within the country, the number of quality staff at the local level needs improvement.

### Surveillance, Laboratory, and Reporting Systems

Vietnam has both event-based and indicator-based surveillance systems. Its infectious disease surveillance system monitors 42 diseases and began reporting cases online on a case-by-case basis in parallel with the periodic paper report. Surveillance systems for the early detection of animal diseases have also been established. Data are reported from health units to district health centers which report to provincial centers for disease control. Data are then reported in the form of e-mail and official correspondence to the GDPM and the national and regional Institutes of Hygiene and Epidemiology/Pasteur at regular intervals. However, a challenge that continues to be encountered is the fragmentation of reporting systems (e.g., separate reporting systems for a specific disease, resulting in duplication of notification for the reporting staff), data quality, timeliness, and completeness of the surveillance data.

Vietnam's medical laboratory system consists of about 900 infectious disease testing laboratories including public health diagnostics and reference laboratories, and clinical laboratories at different levels of the health care system. Of these, 73 laboratories have diagnostic and reference capabilities including four national-level labs that also serve as reference laboratories for the infectious disease specimens of centers of the provincial preventive system and offer training to laboratory personnel on techniques. During COVID-19, with support from several external government organizations, laboratories purchased testing machines and obtained diagnostic biological products, however, this meant that the testing techniques and systems used were not consistent.

Vietnam is slowly building a national sequencing network that can detect and respond to emerging public health threats and enhance overall surveillance capacities in the country. In May 2021, Pasteur Institute Nha Trang (one of Vietnam's national reference laboratories) acquired its first next-generation sequencer and developed a protocol to identify and monitor the relative prevalence of SARSCoV-2 variants among COVID-19 cases identified in the central region. Vietnam's National Innovation Center (NIC) now has Southeast Asia's largest genome sequencing center, which was established in partnership with Genetica, a US private sector company.

### Data Access and Transparency in Surveillance

A vast amount of data are recorded and stored in Vietnam's public sector health system and the data are stored in a relatively fragmented way with different systems being used at different institutions. Electronic health records are not yet commonly in use, but the government has set the goal to have 90% coverage by 2025. At this time, web-based surveillance systems are not fully harmonized with the medical record systems based in the hospital, but these systems need to be better integrated to support patient care and surveillance needs.

Another important feature is the need to strengthen the ability of the local level to conduct basic, regular, and descriptive analyses of surveillance data and reduce reliance on national-level analysis so that that data can be more useful for decision-making in the local context.

There are some ongoing projects to improve the integration of data systems in Vietnam including USAID-funded Infectious Disease Detection and Surveillance (IDDS), which is aiding the interoperability of surveillance systems across the human-animal-environment sectors.

### Access to Diagnostics, Equipment, and other Laboratory Supplies

The National Institute of Hygiene and Epidemiology (NIHE) is the leading public health agency in Vietnam and plays a crucial role in diagnosis, testing, and research. During the country's COVID-19 response, it served as the main laboratory, and any other laboratory that wanted to perform COVID-19 confirmatory testing needed to get certified by the NIHE. In terms of access to diagnostic tests, reagents, and other diagnostic and laboratory supplies and equipment, Vietnam like all other countries faced supply chain issues.

The NIHE had to rapidly assess testing techniques, evaluate biological products from many different manufacturers that were manufacturing or importing them, and grant licenses or temporary registrations for these new biological products or diagnostics to be used. This requires maintaining a strong, well-staffed regulatory system.

| |
|---|
| **World Bank FY23 Classification:** Lower-middle income economy |
| **Vietnam:** 97,468,029 (2021) |
| **Urban population:** 38% (2021) |
| **UHC Coverage Index:** 70% (2019) |
| **General government spending on health as % of general government expenditure:** 9.41% (WHO, 2020) |
| **Physicians per 1,000 pop.:** 0.8 (2016) |
| **Nurses per 1,000 pop.:** 1.1 (2016) |
| **Hospital beds per 1,000 pop.:** 2.6 (2014) |
| **FETP:** Est. 2007 (frontline, intermediate, advanced) |



**Infectious Disease Detection Capabilities of Southeast Asian Countries:** A Landscape Analysis of Surveillance Systems and Stakeholders

# Stakeholders

## National Government

| Ministry | Department |
|---|---|
| Ministry of Agriculture and Rural Development | Department of Animal Health |
| Ministry of Agriculture and Rural Development | National Institute of Veterinary Research |
| Ministry of Health | Vietnam Food Administration (VFA) |
| Ministry of Health | National Institute of Hygiene and Epidemiology (NIHE) |
| Ministry of Health | General Department of Preventive Medicine |
| Ministry of Health | Pasteur Institute Ho Chi Minh City (PI-HCMC) |
| Ministry of Health | Pasteur Institute- Nha Trang |
| Ministry of Health | Central Highlands Institute of Hygiene and Epidemiology |
| Ministry of Health | General Department of Preventative Medicine (GDPM) |
| Ministry of Health | Health Strategy and Policy Institute (HSPI) |
| Ministry of Health | National Institute for Control of Vaccines and Biologics |
| Ministry of Industry and Trade (MoIT) | |
| Ministry of Information and Communication | |
| Ministry of Planning and Investment | National Innovation Centre |
| Ministry of Public Security | |
| Ministry of Science and Technology (MoST) | |
| Ministry of Health | Center for Research and Production of Vaccines and Biologicals |





## External Stakeholders

| Organization or Department | Stakeholder type | Type of activity | | | | |
|---|---|---|---|---|---|---|
| | | Funding | Technical assistance/ Capacity Building | Resources and Infrastructure | Research | Policy/ Advocacy/ Legislative Support |
| Oxford University Clinical Research Unit in Vietnam | Academia | | ● | | ● | |
| Vietnam One Health University Network | Academia | | ● | | | ● |
| Canada | Bilateral government support | | ● | | ● | |
| Denmark | Bilateral government support | | ● | | | |
| EU | Bilateral government support | | ● | ● | | |
| German Federal Ministry of Education and Research | Bilateral government support | ● | | ● | ● | |
| Indo-Pacific Centre for Health Security | Bilateral government support | ● | ● | ● | | |
| Japan International Cooperation Agency | Bilateral government support | | ● | ● | | |
| Republic of Korea | Bilateral government support | | ● | ● | | |
| U.S. Centers for Disease Control and Prevention | Bilateral government support | ● | ● | ● | ● | ● |
| U.S. Defense Threat Reduction Agency (DTRA) | Bilateral government support | ● | ● | ● | | |
| US Agency for International Development | Bilateral government support | ● | ● | ● | | |
| Asia Development Bank | Multilateral | ● | ● | ● | | |
| Food and Agriculture Organization of the United Nations (FAO) | Multilateral | | ● | | | |
| WHO | Multilateral | | ● | | | |
| World Bank | Multilateral | | ● | | | |
| International Decision Support Initiative (iDSI) | NGO | | | | | ● |
| International Vaccine Institute | NGO | | ● | | | |
| FIND | NGO | | ● | ● | | |
| PATH | NGO | | ● | | | |
| South Asia Field Epidemiology and Safety Network (Safetynet) | NGO | | ● | | | |
| Polyvac | Private Industry | | ● | | | |

## Observations and Areas of Potential Engagement

There is a lot of ongoing work within Vietnam that addresses areas that need strengthening as identified in the JEE in Vietnam.

One of the key challenges for surveillance faced in Vietnam is the ability to maintain quality staff at the healthcare units serving rural populations who can identify and report cases of interest quickly and efficiently into national surveillance systems. Identifying mechanisms to retain staff and provide the right mix of training at local levels may help to alleviate the staffing needs. Also exploring the use of new data collection tools that can be easily integrated into ongoing surveillance activities.

Some development partners have made healthcare and laboratory infrastructure investments that are disease-specific e.g., built diagnostic capabilities for TB and HIV. These investments can have positive spillover effects on preparedness for emerging diseases and these laboratories could be leveraged to surge testing capacity for example. However, there needs to be better integration of these laboratories into the national system in terms of certifications/ accreditations and laboratory reporting systems (e.g., use of data reporting standards and interoperability of systems). Ensuring interoperability of systems is necessary as Vietnam also moves to more widespread use of digital platforms for handling surveillance and medical data (e.g., electronic health records).

It would also be helpful to invest and deploy tools that provide more real-time analysis of surveillance data and feedback to those inputting data. This will help provide faster, meaningful information for those inputting data to utilize for decision-making.

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## Observations and Recommendations

All six countries in this analysis give priority to health and health security. Based on their respective JEE scores from a few years ago, Indonesia, Philippines, and Vietnam already had "developed capacity" and Brunei, Malaysia, and Thailand had "demonstrated capacity" for surveillance. As evidenced by their respective COVID-19 pandemic responses, their strong detection capabilities enabled them to, for example, surge their clinical surveillance, laboratory capacities, and contact tracing capacities rapidly. The investments they have made, not just in the health security space, but in providing universal healthcare coverage (UHC) to their populations through national health insurance, welfare, or similar programs, has helped position these countries to better prevent, detect, and respond to emergencies.

While these countries have good foundational surveillance systems, it was found during the COVID-19 pandemic, that like many other countries around the world, their surveillance systems were not necessarily equipped to answer the wide variety of questions around the emergence of a novel pathogen. Some measure of pathogen genomic surveillance, which helps to answer questions about viral evolution and inform diagnostic and treatment options is being conducted in the region, but not necessarily under the national surveillance program umbrella. The use of siloed surveillance and laboratory systems that are not integrated (i.e., don't communicate with one another) or interoperable (i.e., speak the same language) makes it challenging to triangulate data and build intelligence. For example, the surveillance systems for human health and animal health are separate in many countries. Additionally, even within human health, the surveillance system for tuberculosis, for example, may not be interoperable with the surveillance system for hepatitis.

Investments made, not just in the health security space, but in providing universal healthcare coverage (UHC) to populations national health insurance, welfare, or similar programs, has helped position countries to better prevent, detect, and respond to emergencies.

Consideration should be given from the outset as to how surveillance activities can be seamlessly integrated with ongoing epidemiological surveillance activities as integrating these types of data can aid in comprehensive risk assessments.

The ability to answer important questions is hindered by poor data reporting, particularly from rural areas, and data sharing issues. Within the region, the maldistribution of qualified public health and healthcare personnel (i.e., fewer qualified personnel in rural areas) means that data don't always get reported and the importance of reporting and sharing data is not well understood. Further, even with the use of digital or web-based systems, some countries still rely on paper/manual methods, particularly in rural areas. In addition to resolving reporting and data sharing issues, decision-makers at all levels of government can benefit from more real-time data analysis of data from surveillance systems.

More can be done to improve the timeliness of detection. There is a global push to reduce the time to detect and respond, with new timeliness goals being advocated for such as Resolve to Save Lives' 7-1-7: 7 days to detect a suspected infectious disease outbreak, one day to notify public health authorities to start an investigation, and seven days to complete an initial response. Testing capacity is highly centralized in most of Southeast Asia where specimens often must be referred to a specialized

laboratory for gold-standard testing methods (e.g., culture-based assays and nucleic acid amplification testing). This means the diagnosis turnaround time- the time from collection of a sample from a patient to final delivery of a test result- can be delayed.

To address some of the above-outlined challenges and move these countries closer to achieving collaborative surveillance as defined by WHO, below are three potential areas where stakeholders can work with each of the respective governments. These three overarching areas are not all-encompassing. However, they are guided by the following considerations: (1) areas that appear to be of growing importance to the region, (2) applicability to all six countries – even those with already "high surveillance capacity", and (3) actionable in the near-term:

## Improved sharing of samples and data for early warning, risk assessment, and decision-making

### Data Integration and Interoperability

Many of the countries within Southeast Asia already have existing electronic real-time surveillance systems for multiple diseases and different sectors. Due to their high surveillance capacities, they have the foundations to move toward the WHO-outlined collaborative surveillance model, which aims to improve surveillance across the various data systems, sectors, emergency cycles, and geographies. Strengthening integration and collaboration between multisectoral surveillance and laboratory networks (e.g., human-animal-environment and private-public sectors), can help with triangulation of intelligence and decision-making, particularly when a novel pathogen emerges.

Many countries are attempting to implement national electronic health record systems similar to Singapore and Brunei and incorporate other types of information and communication technology into healthcare such as new applications and telemedicine options. This allows many

An ideal genetic database for pathogen identification and disease outbreak monitoring would be a hybrid of major features of NCBI and GISAID.

opportunities for the collection of useful data such as sample and patient metadata that is helpful to have for data analysis. There are also other types of surveillance, some novel and innovative, that are being conducted in countries on an ad-hoc basis. This includes pathogen genomics surveillance and wastewater surveillance, which was used during the COVID-19 pandemic to understand how the virus was spreading and evolving. As these surveillance efforts move from piecemeal activities (usually conducted in academic settings) to a concerted national surveillance effort, consideration should be given from the outset as to how these surveillance activities can be seamlessly integrated with ongoing epidemiological surveillance activities as integrating these types of data can aid in comprehensive risk assessments.

### Data Inclusivity

A common challenge during the COVID-19 pandemic for most countries – even those with high-capacity surveillance – was ensuring data was inclusive of communities that are disadvantaged in reaching healthcare services (e.g., ethnic minorities, those living in remote areas, migrant workers, and refugees). In Thailand for example, getting a clear picture of viral transmission in migrant populations and communicating risk to them, was a challenge. Being able to get data from these populations is important not only for equity but also for proper risk assessment and policy decision-making.

It is also notable that while some countries are taking a One Health approach to implementing surveillance, data from the environmental sector is often lacking from the human-animal-environment triad. This may in part be due to the lack of resources (financial, human) and existing environmental surveillance systems due to a poor understanding





As countries increase their uptake of digital healthcare platforms and improve data interoperability, sharing, and transparency, the cybersecurity risks also increase. Countries will need to get ahead of these risks by building safeguards at the outset.

of the important role environmental surveillance for pathogens can have in understanding disease transmission and spread. However, ensuring data from other sectors is included is important to move toward collaborative surveillance. The supplementation of COVID-19 clinical surveillance with wastewater surveillance is a good example of where surveillance activities in other sectors, which may be less resource-intensive in terms of time, effort, tests/supplies, personnel, and financing, can aid in early warning, resource allocation, and other planning decisions. Currently, such surveillance in the region is being conducted as a "proof of concept" or "pilot" within academia and is yet to be incorporated as part of routine national surveillance activities.

### Genetic Sequence Databases and Biorepositories

There are several existing databases for sharing genetic sequence data, which is important for understanding pathogen evolution and informing, for example, the development of diagnostics and vaccines and assessing their effectiveness. Examples of three that were used a lot during the COVID-19 pandemic are GenBank (under NCBI), GISAID, and Virological.org. These systems operate under varying rules around handling intellectual property rights, use of the data, and acknowledgment of the original data providers among others. They also have different file formats, limited analytic capabilities, and metadata submission requirements. All these contribute to a time- and resource-intensive process for uploading and accessing data while dealing with limitations on how the data can be used.

An ideal genetic database for pathogen identification and disease outbreak monitoring would be a hybrid of major features of NCBI and GISAID. It could, for example, follow standard bioinformatics practice and file formats, allow for disease-specific sub-databases (e.g., Dengue, Malaria, Influenza), incorporate tools that enable automatic versus manual download of files and more seamless exchange of data with other databases, and potentially have a cloud-based research analysis platform to enable faster access to data and analysis. Additionally, if data analytical tools are incorporated such as Nextstrain https://nextstrain.org/ or others that aid in the measurement of the spatiotemporal prevalence of pathogens, it can greatly enhance data analysis and its use not only for research but risk assessment and decision-making.

Within the region, there aren't many countries that have the biorepository infrastructure at the national level that can provide access to high-quality, well-characterized biospecimens and reagents that are critical for enabling research and development of diagnostics, therapeutics, vaccines, and other countermeasures. Examples of such biorepositories include the National Biobank of Thailand, Singapore's PREPARE Biorepository Core, U.S.-supported BEI Resources Repository, and European Virus Archive Global. Similar to genetic sequence databases, biorepositories need to consider the legal and regulatory factors in the downstream use of specimens and the sharing of related data.

Stakeholders within the region can consider how to support the development and maintenance of databases and biorepositories that will aid in the generation and timely sharing of meaningful data and specimens for use nationally, regionally, and globally.

### Blockchain

During the COVID-19 pandemic, data was shared through various platforms and allowances were made for certain systems to share data outside of usual protocols (e.g., early access to data). However, permanent systems and long-term commitment

are needed to promote global scientific collaboration and resources. More needs to be done to understand and address the factors that influence willingness and ability to report and share health data, but from what we do know, among the top reasons why data are not shared (or are delayed) are concerns about where the data are going, how the data will be used, attribution, and expectation of receipt of benefits due to sharing.

Blockchain is a technology that can potentially aid in tracking where data are going and how it is used. It could potentially also be used to facilitate attribution to original data contributors. Work needs to be done to assess whether such technology is fit for purpose and how it could be applied in the Southeast Asian context to support data sharing objectives.

### Policy and regulatory environment to facilitate data and specimen sharing

Countries have domestic plans/strategies (e.g., Malaysia and Thailand) while others need to implement domestic strategies that promote data sharing, particularly for preparedness and response purposes.

The COVID-19 pandemic has expedited the adoption of plans by governments in the region to implement healthcare digitalization. As countries develop and utilize technology to store, share, and analyze healthcare information, consideration must be given as to how to ensure the right type of data are being collected for surveillance purposes, data provenance is maintained, and sufficient data privacy and security protections are in place.

As countries increase their uptake of digital healthcare platforms and improve data interoperability, sharing, and transparency, the cybersecurity risks also increase. There can be data breaches or ransomware attacks where healthcare facilities/organizations are extorted for financial gain and their ability to operate. Countries will need to get ahead of these risks by building safeguards at the outset.

## Incorporation of digital technologies into systems to provide real-time data modeling and analysis for early warnings, risk assessment, and decision-making

Risk assessments, which assign a level of risk to human health to any event based on hazards, exposure, and context, are performed at the national level in these countries. However, there is value in making risk assessment more applicable to the local context for local decision-making needs. An example is the assessment of disease risk in a particular area/city/zone during an outbreak based on population, vaccination rates, etc. This requires granular and better triangulation of data from different sources. Additionally, if the data analysis and/or modeling is automated and provides real-time feedback, it allows for its timely application within and across all administrative levels where public health decisions need to be made. Additionally, if there is better bi-directional flow of relevant data and analysis, it can incentivize providers of data to input data, potentially improving data reporting rates – a challenge experienced by many countries.

Artificial intelligence can be incorporated to monitor and analyze vast amounts of data in real-time from a wide variety of data sources to detect patterns and anomalies that may indicate the emergence of a disease or a potential epidemic, and aid in contact tracing, resource allocation, and planning. Enhance decision-making, response speed, and effectiveness in disease surveillance and pandemic preparedness.

> Regulatory authorities and policymakers in the region need to work together to put in place regulatory mechanisms to quickly authorize/approve the use of unapproved tests and plans for addressing shortfalls in accessing diagnostic supplies and equipment.





During the COVID-19 pandemic, all the countries in Southeast Asia demonstrated their ability to collaborate and innovate across sectors, developing, for example, mobile applications and other tools to aid in contact tracing, support an individual's assessment of risk, and communication with the public. This willingness to work together, accept and use new technological tools, and importantly, the eagerness to identify ways to gather and analyze data for decision-making, increases the likelihood that these countries will have ideas for the types of analytical tools that will be helpful and used by them.

## Improved access to diagnostics for better pathogen identification and tracking

### Decentralizing diagnostic capacity

Many countries rely on specialized national laboratories to conduct the current gold-standard detection techniques that clinicians and public health professionals rely on for decision-making. Decentralizing this diagnostic capability takes testing closer to the patient, reducing turnaround times and faster detection. Stakeholders can support interested countries in building this capability, including by supporting laboratory accreditation efforts that enable laboratory surge capacity and improve data quality output from laboratories.

### Novel diagnostics that feed into existing surveillance systems

Current gold-standard detection techniques, such as culture-based assays and polymerase chain reactions, are time-consuming and require specialized laboratories. Investing and moving toward the use of novel technologies that enable detection at the local level can be explored. However, an important aspect is to ensure that the results of diagnostic tests used at the point-of-care or low-resource settings are captured in surveillance systems.

### Strengthening the diagnostic supply chain

Within the region, there is a heavy reliance on imported supplies and equipment needed for pathogen detection including primers, probes, laboratory reagents, and commercially-developed diagnostic test kits. This leaves the countries sensitive to shifts in the supply chain, including disruptions. While some countries maintain small stockpiles of medical supplies, none appear to address stockpiles or at least a system that enables rapid access to reagents and other diagnostic supplies that may be in short supply during an emergency. There is also a need for diversifying the supply chain and finding alternative solutions when using equipment-specific kits.

Plans for surging diagnostic capacity could consider how to avoid reliance on a single supplier of reagents and diversifying the supply chain. Consideration can also be given to how to increase transparency of the supply chain to aid in the identification of bottlenecks.

### Strengthening regulatory mechanisms

From a regulatory standpoint, regulatory authorities and policymakers in the region need to work together to put in place regulatory mechanisms to quickly authorize/approve the use of unapproved tests and plans for addressing shortfalls in accessing diagnostic supplies and equipment. For example, during COVID-19, some testing equipment couldn't be used because only equipment-specific extraction kits, which were in short supply, were permitted for use with those machines. In such a situation, if laboratorians want to use other kits with those machines, regulatory authorization or approval, as appropriate, may be needed. To improve regulatory preparedness for emergencies, regulatory authorities and private industry can conduct a legal and regulatory mapping exercises together to determine if the necessary authorities, mechanisms, and data requirements are in place to rapidly assess and authorize medical countermeasures during emergencies.

Consideration must also be given to the regulatory mechanisms needed to quickly surge laboratory capacity. Most countries strengthened their laboratory testing capacities during the COVID-19 pandemic by, for example, increasing the number of laboratories that could conduct PCR testing and genomic surveillance. Are the regulatory mechanisms including accreditation adequate?

Support to strengthen regulatory infrastructure can leverage fora such as ASEAN, APEC, US-ASEAN Business Council, and EU-ASEAN Business Council, where there is political will to make change in this area.

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# Appendix A: JEE and 2021 GHS Index Scores by Country

## JEE Scores

Note: Scores are between 1-5 where 1 = No Capacity, 2 = Limited Capacity, 3 = Developed Capacity, 4 = Demonstrated Capacity, and 5= Sustainable Capacity

| Country | Brunei | Indonesia | Malaysia | Philippines | Thailand | Vietnam |
|---|---|---|---|---|---|---|
| Month-Year Completed | Jul-20 | Nov-17 | Oct-19 | Sep-18 | Jun-17 | Nov-16 |
| JEE Tool Version | v2 | v1 | v2 | v2 | v1 | v1 |
| PREVENT | | | | | | |
| National legislation, policy and financing | 4.3 | 3.0 | 4.0 | 2.0 | 4.5 | 3.0 |
| IHR coordination, communication and advocacy | 3.0 | 3.0 | 5.0 | 2.0 | 4.0 | 4.0 |
| Antimicrobial Resistance (AMR) | 3.0 | 2.5 | 4.0 | 2.5 | 3.0 | 2.3 |
| Zoonotic Disease | 3.0 | 2.7 | 4.0 | 2.5 | 4.0 | 3.7 |
| Food safety | 3.0 | 3.0 | 4.5 | 2.0 | 3.0 | 3.0 |
| Biosafety and Biosecurity | 2.5 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 |
| Immunization | 5.0 | 4.0 | 4.5 | 2.0 | 5.0 | 4.0 |
| DETECT | | | | | | |
| National Laboratory System | 4.3 | 3.5 | 4.0 | 3.3 | 3.8 | 3.0 |
| Surveillance | 3.7 | 3.0 | 4.0 | 3.3 | 4.0 | 3.5 |
| Reporting | 4.5 | 3.0 | 4.0 | 2.5 | 3.0 | 2.5 |
| Human resources (animal and human health sectors) | 3.0 | 3.3 | 4.5 | 2.8 | 4.0 | 3.3 |
| RESPOND | | | | | | |
| Emergency preparedness | 2.5 | 2.5 | 4.5 | 2.5 | 3.0 | 2.0 |
| Emergency response operations | 3.0 | 2.8 | 5.0 | 3.0 | 3.0 | 2.8 |
| Linking public health and security authorities | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 2.0 |
| Medical Countermeasures and Personnel Deployment | 3.0 | 4.0 | 4.3 | 3.3 | 4.0 | 2.0 |
| Risk Communication | 3.8 | 3.6 | 4.4 | 2.6 | 4.0 | 2.8 |
| OTHER MEASURES | | | | | | |
| Points of entry | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | 2.5 |
| Chemical events | 4.0 | 2.5 | 4.5 | 2.5 | 4.0 | 2.0 |
| Radiation emergencies | 2.0 | 3.0 | 4.0 | 2.0 | 4.0 | 2.5 |

## 2021 GHS Index Scores

Note: Scores are normalized 0-100 where 100 = more favorable.

| | Brunei | Indonesia | Malaysia | Philippines | Thailand | Vietnam |
|---|---|---|---|---|---|---|
| OVERVIEW | 43.5 | 50.4 | 56.4 | 45.7 | 68.2 | 42.9 |
| 1. PREVENTION | 30.1 | 31.8 | 37.7 | 27.7 | 59.7 | 40.3 |
| 1.1) Antimicrobial resistance (AMR) | 58.3 | 75.0 | 83.3 | 75.0 | 66.7 | 66.7 |
| 1.2) Zoonotic disease | 18.4 | 42.0 | 23.9 | 17.3 | 64.1 | 26.1 |
| 1.3) Biosecurity | 4.0 | 24.0 | 44.0 | 24.0 | 69.3 | 24.0 |
| 1.4) Biosafety | 0.0 | 0.0 | 0.0 | 0.0 | 50.0 | 50.0 |
| 1.5) Dual-use research and culture of responsible science | 0.0 | 0.0 | 0.0 | 0.0 | 33.3 | 0.0 |
| 1.6) Immunization | 100.0 | 50.0 | 75.0 | 50.0 | 75.0 | 75.0 |
| 2. DETECTION AND REPORTING | 44.7 | 55.4 | 72.5 | 52.6 | 91.5 | 55.1 |
| 2.1) Laboratory systems strength and quality | 62.5 | 75.0 | 87.5 | 87.5 | 87.5 | 87.5 |
| 2.2) Laboratory supply chains | 50.0 | 50.0 | 100.0 | 0.0 | 100.0 | 0.0 |
| 2.3) Real-time surveillance and reporting | 75.0 | 75.0 | 100.0 | 87.5 | 100.0 | 62.5 |
| 2.4) Surveillance data accessibility and transparency | 43.3 | 20.0 | 60.0 | 53.3 | 86.7 | 43.3 |
| 2.5) Case-based investigation | 12.5 | 62.5 | 37.5 | 37.5 | 75.0 | 37.5 |
| 2.6) Epidemiology workforce | 25.0 | 50.0 | 50.0 | 50.0 | 100.0 | 100.0 |
| 3. RAPID RESPONSE | 44.0 | 50.2 | 61.4 | 38.8 | 67.3 | 30.6 |
| 3.1) Emergency preparedness and response planning | 33.3 | 58.3 | 41.7 | 33.3 | 100.0 | 29.2 |
| 3.2) E●ercising response plans | 25.0 | 25.0 | 50.0 | 25.0 | 25.0 | 25.0 |
| 3.3) Emergency response operation | 33.3 | 33.3 | 66.7 | 66.7 | 66.7 | 33.3 |
| 3.4) Linking public health and security authorities | 0.0 | 100.0 | 100.0 | 0.0 | 100.0 | 0.0 |
| 3.5) Risk communication | 83.3 | 41.7 | 66.7 | 41.7 | 100.0 | 54.2 |
| 3.6) Access to communications infra-structure | 83.3 | 67.9 | 79.8 | 79.6 | 79.7 | 72.6 |
| 3.7) Trade and travel restrictions | 50.0 | 25.0 | 25.0 | 25.0 | 0.0 | 0.0 |
| 4. HEALTH SYSTEM | 34.9 | 41.2 | 36.6 | 46.5 | 64.7 | 24.0 |
| 4.1) Health capacity in clinics, hospitals and community care centers | 61.3 | 37.2 | 8.0 | 22.9 | 56.2 | 22.5 |
| 4.2) Supply chain for health system and healthcare workers | 27.8 | 38.9 | 44.4 | 44.4 | 50.0 | 33.3 |
| 4.3) Medical countermeasures and per-sonnel deployment | 0.0 | 50.0 | 0.0 | 50.0 | 0.0 | 0.0 |
| 4.4) Healthcare access | 55.1 | 62.2 | 53.5 | 58.3 | 96.8 | 62.3 |
| 4.5) Communications with healthcare workers during a public health emer-gency | 50.0 | 50.0 | 0.0 | 0.0 | 50.0 | 0.0 |
| 4.6) Infection control practices | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 4.7) Capacity to test and approve new medical countermeasures | 50.0 | 50.0 | 50.0 | 50.0 | 100.0 | 50.0 |
| 5. COMPLIANCE WITH INTERNATIONAL NORMS | 41.5 | 68.9 | 56.4 | 55.9 | 68.9 | 53.3 |
| 5.1) IHR reporting compliance and disaster risk reduction | 0.0 | 100.0 | 50.0 | 50.0 | 100.0 | 50.0 |
| 5.2) Cross-border agreements on public health and animal health emergency response | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 |
| 5.3) International commitments | 40.6 | 84.4 | 96.9 | 93.8 | 96.9 | 78.1 |
| 5.4) JEE and PVS | 25.0 | 50.0 | 25.0 | 25.0 | 25.0 | 25.0 |
| 5.5) Financing | 66.7 | 62.5 | 50.0 | 50.0 | 75.0 | 50.0 |
| 5.6) Commitment to sharing of genetic & biological data & specimens | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 |
| 6. RISK ENVIRONMENT | 65.9 | 55.0 | 73.9 | 52.8 | 57.2 | 53.9 |
| 6.1) Political and security risk | 75.7 | 61.8 | 73.7 | 43.9 | 41.6 | 63.1 |
| 6.2) Socio-economic resilience | 49.9 | 67.1 | 83.2 | 77.4 | 63.1 | 54.0 |
| 6.3) Infrastructure adequacy | 75.0 | 50.0 | 75.0 | 33.3 | 50.0 | 33.3 |
| 6.4) Environmental risks | 65.0 | 47.5 | 67.5 | 46.0 | 60.4 | 66.0 |
| 6.5) Public health vulnerabilities | 63.7 | 48.6 | 70.2 | 63.5 | 70.7 | 53.3 |



**Infectious Disease Detection Capabilities of Southeast Asian Countries:** A Landscape Analysis of Surveillance Systems and Stakeholders

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