# Disease Surveillance and Monitoring in the Philippines:

## Building resilience through mobile and digital technologies

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# Contents

## Acronyms and abbreviations

| | |
|---|---|
| **AI** | Artificial intelligence |
| **BHS** | Barangay Health Stations |
| **DICT** | Department of Information and Communications Technology |
| **DODRES** | Enhancing Community-Based Disease Outbreak Detection and Response in Eastern and Southern Africa |
| **DRU** | Disease Reporting Units |
| **DSM** | Disease Surveillance and Monitoring |
| **ESU** | Epidemiology and Surveillance Units |
| **FASSSTER** | Feasibility Analysis of Syndromic Surveillance using Spatio-Temporal Epidemiological Modeler |
| **ICT** | Information and Communications Technology |
| **LGU** | Local Government Unit |
| **LMIC** | Low- and Middle-Income Country |
| **MNO** | Mobile Network Operator |
| **PIDSR** | Philippine Integrated Disease Surveillance and Response |
| **SMS** | Short Message Service |
| **SORMAS** | Surveillance, Outbreak Response Management and Analysis System |

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# Executive summary

Global challenges such as rising urbanisation, population density, global mobility and climate change are all increasing the risk of large-scale disease outbreaks, especially in countries and regions that already experience a high incidence of infectious diseases. Like many countries in the Asia-Pacific region, the Philippines frequently copes with disease outbreaks and public health emergencies, and its high vulnerability to natural disasters exacerbates these risks. Most recently, the Philippines was one of the countries in the region hit hardest by the COVID-19 pandemic, with economic development disrupted by some of the longest lockdowns in the world.

As part of the national public health strategy, the Philippines has a well-established disease surveillance and monitoring (DSM) system to reduce risks to people's health and related economic impacts. The system relies mainly on government stakeholders working together throughout the various stages of disease surveillance, from case detection and registration to information sharing and reporting, analysis and interpretation, response and control measures and monitoring and evaluation.

Mobile and digital technologies have the potential to play a key role in disease surveillance, but digital solutions are yet to be fully deployed, including at critical stages such as case detection and registration. Various digital initiatives have been piloted by government agencies or in partnership with the private sector, NGOs and academia, but their implementation has been extremely fragmented. Existing solutions and projects are often overlapping and come with inadequate coordination and data-sharing processes.

Despite challenges, there are significant opportunities to harness digital innovation to close these gaps, and the Philippines can learn from and build on the experience and best practices of other low- and middle-income countries (LMICs). In Sierra Leone, Ghana and India, for instance, mobile big data is being used to define the mobility patterns of populations and identify disease hotspots. In Tanzania, an app has been developed to unify human and animal disease surveillance systems. More advanced economies can also provide valuable insights into the management of disease outbreaks. For example, big data analysis was used in South Korea to manage the COVID-19 pandemic and in the United States to identify priority populations for vaccination programmes.

To leverage these solutions, the Philippines will need to address several barriers to technology adoption and digital inclusion. Access to relevant digital technologies is still limited in government agencies, especially at the local level, while many communities do not have mobile network coverage. In many cases, both public health civil servants and the population face barriers to use. These include the high costs of digital devices and services, lack of digital literacy and skills and low awareness of digital solutions and how they are relevant to people's lives. Inadequate data governance and regulatory frameworks, coupled with a lack of political will, may also reduce investment in, and adoption of, mobile and digital technologies.

Addressing gaps in disease surveillance and tackling barriers to digital innovation will require effective and genuine cross-sector collaboration and coordination at national, regional and local levels.

- The national government should encourage and facilitate the use of digital innovation and leverage it to improve the availability and quality of data. It should create an enabling environment for digital innovation by improving data governance and establishing mechanisms for data privacy. Building the capacity of public health employees and the digital skills of the population should also be a key priority.
- Mobile network operators (MNOs) need to continue to expand network coverage, improve connectivity and identify opportunities for public-private data sharing partnerships to enable insightful analysis. They should also support their customers to access information and disseminate it in an inclusive way.
- Digital solution providers should complement existing government platforms, build partnerships and take an inclusive approach to ensure people-centred design.
- International donor organisations have an important role to play in supporting the government and digital innovators with capacity building and technical assistance. Coordinating with the development community will be important to avoiding duplication of efforts.

01

# Introduction

Rising urbanisation, population density, global mobility and climate change are increasing the risk of large-scale outbreaks of infectious disease.[1] Recent epidemics and pandemics, such as Ebola in Western Africa or COVID-19 around the world, have highlighted the need to continuously strengthen disease surveillance systems.

The World Health Organization (WHO) defines disease surveillance as the collection, analysis and interpretation of data for planning, implementing and evaluating public health policy and practice.[2] Disease surveillance and monitoring (DSM) systems are vital components of national public health strategies. When implemented effectively, they help identify diseases and inform decision-making to control the speed of the spread, reduce risks to people's health and minimise economic impacts.

At the 2005 World Health Assembly on International Health Regulations (IHR), countries committed to improving their capacity to detect events that may present public health risks, to communicate them accurately and to respond quickly.[3] Since then, most countries have implemented disease surveillance systems, but with varying degrees of coverage and effectiveness.

1 de Vries, L. et al. (2021). "The economics of improving global infectious disease surveillance". BMJ Global Health.
2 WHO. (2006). "Communicable disease surveillance and response systems: guide to monitoring and evaluating". World Health Organization Institutional Repository for Information Sharing.
3 WHO. (2005). "WHA58.3 Revision of the International Health Regulations". World Health Organization Fifty-Eighth World Health Assembly.

Strong disease surveillance systems are particularly important in countries and regions with a high incidence of infectious and vector-borne diseases. Low- and middle-income countries (LMICs) are often more vulnerable to disease outbreaks due to their geographical location and demographics. The WHO emphasises that the limited resources and capacity of LMICs should be focused on monitoring priority diseases. Yet, laws and regulations are often outdated or neglected in these countries due to competing priorities and capacity and budget constraints.[4]

## 1.1 Context

Like many countries in the Asia-Pacific region, the Philippines is extremely vulnerable to infectious diseases and is often affected by outbreaks and public health emergencies. The country regularly experiences multiple outbreaks of diseases such as dengue, diphtheria, measles and polio, although polio is close to being eradicated.[5] Most recently, the COVID-19 pandemic added pressure to the Philippines' health system[6] and disrupted economic development.

The Philippine Integrated Disease Surveillance and Response (PIDSR) system was implemented in 2007 under an administrative order by the Department of Health (DOH). The system monitors 25 diseases and syndromes that have the potential to cause outbreaks.[7] Since then, the monitoring of infectious (including vaccine-preventable), vector-borne, animal-related and water- and food-borne diseases have generally improved.

Despite these efforts, the Philippines lags behind many middle-income countries and its ability to rapidly identify and respond to disease outbreaks could be improved. As disease outbreaks continue, the Philippines will need to strengthen disease surveillance to be better prepared for future epidemics and to mitigate their impact.

## 1.2 Research objectives and methodology

In many LMICs, mobile and digital technologies have a potentially transformative role to play across all stages of disease surveillance. They can reduce costs, make processes more efficient, and increase access for marginalised groups.[8,9]

This research aims to understand the DSM system in the Phillipines and identify opportunities for digital solutions to address gaps in the system. It prioritises examples from other LMICs, but also includes use cases from more advanced economies where relevant. The focus is on mobile-enabled service delivery, from phone calls and SMS to public health services apps and enabling digital technologies such as big data, artificial intelligence (AI) and machine learning. The report does not focus on the monitoring of specific diseases but instead looks at integrated approaches to disease surveillance.

This study takes a qualitative research approach and is informed by a comprehensive desk-review as well as 34 interviews with key stakeholders in disease surveillance in the Philippines and experts implementing digital solutions at different stages of DSM. A detailed methodology can be found in Annex 1.

4 Jayatilleke, K. (2020). "Challenges in Implementing Surveillance Tools of High-Income Countries (HICs) in Low- and Middle-Income Countries (LMICs)". Current Treatment Options in Infectious Diseases.
5 WHO. (2021). "WHO, UNICEF laud end of polio outbreak in the Philippines".
6 DFID. (2020). "Ethical Guidelines for Research, Evaluation and Monitoring Activities".
7 SingHealth. (2008). "Strengthening epidemiological surveillance and response (ESR) for communicable diseases in Indonesia, Malaysia and Philippines".
8 Buckee, C. et al. (2018). "Productive disruption: opportunities and challenges for innovation in infections disease surveillance". BMJ Global Health.
9 Greenway, A. et al. (2018). Digital Transformation at Scale: Why the Strategy Is Delivery.

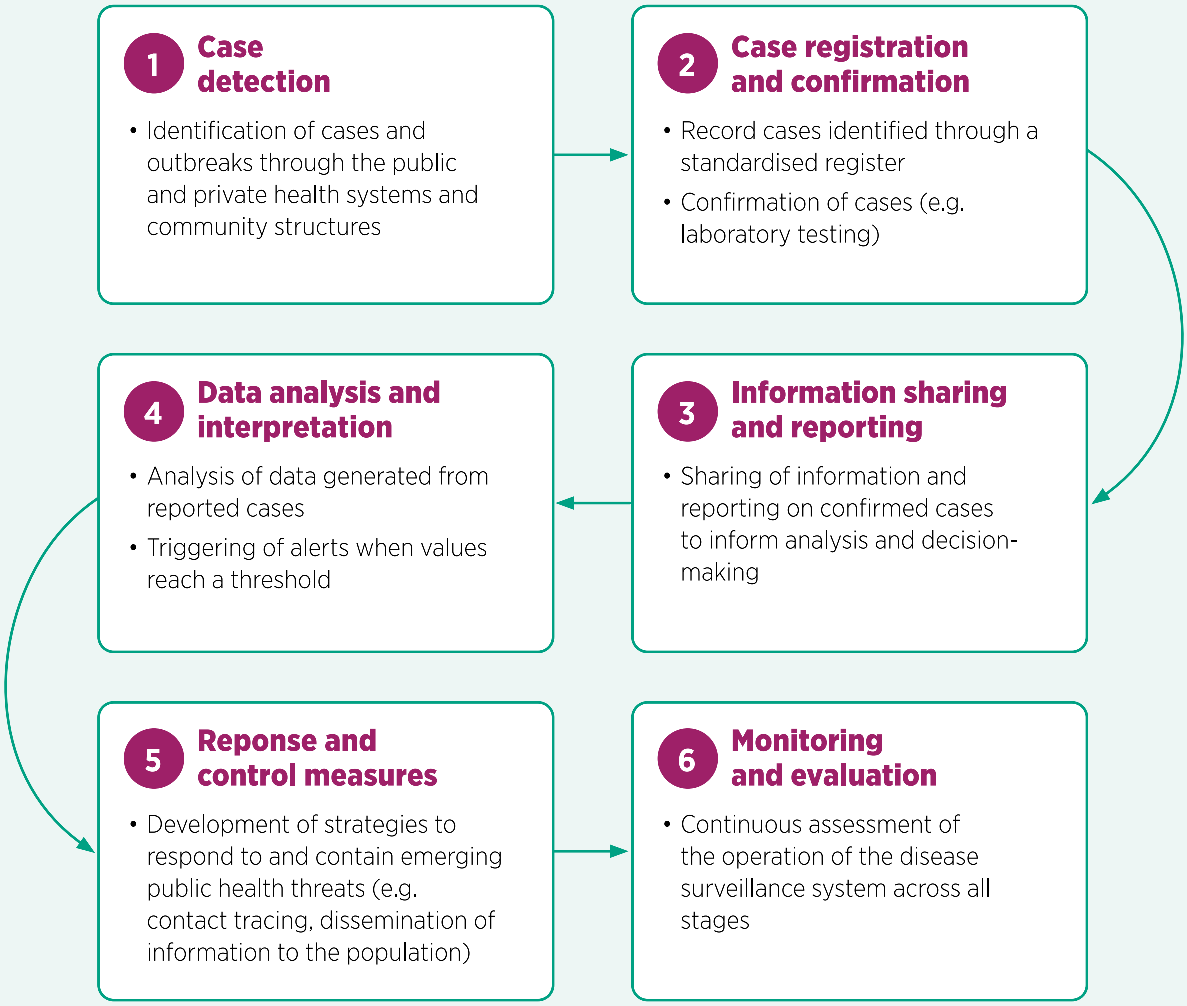
## Box 1 Key functions of DSM systems

An effective DSM system serves three objectives:

1. Detecting potential health threats before they become public health emergencies;
2. Monitoring and evaluating the progress of response measures to control an outbreak and monitoring the epidemiological nature of diseases; and
3. Informing and evaluating public health policies and strategies to guide priority-setting and planning.[10]

To achieve these objectives, DSM systems perform the following core functions (Figure 1, and Annex 2, Table A.2):

**Figure 1: Core functions and stages of disease monitoring and surveillance**




Source: WHO, 2006

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10 WHO. (n.d.). "Surveillance in emergencies".

02

# Strengthening disease surveillance through digital innovation

Disease surveillance systems are a key element of national public health strategies. They help countries identify diseases and inform decision-making to control their spread and reduce the related economic and social impacts. Strong national disease surveillance systems are critical in preventing an outbreak from escalating and can limit the spread of diseases to other countries.

This section provides a high-level overview of disease surveillance in the Philippines and identifies the key actors involved at various stages. It then looks at challenges in the Philippines and how they can be addressed with mobile and digital innovation, building on use cases from other countries. Insights are mapped by governance level and the core activities of disease surveillance, as explained in Box 1.

## 2.1 Disease surveillance and monitoring in the Philippines

The DOH is in charge of overseeing the public health system and the coordination of stakeholders, including health sector entities, public and private organisations, national agencies, local government units (LGUs) and external agencies, as well as community-based organisations. To align with international standards of the IHR 2005, the DOH established the Philippine Integrated Disease Surveillance and Response (PIDSR) system in 2007 (see Box 2).[11] As the country's official system for disease surveillance, the objective of the PIDSR is to support the health sector in reducing morbidity and mortality through an institutionalised, functional and integrated system.[12]

### Box 2 Integrating disease surveillance in the Philippines

Prior to the PIDSR, there were four different disease reporting systems in the Philippines: the Notifiable Disease Reporting System, which generated information on various diseases; the National Epidemic Sentinel Surveillance System, a hospital-based surveillance system for diseases with outbreak potential; the Vaccine-Preventable Disease Surveillance, which monitored vaccine-preventable diseases targeted for eradication; and the HIV/AIDS Registry, which kept track of HIV/AIDS cases through a voluntary testing programme.

The purpose of unifying these systems was to strengthen the capacity of all DSM actors to provide timely, accurate and actionable information to prevent disease outbreaks. The PIDSR relies on the use of standardised case definitions and surveillance activities, from case detection to monitoring and evaluation, which has made it a well-integrated system. The PIDSR relies on different but complementary approaches to disease surveillance, including: 1) case-based surveillance (individual cases of notifiable diseases are reported and recorded in clinics and hospitals); 2) event-based surveillance (health events and trends are identified by monitoring traditional media channels and social media, which can identify the occurrence of disease beyond notifiable cases[13]); and 3) laboratory-based surveillance (national reference laboratories that focus on specific types of diseases). Management of surveillance data (collection, analysis, interpretation and dissemination) and the use of information for decision-making are generally well-functioning.[14]

11 Republic of the Philippines Department of Health. (2007). AO 2007-0036: Guidelines on the Philippine Integrated Disease Surveillance and Response (PIDSR) Framework.
12 Tayag, E. et al. (2014). Manual of Procedures for the Philippine Integrated Disease Surveillance and Response (PIDSR). 3rd Edition.
13 Data from interview with a key informant from national government.
14 Tayag, E. et al. (2014). Manual of Procedures for the Philippine Integrated Disease Surveillance and Response.

The PIDSR has optimised limited resources – workforce capacity, money and time – by addressing redundancies and duplication of efforts.[15] It relies on a multitude of stakeholders operating at all levels of governance (see Figure 2). Oversight is provided at the national level by the DOH, notably through the Epidemiology Bureau (EB-DOH), which supervises core disease surveillance activities and centralises information from different subnational entities.[16,17]

Cases are detected by health facilities, collectively referred to as Disease Reporting Units (DRUs), which include Barangay[18] Health Stations (BHS), Municipal Health Offices (MHO), City Health Offices (CHO), local hospitals, private clinics, community and quarantine stations at seaports and airports. Detection occurs either passively, when a person is observed and/or reported to have symptoms of diseases that are mandatory for reporting, or actively, when Epidemiology and Surveillance Units (ESUs)[19] investigate cases following the notification of potential outbreaks that might be of public health interest.

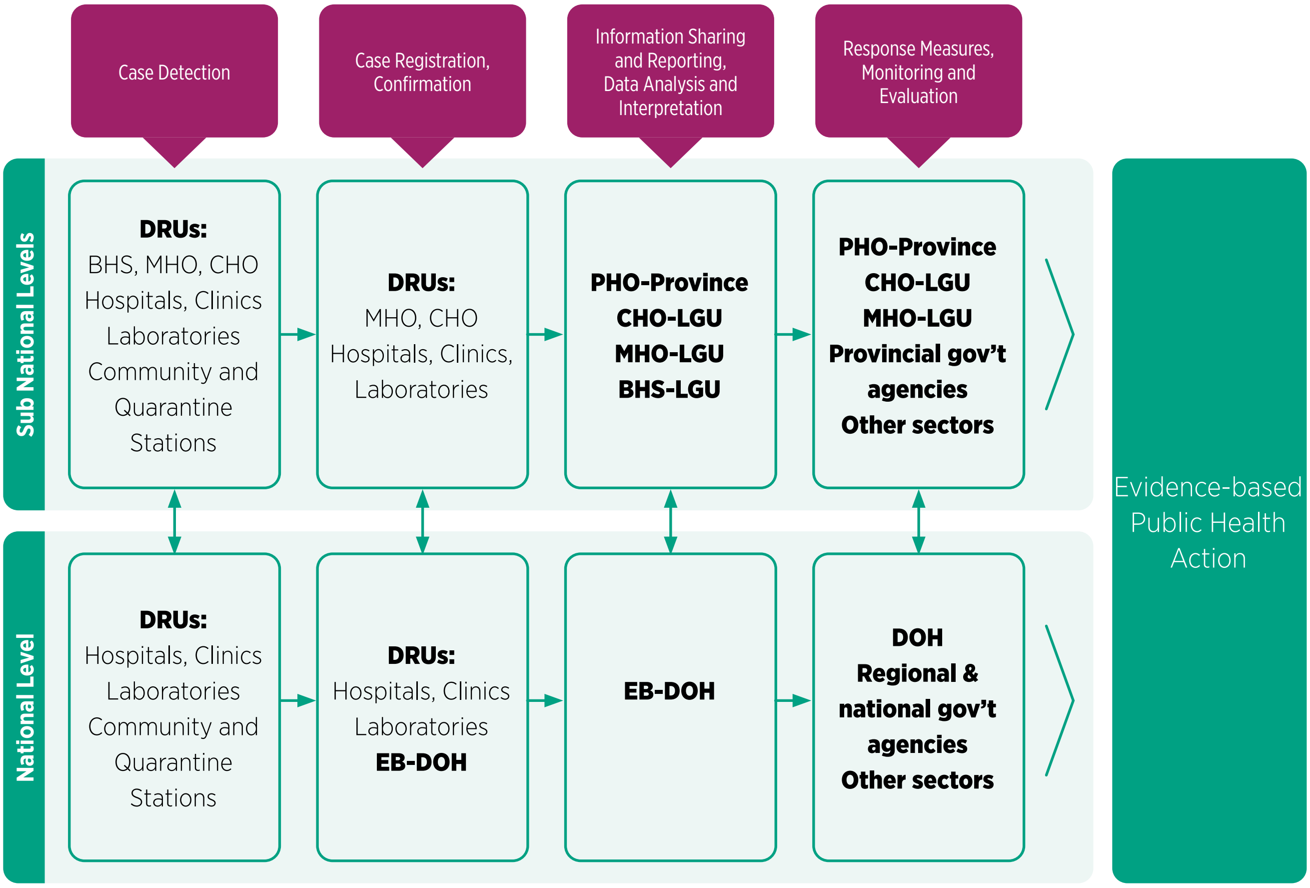
DRUs work alongside health laboratories and facilities to register and confirm cases using standardised PIDSR case investigation and reporting forms. For cases that seem to indicate a potential outbreak or novel disease, an investigation is undertaken by ESUs to determine whether it is an isolated incident or part of a wider outbreak.

Data is gathered at the local level before being shared with, and reported to, higher levels of government for in-depth analysis and identification of trends and potential outbreaks. This then informs decision-making at regional and national levels. Response measures commonly include contact tracing and often require information to be disseminated and communicated effectively to the population. The DOH is in charge of disseminating relevant information through multiple channels, including postings, bulletins, SMS, official websites and social media platforms.

Because subnational DRUs and ESUs operate at the frontline of case detection, they are best positioned to warn contacts of exposure and play a key role in breaking the chain of transmission. After cases are confirmed, they initiate contact tracing at specific locations to identify close contacts within 48 hours, notify them of suspected and confirmed cases and provide information and advice on steps to take to prevent the spread of disease.

15 Ibid.
16 Republic of the Philippines. (2018). "Republic Act No. 11332: Mandatory Reporting of Notifiable Diseases and Health Events of Public Health Concern Act". Official Gazette.
17 Data from interview with a key informant from an LGU.
18 Barangay is the smallest administrative unit in the Philippines
19 ESUs refer to units established in Provincial Health Offices, City Health Offices, and Rural Health Units that provide services on public health surveillance and epidemiology.

**Figure 2: Key actors in the Philippines' disease surveillance system**[20]




DRUs: Disease Reporting Units | BHS: Barangay Health Stations | MHO: Municipal Health Offices | CHO: City Health Offices | PHO: Provincial Health Offices | LGU: Local Government Units | EB: Epidemiology Bureau | DOH: Department of Health

Data privacy is vital in disease surveillance systems. In 2012, the Philippines enacted the Data Privacy Act, which focuses primarily on data collection related to individual health records, and makes it mandatory for authorities and institutions to collect only what is strictly necessary and to share information with the proper authorities. Surveillance of the COVID-19 pandemic has also drawn on provisions of the Republic Act No. 11332, otherwise known as the Mandatory Reporting of Notifiable Diseases and Health Events of Public Health Concern Act (RA 11332) that was enacted in 2019. This includes the prevention of unauthorised disclosure of private and confidential information on a patient's medical condition or treatment.[21]

20 Authors' analysis.
21 Republic of the Philippines. (2018). "Republic Act No. 11332: Mandatory Reporting of Notifiable Diseases and Health Events of Public Health Concern Act". Official Gazette.

## 2.2 Addressing gaps through digital innovation

Although the use of digital and mobile technologies in the public health sector is not new in the Philippines, many of the core activities of disease surveillance still rely mainly on manual processes. Some innovative initiatives have been launched (see Annex 3, Table A.3), but they are mostly used at the later stages of disease surveillance, such as analysis and response measures, and tend to operate in silos. Our research identifies significant opportunities to leverage mobile- and digitally-enabled solutions to strengthen disease surveillance, either by building on existing systems and infrastructure or by leapfrogging innovations from other LMICs or, in some cases, from more advanced economies.

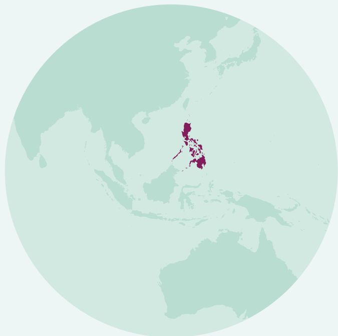
**Figure 3: Digital landscape in the Philippines**

**With a population of ~112 million, the Philippines has relatively high mobile penetration and internet usage**

**74 million**
unique subscribers[a]

**99%**
covered by 4G[b]

**80%**
of mobile connections were smartphones in 2021[c]



**Expanding infrastructure for increased digitalisation is a priority in the Philippines**

- One of the first countries in the Asian Pacific region to roll out 5G[c]
- National Broadband Plan and the 'Free Wi-Fi-For-All Program' aim to increase internet access for hard-to-reach communities[d]
- Private sector actively improving and expanding ICT infrastructure to meet the growing demand for broadband access[d]

a GSMA Intelligence.
b GSMA (2022) Typhoon Rai Response: The role of the mobile industry.
c GSMA (2021). The Mobile Economy. Asia Pacific 2021.
d DICT (2019) E-Government Masterplan 2022. Republic of the Philippines.

## Strengthening local capacity for case detection and registration

The ability to identify and register cases in a timely manner is critical to contain the spread of an outbreak. These early stages affect the overall effectiveness of DSM systems and, ultimately, the capacity of public health systems to implement response measures before an outbreak happens.

Case detection and registration takes place at local and community levels when an individual shows symptoms and attends their first point of care and when a local health unit identifies an increase in the number of cases within a community.

In the Philippines, the capacity for accurate and timely case detection and registration has been undermined by heavy reliance on manual and fragmented systems and low levels of self-reporting. Our research identified important opportunities to leverage mobile and digital technologies to strengthen local capacity in these critical stages of disease surveillance.

### Big data analysis can tackle data gaps and improve data quality

As in many LMICs, case detection and registration in the Philippines generally rely on manual processes. This means that DSM systems often take several days to detect an increase in cases that may indicate an outbreak, which significantly limits the availability of real-time data. The lack of real-time case monitoring not only creates a delay between case detection and response, which leads to the disease spreading further, but also increases the likelihood of reporting errors. Initiatives that use digital solutions for case detection often operate in silos and are limited to a few specific diseases. Real-time data from Twitter has been used for syndromic surveillance to complement existing efforts, but it has been limited to diseases such as dengue and typhoid.[22]

There are, therefore, opportunities for digital technologies to support faster and more effective case detection. Analysis of mobile big data and social media big data allows potential cases to be detected by scanning online content to speed investigations of possible outbreaks.[23] AI analysis can detect proxy indicators across multiple platforms and data sources to identify symptoms of potential diseases. Innovative techniques based on analysis of mobile big data or social media big data have been tested in other LMICs and have played an important role in outbreak detection. Box 3 highlights the potential of such solutions, with examples from West Africa and India.

22 Espina, K. et al. (2017). "Infodemiology for Syndromic Surveillance of Dengue and Typhoid Fever in the Philippines". Procedia Computer Science.
23 Mandyata, C.B. et al. (2017). "Challenges of implementing the integrated disease surveillance and response strategy in Zambia: a health worker perspective". BMC Public Health.

**Box 3** **Leveraging mobile big data for disease surveillance: insights from Sierra Leone, Ghana and India**

Anonymised and aggregated data from mobile network operators (MNOs) is key to understanding the mobility patterns of populations and identifying disease hotspots.

In Sierra Leone, the MNO Africell provided call detail records of their subscribers to the Directorate of Science, Technology and Innovation during the 2014 Ebola epidemic. Africell worked with the Massachussets Institute of Technology (MIT) to aggregate the data, and with Flowminder[24] to derive mobility indicators such as crowdedness, intra-city travel and population mixing.[25] This data could be analysed in near-real time and provided an overview of mobility patterns across all of Sierra Leone, improving decision-making and scenario planning.[26]

In Ghana, Flowminder worked with Vodafone Ghana and the Ghana Statistical Service to use mobile big data across a range of sectors while ensuring data privacy. When the COVID-19 pandemic reached Ghana in 2020, mobile big data was analysed in near-real time and provided an overview of mobility patterns across the country. These insights were used by the government and public health experts to inform response efforts and understand the impact of lockdowns, which have helped to evaluate and improve response measures.[27]

In India, Airtel and the GSMA partnered with Be He@lthy, Be Mobile, an initiative of the WHO and the International Telecommunication Union (ITU) to leverage mobile network insights to fight tuberculosis (TB)[28] Using mobile big data and public information such as TB incidence made it possible to pinpoint geographical locations at risk of increased TB exposure. Understanding these patterns, in turn, enables targeted strategies for prevention, diagnosis and treatment.

24 Flowminder is a nonprofit that leverages mobile operator data analytics for development and humanitarian purposes. See https://www.flowminder.org/
25 Peak, C.M. et al. (2018). "Population mobility reductions associated with travel restrictions during the Ebola epidemic in Sierra Leone: use of mobile phone data". Oxford Academic International Journal of Epidemiology.
26 Sierra Leone Directorate of Science, Technology and Innovation (DSTI) et al. (2021). "Covid-19 Supporting the Government of Sierra Leone with mobility data". Flowminder.org.
27 Flowminder. (2020). "Mobility analysis to support the Government of Ghana in responding to the COVID-19 outbreak. In association with Vodafone and Ghana Statistical Service"
28 GSMA. (21 September 2018). Airtel case study: Harnessing mobile Big Data to identify tuberculosis hotspots in India.

## Mobile apps and remote diagnostic technology can break down silos and enable multiple disease testing

While some diseases, including rabies, TB or COVID-19, can be transferred between species, our research shows that a lack of communication and collaboration between human and animal disease monitoring systems is a key challenge in the Philippines. Identifying whether, where and to what extent disease is circulating among animals should inform the distribution among humans post-exposure.

Integrated digital platforms have the potential to speed the detection and confirmation of cases since they have a greater ability to identify patterns and linkages between human and animal disease outbreaks and prepare an appropriate response. In Tanzania, for instance, the AfyaData app provides health information on case definitions of human and animal diseases, with associated advice on response measures for community officials (Box 4).

### Box 4 Supporting a One Health approach to disease surveillance in Tanzania

The Enhancing Community-Based Disease Outbreak Detection and Response in East and Southern Africa (DODRES) system uses mobile technology to promote Community Level One Health Security, an approach that empowers community-based human and animal health reporters with training and ICT-based solutions to detect and respond to disease.

An EpiHack was held in Tanzania in 2014, which brought together human and animal health experts and ICT programmers to identify major challenges in early detection, timely reporting and prompt response to disease events. Key actors participated in a project inception workshop to refine the objectives and implementation plan of the DODRES project, and developed the AfyaData app to support a "One Health" disease surveillance approach.[29]

Community health reporters and officials from animal and human health sectors in the Morogoro and Ngorongoro districts of Tanzania were trained to use the AfyaData app. The app supports near-real time data collection and submission at both community and health facility levels, as well as the provision of feedback to reporters. It also provides health information on case definitions of human- and animal-related diseases and synthesises advice that can be transmitted to community health reporters with next-step response activities or interventions. A WhatsApp group was also set up for community members, local government officials and DODRES team members to communicate.[30]

29 Karimuribo, E.D. et al. (October–December 2017). "A Smartphone App (AfyaData) for Innovative One Health Disease Surveillance from Community to National Levels in Africa: Intervention in Disease Surveillance". JMIR Public Health and Surveillance.

30 Ibid.

Recent advances in science and technology are making it possible to use highly sensitive and specific devices for case confirmation outside of laboratories. Nanotechnology, microfluids and microarray-based systems (which are able to process small quantities of fluids and detect thousands of genes simultaneously) can now be leveraged for example, although financial, technical and political constraints must be overcome for these technologies to be a viable option. The example of AMPHEUS in Zambia (Box 5) shows how remote sequencing of pathogens has become possible as new decentralised diagnostic technology becomes more affordable. It also shows how an integrated system for multiple disease testing is much more efficient than disease or pathogen-specific communication channels.

**Box 5** **Digital solutions in Zambia make lab testing more efficient**

AMPHEUS is a unified public health testing system that takes a sample through a process to rapidly identify both known and unknown pathogens in an outbreak.[31] Critically, it is designed to speed the identification of unknown pathogens in LMICs. This is typical of a scenario where a cluster of sick individuals with similar overlapping symptoms are tested by public health officials for common diseases (e.g. flu, COVID-19, rhinovirus). If they all test negative, a novel pathogen is likely.

AMPHEUS generates a sequence of the pathogen remotely at a clinic. The result is that a new pathogen can be routinely identified within 48 hours as part of an automated system without the intervention of a lab technician. AMPHEUS is now seeking to develop an app that will allow it to test how patients can access the lab most effectively and how they are informed of their test results. The app will also need to communicate with the broader public health system to prevent the spread of transmission.

31 Bonsall, D. et al. (2018). "A comprehensive genomics solution for HIV surveillance and clinical monitoring in a global health setting". Biorxiv The Preprint Server For Biology.

## Mobile apps can increase case detection and enable preventive health surveillance

Mobile technology can also play a significant role in case detection and registration. Given that 80 per cent of mobile connections in the Philippines are via smartphones,[32] there is potential to introduce add-ons to existing smartphone apps. For instance, when people regularly use a particular lifestyle app, they could be encouraged to report their symptoms. This would enable a much more dynamic and insightful set of data in real time and help to identify possible disease outbreaks.

One example of linking disease surveillance and case detection in a lifestyle app is the mRamadan campaign in Senegal (Box 6).

> **"Reporting initial symptoms, that's real surveillance."**
>
> **– Key informant**

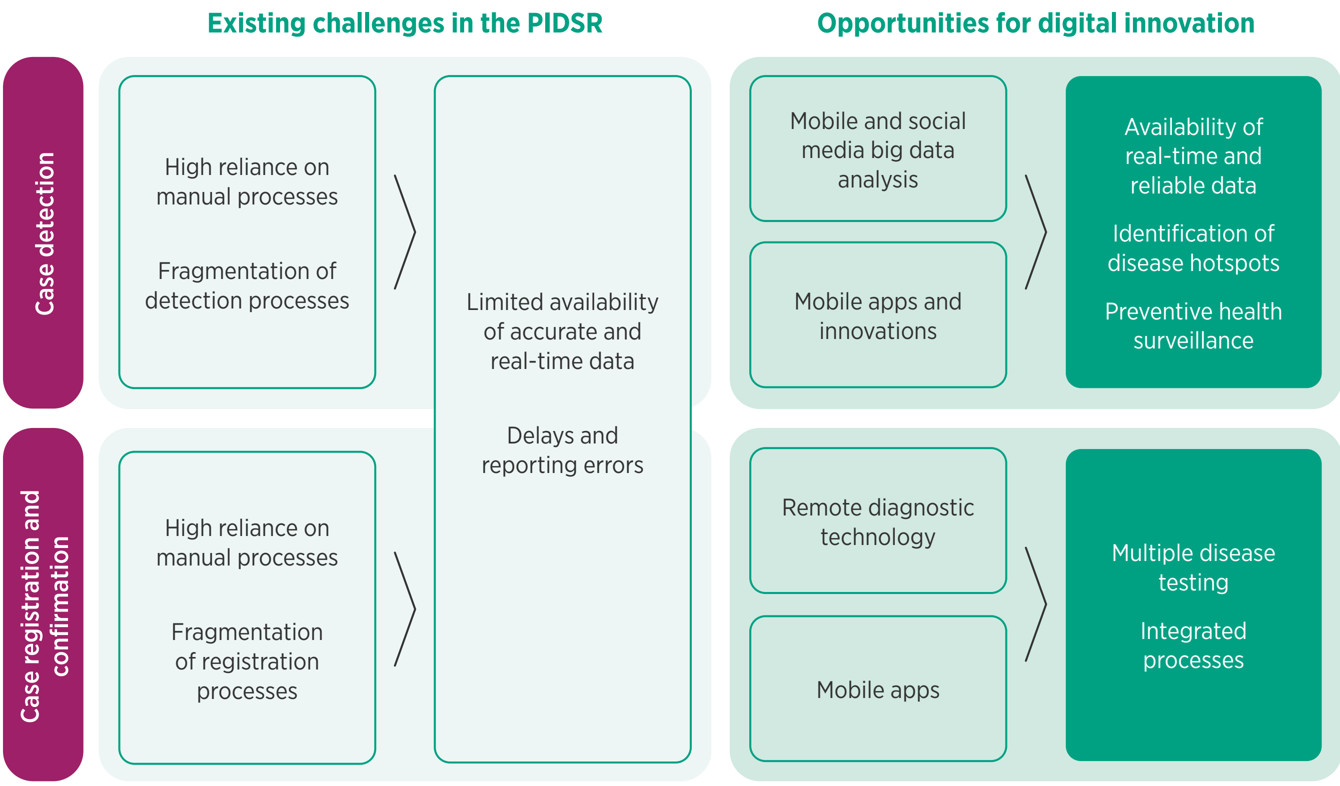
### Box 6 Linking diabetes advice to cultural events in Senegal

For many years, Senegal has grappled with establishing and financing a national diabetes programme.[33] The launch of the mRamadan campaign, with support from the WHO, has helped the government in the fight against diabetes, raising awareness of the symptoms and increasing the reporting of symptoms.[34] When the month of fasting starts, residents can opt in to receive a series of SMS messages that explain the symptoms of diabetes and ways to report symptoms. When Ebola and COVID-19 came to Senegal, health officials were able to use the same app to increase symptom reporting.[35]

32 GSMA. (2021). The Mobile Economy: Asia Pacific 2021.
33 WHO. (2021). "On the frontlines of diabetes fight in Senegal".
34 Lazuta, J. (2014). "Mobile Phone App Helps Diabetics During Ramadan in Senegal". VOA Science & Health.
35 Khan, H. (2020). "The effect of COVID-19 on Ramadan fasting in people with diabetes in East London 2020: The East London diabetes in Ramadan survey". Diabetes Residential Clinical Practice.

Similarly, mobile innovations can allow early symptoms to be detected passively. Data from smartphone-connected thermometers, for instance, can allow real-time tracking of influenza activity.[36] In the United States, analysis of data from temperature readings generated by smartphone-connected thermometers in households revealed that the data was highly correlated with information collected from traditional surveillance systems and had the potential to predict influenza activity up to three weeks in advance.[37] In the Philippines, such digital solutions could be implemented in areas with high smartphone penetration, although uptake would depend on incentives for behaviour change and effective campaigning.

**Figure 4: Strengthening case detection, registration and confirmation: opportunities for digital innovation**




36 Asian Development Bank (ADB). (May 2022). Harnessing the Potential of Big Data in Post-Pandemic Southeast Asia.

37 Miller, A. et al. (2018). "A Smartphone-Driven Thermometer Application for Real-Time Population and Individual-Level Influenza Surveillance". Clinical Infectious Diseases. 67(3). pp. 388–397.

## Strengthening government capacity for information sharing and data analysis at the local, regional and national level

Data emerging from multiple sources at different subnational levels (e.g. barangay, city, provincial levels) need to be reported in time to a more centralised body at the regional or national level that can take appropriate response measures. Optimal reporting requires an appropriate and effective communication channel at each level of surveillance.

Centralised databases and information on confirmed cases are a critical resource for analysing and interpreting trends. Adequate capacity at all levels of government for data analysis and management, as well as the ability to model disease projections, are essential to identify potential outbreaks and take preventive actions to reduce the risk of a disease spreading.

Fast reporting and accurate analysis can also help to mobilise more resources in emerging disease hot spots; ensure critical equipment and supplies are in the facilities with the greatest need; divert patients and service users to the facilities best able to care for them (based on demand, resources and staffing capacity); and support local clinical research to better understand a spreading disease and its impacts.

### Digitally-enabled reporting platforms can reduce delays in information reporting and improve data analysis

In the Philippines, the accuracy and timeliness of information shared between health professionals could be improved. Under the current health structure, municipal health officers are individually responsible for providing information to local government however they see fit. They often do not use standardised reporting systems to provide health updates, which leads to communication gaps. Digitising and streamlining information sharing and reporting processes has the potential to improve the reliability and volume of information.

The PIDSR could use existing frameworks and tools, including WHO-promoted standards such as District Health Information Software (DHIS2)[38] or Fast Healthcare Interoperability Resources (FHIR). FHIR is the global industry standard for passing healthcare data between systems,[39] providing a standardised way to represent and share information among health professionals and organisations regardless of how different organisations store their data.[40] FHIR provides faster, real-time access to data, reduces the burden of reporting and promotes interoperability. Another example is the Surveillance, Outbreak Response Management and Analysis System (SORMAS) described in Box 7.

**Box 7** **SORMAS: a digital platform for integrated disease surveillance**

The Surveillance, Outbreak Response Management and Analysis System (SORMAS) was developed during the 2014 Ebola pandemic in West Africa. It was first deployed in Nigeria in 2015, followed by Ghana a few years later and has been used in other countries across Africa, Asia and Europe since the COVID-19 pandemic.[41] SORMAS is a digital solution for improving the prevention and control of communicable diseases, particularly in resource-poor settings. It provides comprehensive disease surveillance and outbreak management in a single digital platform, processing real-time data critical to tackling outbreaks.

Health workers at any level of government can enter suspected or confirmed cases in the system, which automatically triggers a series of actions to ensure it is managed quickly and efficiently. SORMAS allows actors to receive and share new information that becomes immediately accessible to those who need to see and use it. They can then use this real-time data to generate early warnings of potential outbreaks and activate response measures to help manage and control the spread of diseases. The platform is highly integrated, covering 12 epidemic-prone, high-priority diseases, and has the capacity to include new diseases as they emerge.[42]

Some of the top features of the system include open-source, case-based surveillance, contact follow-up management, web- and mobile-based, offline capability and interoperability.

38 DHIS2 Communication. (n.d.). "What is DHIS2?"
39 eCQI Resource Center. (n.d.). "Fast Healthcare Interoperability Resources (FHIR®)".
40 Ibid.
41 SORMAS: https://sormas.org/
42 European Commission. (n.d.). "Disease surveillance and outbreak response technology in West Africa".

### Digitally-enabled modelling tools can improve local capacity for data analysis and interpretation

In the Philippines, the Feasibility Analysis of Syndromic Surveillance using Spatio-Temporal Epidemiological Modeler (FASSSTER) is a user-friendly tool for modelling disease spread and supports the disease surveillance efforts of the DOH (Box 8).

While tools like FASSSTER are promising, the lack of a skilled local workforce is a major barrier to advanced data analysis. Subnational ESUs still rely on analytical tools such as Excel spreadsheets that allow only limited analysis. LGUs and other local stakeholders must rely on centralised bodies for insights on disease projections, which may delay response measures. Several key informants interviewed for this report emphasised that capacity for analysis at the local level must be a priority, and that local stakeholders should be able to use their own data for decision-making to act in a timely fashion and prevent the spread of disease to other regions.

**"Analysis is most important not at the national level, but rather at subnational levels. We saw during COVID-19 that local stakeholders are the frontliners of disease surveillance and response."**

**– Key informant**

**Box 8** **FASSSTER: a digital tool for disease trends modelling**

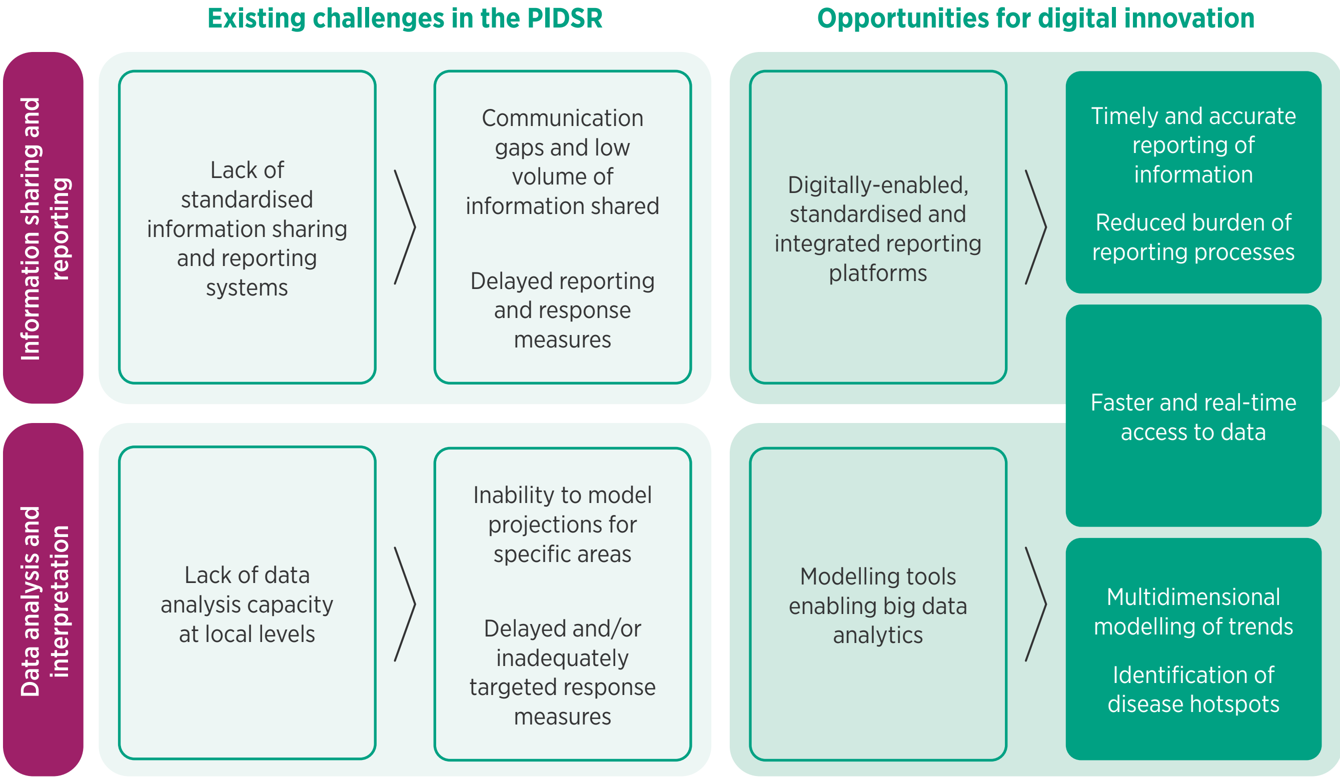
FASSSTER was designed and developed through a partnership of the DOH, the Department of Science and Technology (DOST), the Philippine Council for Health Research and Development and Ateneo de Manila University. The initial concept was to present possible scenarios for disease outbreaks like dengue, measles and typhoid fever, but became even more relevant during the COVID-19 pandemic.[43]

The aim of FASSSTER is to create a hub for different data sources (disease records, environmental parameters, etc.) and a rich array of integrated information to better understand the spread of disease.[44] It takes a multi-dimensional approach to modelling disease spreads by using data from the PIDSR, electronic medical records and SMS-based reports of primary care facilities.[45]

The key feature of this web-based disease surveillance platform is the prediction of critical information, such as the peak of confirmed cases, peak data and case doubling time, among others. Other advantages include the ability to forecast health system capacity requirements based on the projected peak and number of mild, severe and critical cases at municipal, provincial and regional levels.[46] The tool can also perform spatial analysis to determine the clustering of cases at the barangay level, and considers the social, economic and security risk rating and classification of all cities and municipalities when visualising responses.[47]

43 Dillera, A. (7 September 2020). "FASSSTER App to bolster COVID-19 response in the Philippines". OpenGovAsia.
44 Republic of the Philippines Department of Health. (n.d.). "COVID-19 Philippines LGU Monitoring Platform".
45 UN Compendium: "FASSSTER – Feasibility Analysis of Syndromic Surveillance using Spatio-Temporal Epidemiological Modeler".
46 Dillera, A. (7 September 2020). "FASSSTER App to bolster COVID-19 response in the Philippines". OpenGovAsia.
47 Ibid.

**Figure 5: Strengthening information sharing, reporting, data analysis and interpretation: opportunities for digital innovation**




## Translating data into policy: from data analysis and interpretation to response measures

Disease surveillance is only useful if the data supports a public health response that controls and prevents outbreaks from escalating. Some of the most common response measures are contact tracing and vaccination campaigns, which require effective dissemination of information and communication with the population to raise awareness and incentivise behaviour change.

In the Philippines, as in the rest of the world, the COVID-19 pandemic provoked an unprecedented surge of innovation in response measures and contact tracing. Contact tracing is extremely important for warning contacts of exposure and breaking the chain of transmission.[48] The urgency of the pandemic brought together national and local governments, private companies and international development organisations to develop software and apps for COVID-19 surveillance and control.

> **"COVID-19 became the main catalyst that pivoted development and multiple innovations solutions in disease surveillance with the goal of securing lives."**
>
> **– Key informant**

For instance, CovidKAYA, designed by the DOH and WHO, allows real-time monitoring and helps identify bottlenecks and delays in patient services. Tracing, communicating test results and monitoring quarantined contacts are some of the automated tasks the service provides. The platform also stores data from all confirmed cases and their close contacts, providing a critical resource for the government to make evidence-based decisions. There is scope to improve the platform and make it part of a more general surveillance system.

48 WHO. (2020). A guide to WHO's guidance on COVID-19.

Many digital solutions targeted at end users aim to disseminate information on the spread of a disease. The KIRA Kontra Bot, launched by the DOH, is an example of an automated chatbot that enables access to verified COVID-19-related information. Filipinos can report their symptoms and receive advice on steps to take in case of an infection. KIRA processes this information by asking self-assessment questions (e.g. health conditions, severity of symptoms, level of exposure to COVID-19), which then allows it to categorise and tag users as either low risk, probable case, suspected mild case or suspected moderate to severe case,[49] although further medical consultation is required.

Although these innovations have provided much-needed support and demonstrate the need for stronger monitoring tools, contact tracing is largely fragmented. Decentralised information channels create gaps between data and findings, and several informants interviewed for this study cited the need to introduce more efficient and integrated systems.

> **"In an ideal world, a single system for all activities and processes must be the way to go."**
>
> **– Key informant**

### Mobile technology and big data can strengthen contact tracing

Data from mobile phones (see Box 3), transport systems or social media can be used to identify the location of confirmed or suspected cases and track travel patterns to support disease surveillance and provide early warnings.[50] In Southeast Asia, several countries used location data and Bluetooth data from mobile phones for contact tracing during the COVID-19 pandemic. For instance, the TraceTogether app in Singapore collects data based on exchanges of Bluetooth signals to identify people who have prolonged proximity with confirmed cases.[51] Box 9 provides an example of using big data for contact tracing and surveillance in South Korea.

**Box 9** **Leveraging big data for disease surveillance during COVID-19 in South Korea**

Through the COVID-19 Smart Management System (SMS), South Korean authorities take about 10 minutes to track the travel history of confirmed cases instead of one day using manual epidemiological surveys. Jointly developed by the Korea Disease Control and Prevention Agency, the Ministry of Land and the Ministry of Science and ICT, the SMS was rolled out in March 2020, a month after COVID-19 cases first spiked.

The system leverages big data provided by 28 cross-sector organisations, including the police, credit card companies and MNOs. It analyses credit card transactions and mobile phone location records to instantly map a virus transmission route and identify potential infection hotspots. This allowed the Korea Disease Control and Prevention Agency to isolate potential cases early and to openly share risk alerts to help the population stay safe.[52] By relying on proactive and thorough contact tracing and widespread testing, South Korea was able to contain the outbreak without resorting to drastic measures.

49 Development Academy of the Philippines. (26 January 2022). "Strengthening the Accessibility of COVID-19 Information through KIRA Kontra COVID and TANOD COVID".
50 Asian Development Bank (ADB). (May 2022). Harnessing the Potential of Big Data in Post-Pandemic Southeast Asia.
51 Government Digital Services, Singapore. Trace Together app: https://www.tracetogether.gov.sg/index.html.
52 Chang, C. (1 May 2020). "How South Korea Used Tech to Track Down Coronavirus and Curb Spread". The Straits Times.

## Big data can support the management of vaccines and vaccination programmes

There are significant opportunities to leverage big data for the management of vaccines, for instance, to ensure they are stored within a precise temperature range. The biopharmaceutical company Merck collaborated with Microsoft to analyse and monitor a range of variables that can affect the cold chain.[53] In another partnership, Google.org, the charitable arm of Google, and Gavi, the Vaccine Alliance, built ColdTrace, a wireless temperature monitoring system that provides real-time data on refrigerators used to store vaccines.[54] The system collects data from sensors placed inside vaccine refrigerators and notifies key personnel when vaccines reach a dangerously low temperature.[55]

As explained in Box 10, big data can also be used in vaccination programmes to identify priority and most at-risk populations, including elderly people with health conditions or "super spreaders" (i.e. individuals with high numbers of close contacts, such as those working in the service industry). In addition, data from social media platforms can be used to understand public perceptions and concerns about vaccines and develop strategies to address them.[56]

### Box 10 Analysing big data to identify priority populations for vaccination programmes in the United States

Blue Shield of California, an insurer in the United States, used big data analysis to identify clients most vulnerable to COVID-19.[57] The company used a machine learning platform to analyse various factors, such as an individual's health history, combined with social and environmental conditions and the most up-to-date medical research on COVID-19. This helped identify a number of risk factors that could have been overlooked, such as location (e.g. individuals who did not live within close-enough range of a grocery store were at an increased risk of ending up in hospital, on a ventilator or even dying from COVID-19 because they could not access basic equipment like masks or sanitary products) and underlying conditions (e.g. individuals who had experienced severe mental health issues were at greater risk). Based on these findings, Blue Shield provided targeted health counselling and support services to their members.

## Mobile big data can help assess the impact of response measures

Monitoring and evaluation is an important function of DSM systems across all stages, from determining the proportion of health facilities with standardised registers, to examining the validity and quality of information recorded, to assessing the capacity to respond to detected outbreaks and emerging public health threats.

Our research revealed there is currently very little capacity in the Philippines to undertake monitoring and evaluation to assess the effectiveness of the PIDSR across the various stages of disease surveillance, or to understand the impact of specific policy interventions to reduce disease outbreaks. For instance, several interviewees mentioned the lack of unified systems for recovery trials and evaluations for new antivirals, vaccines and drugs, and that nonpharmaceutical interventions were rarely evaluated.

Innovative digital solutions based on big data analysis from mobile phones can help determine the correlation between disease infection rates and various disease surveillance processes and measures.

53 Bragazzi, N. et al. (2018). "Vaccines Meet Big Data: State-of-the-Art and Future Prospects. From the Classical 3Is ("Isolate–Inactivate–Inject") Vaccinology 1.0 to Vaccinology 3.0, Vaccinomics, and Beyond: A Historical Overview". Frontiers in Public Health, 6, p. 62.
54 Berkley, S. (20 November 2017). "How Innovation is Improving Vaccine Delivery". LinkedIn.
55 See Nexleaf Analytics: Vaccine Program.
56 Asian Development Bank (ADB). (May 2022). Harnessing the Potential of Big Data in Post-Pandemic Southeast Asia.
57 Velasquez, G. (19 December 2020). "The COVID-19 Vaccine Rollout is Dangerously Flawed. Science and Data Could Fix It". Fortune.

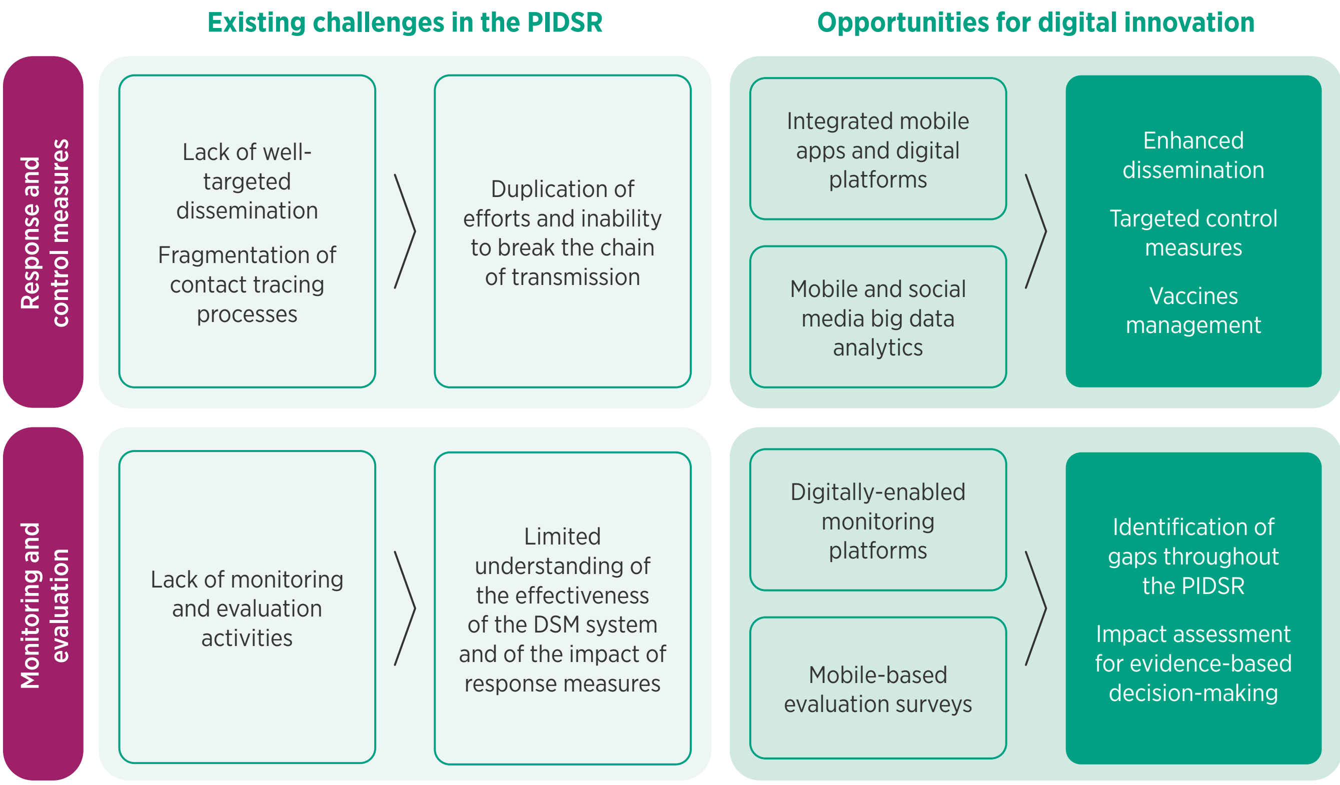
As explained in Box 3, insights gleaned from MNO data can be used by public authorities to evaluate and improve response measures. Another example is the work of Unacast in Nigeria and the United States (Box 11) during the COVID-19 pandemic, which used big data to correlate mobility patterns with infection rates and to understand the impact of nonpharmaceutical interventions, such as self-isolation.

**Box 11** **Integrating impact monitoring activities in Nigeria**

During the COVID-19 pandemic, Unacast, a US-based company that provides insights on human mobility, developed a social distancing scoreboard with the MNO MTN Nigeria, the Ministry of Communication and the Nigerian Centre for Disease Control (NCDC). Unacast is creating a dashboard that shows how changes in community mobility could affect the number of COVID cases in different regions. The purpose of the dashboard is to see whether there were correlations between infection rates and nonpharmaceutical interventions that stopped people moving within and between cities.[58]

Surveys and feedback loops are essential for monitoring DSM processes and the effectiveness of local response measures. There is a role for mobile-based evaluation surveys, both for the general population and the health sector. Surveys could enable the assessment of various public health indicators and determine the effectiveness of data collection, data analysis and data sharing in pinpointing bottlenecks and challenges.

**Figure 6: Strengthening the effectiveness of response measures and impact assessment: opportunities for digital innovation**




58 MTN Nigeria. (2022). "Unacast's Turbine Platform Expands into Africa".

03

# Enabling digital inclusion for disease surveillance

While there are significant opportunities to use mobile and digital technologies to strengthen disease surveillance and monitoring and build long-term resilience, a more enabling environment for technology adoption is needed in the Philippines. This section explores the policy environment in the Philippines and highlights key enablers of technology adoption, focusing on the issues that need to be overcome to drive digital inclusion.

## 3.1 Digital readiness in the Philippines

Establishing an enabling environment for digital innovation is key to foster the digital transformation of disease surveillance and strengthen the PIDSR. Figure 7 summarises the measures and policy initiatives that have been taken to improve digital readiness in the Philippines.

**Figure 7: ICT policy roadmap in the Philippines**

**2012**

### Data Privacy Act

The Act aims to protect the fundamental human right to privacy while ensuring the free flow of information to promote innovation and growth. It recognises the vital role of information and communications technology in nation-building and the inherent obligation of the state to ensure that personal information in government and private-sector ICT systems are secure and protected.

**2017**

### Philippines Development Plan

The Philippines Development Plan 2017–2022 includes a strategy to continue to develop the country's e-government system as a vital tool for good governance. With this plan, the Department of Information and Communications Technology (DICT) aspires for the Philippines to develop and flourish through innovation and constant development of ICT.

**2019**

### E-Government Masterplan (EGMP) 2022

Launched by the DICT in 2019 to promote the digital transformation of government services, enhance intergovernmental coordination and improve the capacity of government agencies to use ICTs in their operations. The plan is intended to serve as a guide for "One Digitised Government Philippines".[59] It is the successor of the EGMP 2013–2016, which also built on previous ICT plans.

### National ICT Ecosystem Framework (NICTEF)

The NICTEF is a pioneering ICT initiative to harness emerging technologies in the country's industries to improve public links, enhance digital inclusion and accelerate economic growth in an integrated, interoperable and interconnected ecosystem. The NICTEF is intended to guide the national ICT development agenda and serveas a blueprint for the harmonisation and coordination of national ICT plans, programmes and projects.[60]

**2020**

### ICT Statistics Roadmap

This three-year plan promotes data-driven governance by creating a robust evidence base to guide ICT development policies and initiatives in the Philippines.[61]

### Cloud First Policy

The Philippines' Cloud First Policy has been updated to encourage government agencies to move to cloud computing as the preferred ICT deployment strategy for internal administrative use and external delivery of government services.[62,63]

**2021**

### AI Roadmap

The government established a cross-ministerial task force of seven agencies to develop the National Artificial Intelligence (AI) Roadmap from 2021.[64] The roadmap aims to transform the Philippines into an AI centre for excellence, leveraging its talent pool and entrepreneurship ecosystem.[65]

59 DICT. (2019). E-Government Masterplan 2022.
60 DICT. (2020). Data-Driven ICT Governance: National ICT Household Survey 2019.
61 Ibid.
62 Government of the Philippines. Department Circular: Cloud First Policy.
63 Ibid.; Department of Information and Communications Technology (DICT). (12 June 2020). "DICT Releases Amended Cloud First Policy for Gov't Transition to 'New Normal'".
64 Parrocha, A. (17 July 2019). "Gov't crafting AI road map to improve PH productivity. Philippine News Agency.
65 Crismundo, K. (7 October 2020). "DTI targets to roll out AI roadmap next year". Philippine News Agency.


## 3.2 Key enablers of digital inclusion

Our research identifies seven key enablers of technology adoption and digital inclusion that need to be enhanced to unlock digital innovations for disease surveillance in the Philippines: access to mobile connectivity and digital technologies; affordability of digital services and devices; digital literacy and skills, relevance and inclusion, awareness and trust, data governance and political will.

### Access to mobile connectivity and digital technologies

To enable digital innovation across government agencies, it is necessary to establish a strong ICT infrastructure capable of collecting, storing, transferring and processing large amounts of data faster than traditional data systems. For instance, improving cloud capabilities can provide a cost-effective and scalable way for governments to store big data and enable big data analytics. Many interviewees highlighted that public health employees lacked access to the ICT equipment needed to implement digital solutions, especially at the local level.[66] Recent initiatives, such as the Cloud First Policy, have the potential to fill some of these gaps if they are implemented holistically across different levels of government.

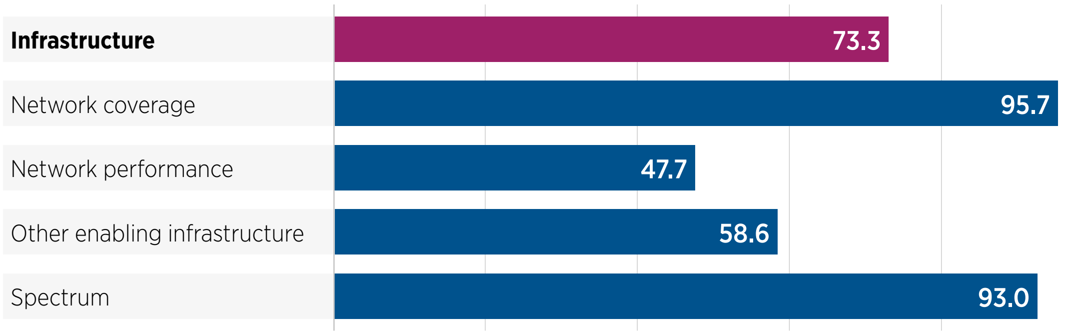
Digital innovation also requires access to relevant technologies to collect, store, process and analyse data. This includes frontier technologies, given the increasingly important role they are expected to play in disease surveillance. According to the Portulans Institute's Network Readiness Index, which monitors the adoption of emerging technologies such as big data analytics and cloud computing, the Philippines scores 52/100 with distance to frontier[67] of 48 per cent for adoption of emerging technologies.[68]

66 Data from interviews with central and local government and international organisations.
67 Distance to frontier refers to the percentage gap between the country's performance and the best performing country globally on that indicator.
68 Portulans Institute. 2020. The Network Readiness Index 2020.

Reliable nationwide broadband connectivity is a prerequisite for the public to benefit from digital innovation for disease surveillance. In the Philippines, the infrastructure network is relatively high (Figure 8) and 93 per cent of the population is covered by a 3G network.[69] Yet, many remote and rural areas, where 52 per cent of the population lives,[70] still lack sufficient coverage and quality connectivity, which limits the possibility to leverage digital innovation.

Several experts interviewed for this study highlighted rural connectivity as a priority policy area.[71] In some geographically isolated areas, communities may also have limited or no access to electricity. This exacerbates inequalities for marginalised groups, especially Indigenous peoples, who make up about 15 percent of the total population[72] and primarily live in areas with poor network signals or no or poor internet connectivity.

**Figure 8: The Philippines' Mobile Connectivity Index: Infrastructure**




Source: GSMA, 2022
All indicators have been normalised to have a value within a range of 0 to 100, with a higher score representing stronger performance.

Closing the coverage gap, both by expanding infrastructure and facilitating access to relevant technologies, is a precondition for digital innovation, but closing the usage gap is equally important.

Many Filipinos who live in an area covered by mobile internet do not use it, an indication that they face important barriers to use.

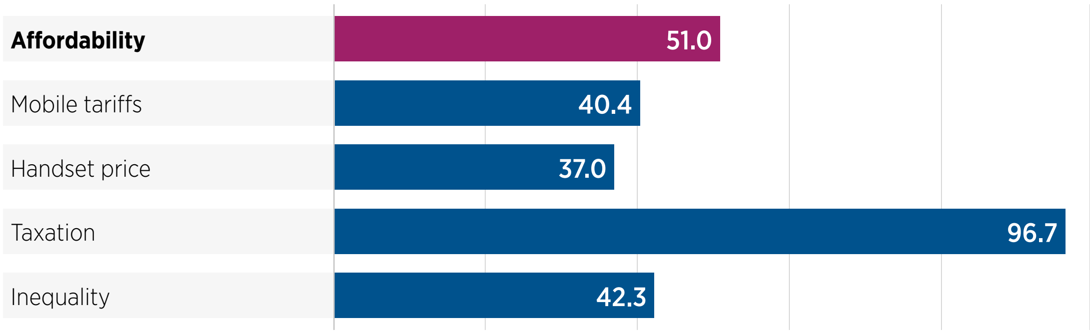
69 GSMA Intelligence
70 World Bank data
71 Data from key informant interviews.
72 De Vera, D.E. (2007). "Indigenous Peoples in the Philippines A Country Case Study". RNIP Regional Assembly Hanoi Vietnam.

## Affordability of digital services and devices

The affordability of mobile devices and data is critical for digital adoption and digital inclusion. In government agencies, the lack of digitisation of public health tools and services is, in part, due to the high cost of mobile and digital technologies, especially cutting-edge ones. Adopting frontier technologies requires massive upfront public investment, which is lacking in local government. Some interviewees mentioned that local health professionals do not have access to ICT equipment and often have to use their personal mobile phones to report cases.

Those who are still unconnected sometimes live in areas covered by mobile broadband, but do not have the financial resources to tap into it. The GSMA Mobile Internet Connectivity Index[73] classifies the Philippines as an advanced country.[74] Despite significant advances in connectivity, the country scores lower on affordability compared to other key enablers of mobile internet connectivity identified in the Index, due to the high costs of handsets and mobile services (see Figure 9). The Philippines has the fourth most expensive mobile internet services in Southeast Asia, after Singapore, Brunei and Malaysia.[75] This reduces incentives for the population to adopt digital tools and services, particularly those with the lowest incomes. In addition, those who use mobile services have slower download speeds compared to their regional peers.[76]

**Figure 9: The Philippines' Mobile Connectivity Index: Affordability**




Source: GSMA, 2022
All indicators have been normalised to have a value within a range of 0 to 100, with a higher score representing stronger performance.

73 The Mobile Internet Connectivity Index is a tool developed by the GSMA that measures the performance of 170 countries against enablers of internet adoption: infrastructure, affordability, consumer readiness and content and services. For more information, see: https://www.mobileconnectivityindex.com/.

74 Advanced countries have a score above 65 and perform well on three enablers of mobile internet connectivity. The Philippines has a score of 65.9/100 and performs relatively well on infrastructure, consumer readiness and content and services (GSMA Intelligence).

75 Economist Impact. (2019). The Inclusive Internet Index.

76 Statista. (2021). "Internet connection speed in Philippines 2021, by type".

## Digital literacy and skills

Digitally-enabled DSM systems require health professionals with strong digital skills, as well as a digitally literate population. Building the capacity of public health employees is particularly important to harness the potential of digital innovation, and several initiatives are equipping government staff with digital skills. For example, the Philippine Statistical Development Programme (PSDP) 2018–2021 aims to strengthen the country's capacity through the use of big data. It plans to implement training programmes for staff on the use of open-source statistical software and computing to use big data to monitor progress on the United Nations Sustainable Development Goals (SDGs).[77]

However, many experts interviewed for this research highlighted that public health employees lack ICT skills, especially at the barangay level.[78] The COVID-19 pandemic has exacerbated this challenge by driving up healthcare spending and putting more pressure on staff resources.[79] Interviewees who are implementing digital solutions reported challenges with the uptake of digital tools in healthcare, due in part to a lack of familiarity with digital systems at the local level. This capacity gap is even more pronounced with the use of frontier technology such as big data, AI and machine learning.

In general, Filipinos are less digitally literate than their middle-income regional peers.[80] Recent research from the Asian Development Bank (ADB)[81] shows that there are human capital gaps in the Philippines compared to best-performing countries across three different indexes – UN E-Government Development Index, Coursera's Global Skills Index, and Portulans Institute's Network Readiness Index (Table 1). As more mobile- and digitally-enabled solutions are adopted, this lack of skills will limit opportunities for people to access information that would help them prepare and respond to an outbreak. This is likely to affect groups that have higher rates of digital exclusion, including women, persons with disabilities and the elderly.

**Table 1: Human capital readiness in the Philippines**

| UN E-Government Development Index – Human Capital Sub-index | | Coursera's Global Skills Index – Data Science Skills | Portulans Institute's Network Readiness Index – ICT Skills | |
|---|---|---|---|---|
| Score out of 1 *(Max score = 1)* | Rank out of 193 | Rank out of 60 | Score out of 100 *(Max score = 100)* | Rank out of 134 |
| 0.8 | 83 | 31 | 77 | 21 |

ICT = information and communication technology, UN = United Nations
Sources: UN E-Government Development Index; Coursera's Global Skills Index; Portulans Institute's Network Readiness Index; AlphaBeta analysis.

77 Ordinario, C. (1 November 2018). "PHL meets 'Big Data' challenges through PSDP 2018–2023". BusinessMirror.
78 Data from interviews with central and local government and international organisations.
79 OECD. (2020). The territorial impact of COVID-19: Managing the crisis across levels of government.
80 World Bank. (2020). Philippines Digital Economy Report 2020: A Better Normal Under COVID-19.
81 Asian Development Bank (ADB). (May 2022). Harnessing the Potential of Big Data in Post-Pandemic Southeast Asia.

## Relevance and inclusion

Mobile- and digitally-enabled DSM solutions need to be relevant for all end users and inclusive to meet the needs of the underserved. Marginalised groups, who tend to live in areas with poor connectivity, are more likely to be left behind because digital tools and services often fail to meet their needs. In particular, contact tracing and dissemination of information must be relevant and inclusive to be effective and incentivise people to take steps that help break the chain of transmission. It is also important that information is available in local languages and contextualised so that is easy to assimilate for end users.[82]

Interviews with key informants from government and NGOs revealed that current solutions often require the latest mobile technologies and usually do not provide information in Indigenous or local languages. This means that a large segment of the population cannot use mobile apps designed to report symptoms or for contact tracing.[83] Awareness campaigns are also generally inaccessible for persons with disabilities, as seen during the COVID-19 pandemic.[84] Designing specialised interfaces or innovative digital communication methods that meet the diverse needs of communities would help drive digital inclusion for those typically left behind.

In addition, access to disaggregated data, for example, by gender, age or income level, enables insights that support better disease response measures because they ensure that they are appropriate and well-targeted to communities located in disease hotspots. This is not the case in the Philippines, however, where systems like FASSSTER do not collect gender-related data.

## Awareness of and trust in digital solutions

Many people may still not use and benefit from digital innovation because they are not aware of the value it offers or because they are averse to risk. According to UNDP, 51 per cent of the offline population in the Philippines reported they were not aware of the benefits of the internet in general and locally relevant content in particular.[85] To encourage uptake in communities less likely to be familiar with mobile and digital technologies, building trust in these solutions is essential. Being responsive to the diverse needs of communities requires adapting to their social and cultural norms and asking for feedback.

82 GSMA mHealth Design Toolkit.
83 Data from interviews with key informants in government and NGOs.
84 Data from interview with key informant interview with civil society.
85 UNDP. (2021). Mapping and Analysis of Vulnerable Groups for Climate Change Adaptation and Disaster Risk Reduction (CCA-DRR) in Support of the Digital Readiness Strategy in the Philippines.

## Data governance

Digitally-enabled disease surveillance systems require effective data governance policies and adequate regulatory frameworks. Data governance policies and regulations define how data is collected, used and shared. This, in turn, influences the availability and accuracy of real-time assessments of disease trends and predictive analysis of disease outbreaks. Ideally, data governance should allow for harmonised national and subnational data policies and standard-setting to increase the speed of data processing.

The Philippines faces multiple data governance issues that make it challenging to establish well-functioning, digitally-enabled disease surveillance systems. Consistent and accurate data can be scarce because of a lack of access to disaggregated and standardised data and inefficient data-cleaning processes. Given the urgency of data and its impact on disease response, implementers use whatever data is available. The nature of surveillance, as one key informant emphasised, is that data is not perfect but still useful to identify trends and make decisions on response measures.[86]

Several interviewees also mentioned the need to improve interoperability and data management and sharing between stakeholders across different sectors. Many systems operate in silos and rely on different software that may not be compatible. This may prevent accurate information sharing and reporting across different levels of government and worsen data discrepancies. The Global Open Data Index, which assesses the availability and openness of government data on multiple aspects, such as ease of access, cost of access, frequency of updates and technical usability (e.g. machine-readable format), ranks the Philippines at just 30 out of 100.[87] Improving data sharing and implementing common standards would significantly enhance processes and the effectiveness of disease surveillance systems. The country could learn from the Cambodia Data Exchange (CamDX), as explained in Box 12.

**Box 12** **CamDX: an integrated data exchange platform to enable the use of big data in Cambodia**

The Cambodia Data Exchange (CamDX) is an initiative of the Government of Cambodia to improve data collection and data sharing. It connects fragmented information systems in an integrated ecosystem to support standardised and secure data exchange. The main objective of the platform is to enable easy access to data in government databases without compromising the security and ownership of the data.[88]

As a data exchange platform, CamDX does not store or know the content of the data, but instead allows each member to connect with the information systems of other members and exchange data directly through a secure server. The platform also provides a way for the public and private sectors to collaborate. Government databases can be used in combination with data from telecommunications companies, banks and insurance companies for purposes such as electronic know-your-customer (KYC) processes.[89]

86 Data from key informant interviews.
87 Global Open Data Index: www.okfn.org
88 Asian Development Bank (ADB). (May 2022). Harnessing the Potential of Big Data in Post-Pandemic Southeast Asia.
89 Ibid.

Data privacy policies are needed to allow data sharing while minimising the risk of unintended consequences, such as data leaks of health records. At the same time, governments must balance data protection with the need to facilitate data sharing during epidemics or pandemics to support crisis management.[90] The Government of the Philippines passed the Data Privacy Act in 2012, but there have been concerns about its enforcement and the resolution of data breaches and data privacy violations.[91] Some interviewees also voiced concerns about the disconnect between data privacy laws and the interest of the private sector in using data for commercial purposes.

## Political will

Addressing barriers to digitally-enabled disease surveillance systems often depends on whether stakeholders consider technology adoption a priority issue and their willingness to invest the necessary financial, technical and human resources. Although the government of the Philippines has implemented various initiatives to foster the digital readiness of the country, these are yet to be translated into practical actions in the public health sector. Some interviewees raised concerns about insufficient political support for effective upgrades in disease surveillance systems, including greater use of digital innovation.[92] The lack of ICT equipment and skills among healthcare professionals indicates that centralised bodies do not consider investment in digital innovation and capacity building a priority. With no regular budget items for laptops or other mobile devices with the required specifications, staff often share or borrow laptops.[93] At the start of the COVID-19 pandemic, the DOH had to request support from Globe, a national MNO, to provide free devices to some LGUs to help healthcare workers conduct mobile-based surveys to assess the prevalence of COVID-19 in local areas.[94] Many interviewees also reported that it is difficult to obtain funding to test and implement new solutions. Funding for FASSSTER, for instance, may not be renewed.

Shifting political priorities may also undermine the stability required to plan and implement more comprehensive and longer-term digital systems for DSM. Political buy-in needs to be reflected in larger budgets and stronger commitments to an integrated approach that could tackle many of the barriers outlined here.

90 Ibid.
91 Damazo-Santos, J. (14 October 2020). "Philippine privacy regime fails to live up to expectations". MLex Market Insight.
92 Data from key informant interviews in civil society and the private sector in the Philippines
93 Data from key informant interviews with health sector workers in the Philippines.
94 Data from key informant interview with an MNO.


04

# Conclusions and recommendations

Digital innovation has the potential to make disease surveillance and monitoring systems more integrated, efficient and able to achieve their primary objective of making populations safer. With high levels of urbanisation, population density, climate change and vulnerability to natural hazards, the Philippines is likely to remain susceptible to the spread of disease and potential outbreaks. Continuous investment in, and strengthening of, disease surveillance and the PIDSR will be essential to respond to disease outbreaks in a timely manner and mitigate the impacts.

The integration of mobile and digital solutions in existing infrastructure and operations has the potential to improve DSM overall, with positive feedback loops across the public health sector. The Philippines can learn from and build on the experiences of other LMICs, as well as from more advanced economies where digital innovation has been leveraged. Some countries have used mobile and digital technologies to improve the availability and quality of data or to make information sharing and reporting processes more efficient. They have also been used to enhance response measures, such as contact tracing and the management of vaccines.

In the Philippines, priorities include making reliable, timely and granular data available; enabling faster digitalisation and transfer of information from local to regional and national levels; and improving the ability of the system to conduct predictive analysis. In terms of response measures, efforts should be focused on breaking down silos between contact tracing processes and improving the dissemination of information and communication with those most likely to be left behind. Better overall monitoring and evaluation of disease surveillance is equally essential.

Tackling existing challenges and strengthening disease surveillance through digital innovation requires effective and genuine cross-sector collaboration and coordination at national, regional and local levels. Table 2 provides more detailed recommendations for stakeholders to strengthen DSM systems through mobile and digital technologies in the Philippines.

**Table 2: Strengthening DSM through mobile and digital innovations: recommendations for stakeholders**

## Government

- **The national government is in a position to more actively promote and facilitate the use of digital innovation in the public health sector for digitally-enabled DSM systems.** Initiatives such as the E-Government Masterplan and AI Roadmap can foster the digital transformation of DSM systems, but they still need to be translated into clear and actionable policies. A paradigm shift may be required to promote digitalisation and recognise the importance of investing in human and financial resources for digital innovation at all levels of government.

- **There is an opportunity for national government agencies to become less dependent on manual processes and to leverage digital innovation to improve data quality and availability.** This involves digitising processes across the various stages of disease surveillance, with a specific focus on improving case detection and confirmation, and information sharing and reporting. There are significant opportunities to use innovative data sources, such as analysis of crowdsourced social media or mobile big data, but the government needs to facilitate the development of strong ICT infrastructure and provide the right incentives for MNOs to expand network coverage.

- **The government should create a more enabling environment for digital innovation by improving data governance.** It should adopt open data policies and create an integrated data platform to facilitate data sharing between government agencies and across different levels of government. The interoperability of data should also be improved (e.g. through common standards) to consolidate the databases of various government agencies, as the Government of Cambodia did with CamDX. At the same time, mechanisms need to be created to minimise the risk of unintended consequences of data sharing, such as breaches of sensitive information. In the Philippines, the enforcement of the Data Privacy Act needs to be strengthened to ensure personal data is protected.

- **The government should build the capacity of public health sector employees, a prerequisite for digitally-enabled disease surveillance systems.** In particular, targeted training and incentives should be provided to acquire relevant digital skills and raise awareness of the role of digital innovation. For instance, expanding the supply of talent with advanced digital skills in data-related fields is essential to take advantage of emerging technologies. In addition, the government needs to provide the right incentives to attract and retain these talents in the public health sector. Initiatives such as the Philippines Statistical Development Programme (PSDP) are promising, but need to be well-structured and targeted. For instance, the government could draw on private sector expertise to conduct training for government officials and consider incentives to encourage civil servants to participate in training and skill-building activities. In addition, the government should expand and strengthen the digital literacy and skills of the general public to ensure everyone, including those most likely to be left behind, can engage effectively with digital solutions and access information about disease outbreaks.

- **The government could also take the lead in establishing a national multistakeholder taskforce that would bring together government agencies, the private sector and academia.** These actors should explore and test mobile and digital technologies for disease surveillance and break down silos between sectors. For instance, engaging and building partnerships with tech innovators and MNOs would allow public authorities to leverage their expertise.

## MNOs

- **MNOs should continue to expand their networks and improve connectivity to support disease response measures.** With disease surveillance and monitoring, the degree of mobile penetration and internet connectivity tends to influence how effectively information is disseminated and communicated. Contact tracing, for instance, relies heavily on data from mobile phones such as location data or Bluetooth data, as seen in South Korea and Singapore. Similarly, most digital solutions targeted at end users require access to mobile phones, as demonstrated by the development of contact tracing apps during the COVID-19 pandemic.

- **MNOs could undertake commercially viable initiatives to address key barriers to mobile adoption.** For example, they could support original equipment manufacturers in providing lower-cost entry level smartphones or offer pay-as-you-go options when feasible. To encourage adoption, they could consider offering low-cost trial packages to first-time users. This would help expand their subscriber base while increasing access.

- **MNOs can build public-private partnerhips with governments to enable better DSM, while ensuring that only de-identified, randomised and aggregated data is shared to protect their customers.** There are significant opportunities to use mobile big data to understand the mobility patterns of populations, identify disease hotspots, improve impact analysis and take appropriate response measures. MNOs can partner with government agencies or relevant third-party entities to share insightful data, such as call detail records and mobile positioning data.

- **There is an opportunity for MNOs to leverage their large distribution networks to support communication campaigns.** This not only involves disseminating information on emerging outbreaks and updates on evolving trends but also relaying government updates on response measures and reminders about actions that can help break the chain of transmission and prevent the spread of diseases. It is important that MNOs take an inclusive approach to ensure information is well-targeted and accessible to everyone, including marginalised groups. For instance, they can ensure information is contextualised and easy to assimilate for end users. In addition, MNOs could conduct surveys so that feedback is integrated with disease surveillance and support monitoring and evaluation processes.

## Solution providers

- **Private sector innovators, NGOs and research institutions involved in the design, development and management of digital solutions for disease surveillance should find ways to complement government platforms.** To support a holistic, nationwide approach to disease surveillance and avoid further fragmentation of the system, it is important that digital tools and apps are linked and add value to existing platforms.

- **When developing innovative projects, organisations should identify ways to work together to avoid duplication of efforts and build on their respective strengths.** Their support is particularly important in implementing open data resources and standards that can improve data sharing. Working with frontier technologies requires adequate equipment and analytical techniques, which are not necessarily accessible to actors outside the private sector. If the right incentives are in place, private sector innovators could take the lead in creating mechanisms to crowdsource innovations and technologies.

- **Solution providers should take an inclusive approach to design, ensuring that the solutions they develop empower end users and consider the needs of those most likely to be left behind.** In many areas of the Philippines, the digital ecosystem is still nascent, which means there cannot be a one-size-fits-all approach. For instance, initiatives aimed at improving access to information and strengthening response capabilities should consider the local context, such as customs and languages, to build trust and maximise impact. In some cases, leveraging low-tech solutions may be more appropriate than building cutting-edge solutions that not everyone can embrace.

## International donor organisations

- **International donor organisations should support the government in implementing policy reforms and provide capacity building and technical assistance.** In line with government priorities, they can provide training to government officials and public health employees, for example on data management and analysis skills. This is especially important at the local level where public funding is lacking. Donors should also strive to empower the population, for instance, by working in partnership with civil society organisations that are dedicated to advancing the digital skills and literacy of citizens.

- **When supporting innovators to develop digital solutions that enhance disease surveillance, international donors could disseminate best practices from established projects in other LMICs and encourage cross-pollination.** When promoting international best practices, including the use of frontier technologies, it is always important to focus on mutual knowledge sharing, take local dynamics and constraints into account and pay attention to the specific needs of local actors.

- **International donors should coordinate approaches, financing and support to avoid duplication of efforts.** Focusing on underlying challenges, such as coordinating multilateral efforts or improving public procurement, is particularly important to ensure policy reforms are impactful and sustainable. For instance, donors should cooperate on standard setting to facilitate the provision of open data. Supporting the standardisation of data collection and information sharing and reporting in line with existing frameworks enables data sharing at regional and international levels, which is crucial for effective disease surveillance.

# Annex 1: Detailed methodology

The aim of this study was to understand the existing disease surveillance and monitoring (DSM) system in the Philippines and to identify how digital interventions can strengthen it. Key components of the research were a desk-based literature review of digital solutions in the Philippines and the readiness of the country to adopt digitally-enabled DSM systems to build a database of best practices and prioritise potential solutions; 34 stakeholder interviews with experts and practitioners and analysis. The main components of the methodology are explained in the following sections.

## Desk-based research

The first task was to conduct secondary research to gather information on existing DSM processes; the digitalisation of the Philippines and the adoption of mobile and digital tools for DSM; and lessons to enable or strengthen digital solutions that have been implemented in other LMICs. The review included secondary sources, such as academic peer-reviewed journals and grey literature from NGOs and donor institutions.

## Stakeholder interviews

Interviews were conducted to validate the findings and cover gaps in the literature. The team conducted 21 semi-structured interviews with relevant DSM experts and stakeholders in the Philippines. Interview guides for each stakeholder group (government, civil society, community organisations, tech companies, etc.) were produced during the inception phase and then adapted based on the desk research findings and analysis.

The first interviews were conducted with international experts to gain a general understanding of DSM processes and the potential role of digital innovation. Once the research revealed how digital solutions could address the current challenges or weaknesses in DSM systems in the Philippines, another set of semi-structured interviews was conducted with innovators and developers of digital solutions that have strengthened surveillance and monitoring systems in LMICs. A total of 13 international interviews were conducted.

Verbatim transcripts in English were produced for each interview. Verbal informed consent was obtained from each interviewee. Recordings were transcribed for analysis.

# Annex 2: Stages of disease surveillance

Well-functioning disease surveillance systems have core functions to ensure that disease cases and outbreaks are detected and recorded and adequate responses are implemented. Table A.2 describes in detail what each core function entails.

**Table A.2: Core functions of disease surveillance**

| Core functions[95] | Description |
|---|---|
| **Case detection** | Case detection is the process of identifying cases and outbreaks through the public health system, private health systems or community structures. Case definitions and a functioning trend verification system are vital for detecting cases and outbreaks. |
| **Case registration and confirmation** | Case registration is the process of recording identified cases and requires a standardised register to record data on targeted diseases and conditions. Effective case registration depends on the epidemiological and laboratory capacity for confirmation, which in turn requires capacity for appropriate specimen collection, packaging and transportation. |
| **Information sharing and reporting** | Information sharing and reporting is the process of sharing information on both suspected and confirmed cases with relevant stakeholders. It aims to support data analysis to identify potential trends in emerging disease outbreaks, and to inform decision-making on minimising the spread of diseases. Different reporting systems may be in place depending on the type of data and information being reported, where it is being reported and the purpose and level of urgency. |
| **Data analysis and interpretation** | Data analysis and interpretation is the regular analysis of surveillance data and its interpretation for use in public health action. Appropriate "alert" and "epidemic" threshold values for diseases with epidemic tendencies should be used by surveillance staff, and capacity should be established and maintained for routine data analysis and interpretation of both epidemiological and laboratory data. |
| **Response and control measures** | Disease surveillance systems are only useful if the data they provide supports an appropriate public health response to control and prevent outbreaks from escalating. One of the most common response measures is contact tracing, which requires effective dissemination of information and communication with the population. Nonpharmaceutical interventions, such as quarantine measures and lockdown protocols, may also be implemented at scale to control outbreaks, as with the COVID-19 pandemic. |
| **Monitoring and evaluation** | Monitoring and evaluation is an important function of all surveillance systems and in every stage, from determining the proportion of health facilities with standardised registers, to examining the validity and quality of the information recorded, to assessing the capacity to respond to detected outbreaks and emerging public health threats. |

95 WHO. (2006). "Communicable disease surveillance and response systems: guide to monitoring and evaluating".

# Annex 3:
# Current use of mobile and digital technologies for disease surveillance in the Philippines

**Table A.3: Examples of digital innovations and solutions for disease surveillance in the Philippines**

| Digital innovation | Description | Status |
|---|---|---|
| **Case detection** | | |
| **End TB App Suites** | mHealth for Tuberculosis is designed to scale up screening, testing, treating and prevention, and features the achievements of regions and LGUs. Maps and graphs can be downloaded, as well as updates on progress to end TB. | Active |
| **StaySafePH** | The official contact tracing mobile app in the Philippines, operated by the Department of the Interior and Local Government (DILG) and the Inter-Agency Task Force on Emerging Infectious Diseases, and which uses Google-Apple Exposure Notification (GAEN). | Active |
| **Tablet-based mapping of malaria cases** | A surveillance approach whereby simultaneous collection of GPS coordinates on tablet-based applications allow real-time mapping of malaria infections.[96] | No update on current status |
| **Geographical Information Systems (GIS) for dengue surveillance** | GIS are databases that can capture, store, analyse and display data that is linked by a common spatial coordinate system. GIS are most commonly used for data visualisation in dengue surveillance, showing the distribution of disease and changes over time and the identification of spatial relationships with risk factors for disease. Mapping the distribution of dengue in a geographical area allows instant visual identification of areas at risk and enables resources to be mobilised faster. These maps are then used by public health staff to target specific neighbourhoods for immediate dengue control measures. | Active |

96 Reyes, R.A. et al. (2021). "Enhanced Health Facility Surveys to Support Malaria Control and Elimination across Different Transmission Settings in the Philippines". National Library of Medicine National Center for Biotechnology Information.

| Digital innovation | Description | Status |
|---|---|---|
| **Twitter data for syndromic surveillance of dengue and typhoid** | Big data generated from Twitter users' status updates can be used to help predict outbreaks such as dengue and typhoid. | Active |
| **SPEEDIER: Surveillance Integrating Phylogenetics and Epidemiology for Elimination of Disease** | SPEEDIER uses a mobile phone app for data collection and reporting by human and animal health workers and real-time sequencing of viruses incorporated into a genomic surveillance platform to communicate the risks of rabies spread and progress on elimination. It has been implemented in three provinces: Romblon, Mindoro Occidental and Mindoro Oriental. | Active |
| **Registration and confirmation** | | |
| **VigiFlow AEFI Reporting** | This digital data entry form for Adverse Effects Following Immunization (AEFI) is tailored to support the digitisation of the WHO AEFI form used in immunisation programmes for a range of diseases. | Active |
| **COVID-19 Data Repository** | A digital management system for COVID-19 was established in May 2020 by the Phil-Invest Foundation. This is an online portal and cloud storage system to which relevant documents are uploaded by local level healthcare providers and DRUs. | Active |
| **Information sharing and reporting** | | |
| **OHASIS (One HIV, AIDS and STI Information System** | A universal reporting platform of the Department of Health that captures client-based encrypted information about HIV/AIDS and STI prevention, diagnosis, care and treatment until cure or viral suppression. It was designed for more efficient reporting. | Active |
| **Community Health Information Tracking System (CHITS)** | CHITS is the first homegrown electronic medical records system in the Philippines, employing an open-source, user-friendly, modular and extensible system that enables automation of core processes in health centres, supporting the effective and efficient delivery of services.[97] | Active |
| **Online Malaria Information System (OLMIS)** | A web-based system that serves as a tool for data collection, processing, reporting and the use of information. OLMIS complements the Philippines' malaria elimination strategy and was developed to ensure ease of access for users with an Android app for mobile phones and the web.[98] | Active |

97 Development Academy of the Philippines. (2020). "Community Health Information Tracking System (CHITS)".
98 WHO. (2018). "Eliminating malaria with better monitoring in the Philippines".

| Digital innovation | Description | Status |
|---|---|---|
| **COVID Kaya** | This digital platform for information management is considered the central repository of COVID-19 data in the country. It stores data from all confirmed cases and their close contacts, which totals around 2 million individual records. This comprehensive data enables the government to make evidence-based decisions and actions. The Department of Health COVID tracker of national case numbers and statistics that is published daily takes its reports directly from the database, making the system not only useful for surveillance and contact tracing, but also for monitoring the use of of hospital and treatment facility beds and equipment and for calculating positivity rates, case fatality rates and the demographics of the affected population.[99] | Active |
| **DataCollect App (Department of Health)** | This app gathers daily data from hospitals and stakeholders, including essential resources and supplies, availability of hospital beds, isolation rooms, ICU beds and mechanical ventilators and human resource needs. It accurately calculates the projected need for personal protective equipment (PPE) and links to logistics offices for delivery of supplies. This facilitates easier and faster tracking of reports between DOH offices. All partner hospitals are mandated to implement this system of data collection.[100] | Active |

## Data analysis and interpretation

| | | |
|---|---|---|
| **OCTA research on data analytics for COVID-19** | Throughout the pandemic, OCTA systematised and analysed data and created public- and government-facing dashboards to support decision-making and response. | Active |
| **Feasibility Analysis of Syndromic Surveillance Using Spatio-Temporal Epidemiological Modeler for Early Detection of Diseases (FASSSTER)** | The official COVID-19 modelling tool of the Philippines, it aims to provide a user-friendly tool for modelling disease spread to aid in the DOH disease surveillance efforts. It takes a multi-dimensional approach to modelling disease spread by using localised indices from Philippine health records and by integrating other data sources, including but not limited to, disease and event surveillance systems and electronic medical records.[101] Based in the Ateneo Center for Computing Competency and Research, Ateneo de Manila University. | Active |

99 WHO. (2020). "COVID Kaya: A Digital Platform for COVID-19 information Management in the Philippines".
100 DOH. (13 April 2020). Press Release: "DOH Launches New COVID-19 Tracker and DOH DataCollect App".
101 Data from interview with an innovator.

| Digital innovation | Description | Status |
|---|---|---|
| **Disease control measures** | | |
| **COVID-19 Tracker (DOH)** | The COVID-19 Tracker enables daily submissions of new cases to hospitals and helps to inform which areas should have stricter local quarantine classifications. It also features additional information on the epidemiology of COVID-19 in the country, COVID-19 testing, health facilities and availability of PPE. The public can view data on the laboratory testing capacities of DOH-accredited laboratories, including the total number of tests and unique individuals tested. It also provides a snapshot of the capacity of the Philippines' health system to respond to the pandemic based on data collected from the DOH DataCollect app.[102] | Active |
| **KIRA (Knowledge Informs Responsible Action) bot** | An automated chatbot that allows people to gain knowledge and access new information related to COVID-19. Accessible via the DOH Facebook page with Messenger, the DOH Viber community and the KontraCOVID PH website, the chatbot answers common questions about the virus, tips on staying healthy and a self-assessment tool for symptoms. Apart from Facebook, the DOH also partners with Google, Senti, Aiah, A14GOV, Plan International, UNDP and Rakuten to make KIRA available on other platforms. The agency is currently working with telecommunications companies to offer the chatbot across all platforms for free.[103] | Active |
| **Tacloban Safe City App** | A Quick Response (QR) code system, this contact tracing and emergency response app supports SMS-based or offline options to receive services, such as applying for a health certificate and COVID-19 vaccination registration. | Active |
| **StaySafePH** | The official contact tracing mobile app in the Philippines, operated by the Department of the Interior and Local Government (DILG) and the Inter-Agency Task Force on Emerging Infectious Diseases, and which uses Google-Apple Exposure Notification (GAEN). | Active |
| **WeTrace-Community Tracing App** | Developed primarily for contact tracing and patient mapping, the Cebuano-made mobile app by DXFORM Inc. keeps a timeline of the user's last and current location through geolocation. It also searches other nearby WeTrace users and notifies users who had recent contact with someone who has tested positive for COVID-19. To ensure data privacy and security, each user is provided with a unique QR code. Only the authorities can check the WeTrace data, maximising confidentiality.[104] | Active |

102 DOH. (13 April 2020). Press Release: "DOH Launches New COVID-19 Tracker and DOH DataCollect App".
103 Cabico, G.K. (2020). "DOH Launches KIRA, the KontraCOVID chatbot." PhilStar Global.
104 WeTrace. (2020). WeTrace, Community Tracing App.

| Digital innovation | Description | Status |
|---|---|---|
| **RC143** | A navigational tool that uses Bluetooth and GPS to trace contact events between users. Through the app's unique contact tracing feature, users can assess their risk of contracting the virus and contact Red Cross representatives to learn more about COVID-19 and receive medical assistance.[105] | Active |
| **COVID Watch PH** | This app was developed through a joint effort of the Department of Information and Communications Technology (DICT), Department of Social Welfare and Development (DSWD), Philippine Health Insurance Corporation (PhilHealth) and Galileo Software to monitor local COVID-19 cases. Apart from being a contact tracing app, COVID Watch PH provides triage assessment and allows a COVID-19 patient to request financial assistance.[106] | Active |
| **TraceFast COVID-19 Exposure** | This is the official Google Apple COVID-19 Exposure Notification App of the Philippines. It is a digital contact tracing app that works by turning on the Bluetooth signal of a 2G, 3G or LTE device to notify those who have been in contact with someone who has tested positive for COVID-19. It also features COVID-19 information, prevention tips, updates and local and global statistics. It is endorsed by the DOH and the Inter-Agency Task Force (IATF) on Emerging Infectious Diseases and developed by Multisys Technologies Corporation.[107] | Active |
| **Southern Leyte ACTS** | A QR code system for contact tracing purposes in the province of Southern Leyte. | Active |
| **National Malaria Bed Net Survey** | A project that uses digital technology to collect data on bed net usage as part of malaria control measures. Enumerators use an open data kit (ODK), an easy tool to learn and use. | Active |

105 Globe Telecom Inc. (2020). "Globe Partners with Philippine Red Cross to Support Rapid COVID-19 Response App".
106 Sta Ana, J. (2022). "Local Android Apps and Websites for tracking COVID-19". YugaTech.
107 Maala. (2020). "TraceFast COVID-19 Exposure app now available on iOS". YugaTech Feature.

# Glossary of terms

| | |
|---|---|
| **Artifical intelligence (AI)** | The ability of a machine or computer to emulate human tasks through learning and automation. |
| **Big data** | Large amounts of digital data, often generated passively by mobile and other digital technologies.[108] It is often generated in large volumes from various resources at a fast speed.[109] In this report, we refer to "mobile big data (MDB)" in instances where big data is specifically generated by mobile technology. |
| **Digital technologies** | In this report, digital technologies include those technological solutions that are enabled by connectivity and data (e.g. IoT, big data and AI) but differ from mobile technologies (e.g. SMS, USSD, mobile apps). Occasionally in this report we use "frontier technologies" as a synonym for digital technologies. |
| **Disease surveillance** | The collection, analysis and interpretation of data for planning, implementing and evaluating public health policy and practice.[110] |
| **Internet of Things (IoT)** | IoT refers to internet-connected devices, appliances, systems and sensors.[111] |
| **Mobile technologies** | Mobile technology is the technology used for cellular communication. It consists of portable two-way communications devices, computing devices and the networking technology that connects them. |

108 United Nations. (n.d.). Big Data for Sustainable Development.
109 GSMA. (2018). IoT Big Data Framework Architecture. Version 2.0.
110 WHO. (2006). "Communicable disease surveillance and response systems: guide to monitoring and evaluating". World Health Organization Institutional Repository for Information Sharing.
111 GSMA. (2018). IoT Big Data Framework Architecture. Version 2.0.

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