

The State of Digital Health 2019

GLOBAL DIGITAL
HEALTH INDEX



ACKNOWLEDGEMENTS

The Global Digital Health Index (GDHI) is as good as the countries who participate in it. This inaugural State of Digital Health report would not have been possible without the support of our partners in the 22 GDHI early adopter countries, including Afghanistan, Bangladesh, Benin, Chile, Ethiopia, Indonesia, Jordan, Kuwait, Lao People's Democratic Republic, Malaysia, Mali, Mongolia, New Zealand, Nigeria, Pakistan, Peru, Philippines, Portugal, Sierra Leone, Sri Lanka, Thailand, and Uganda. Together, they have given life to the GDHI platform and enabled us to learn from the global and regional trends observed through the data that they have contributed.

We would also like to add a special thank you to our Steering Committee members, who have provided invaluable guidance and support to the GDHI through the years. In particular, three Steering Committee members — Adele Waugaman, Chaitali Sinha and Rajendra Gupta — also served as peer reviewers for the State of Digital Health 2019 report, and we are deeply appreciative of their thoughtful feedback. We would like to thank Sara Wallace Beatty and Christine Dickason of the Global Development Incubator for their contributions and editorial expertise throughout the report process. In addition we would like to thank our digital health trends data partners Reena Sangar at IPSOS Healthcare and Sara Campbell and Melissa Coniber at Royal Philips.

Last but not least, we are grateful for Johnson and Johnson's funding support for this report and for their continued leadership in identifying opportunities that will move the field of digital health forward.

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Executive Summary

As our world embraces the adoption of digital technology in all aspects of life, health leaders have an unprecedented opportunity to use that technology to bolster existing health systems and increase the access to and quality of care worldwide. Opportunities to leverage digital health to reduce inequalities in health and well-being rely on the availability of accurate, timely, and reliable data that are triangulated with existing data sources.

In 2016, HealthEnabled and its partners embarked on a journey to fill this knowledge gap through the development of the Global Digital Health Index and Maturity Model, an innovative, interactive digital resource that tracks, monitors, and evaluates the use of digital technology for health across countries. Since launching in 2018, the Index has acquired critical data on the status of digital health ecosystems in 22 participating countries.

“The GDHI helped us gather baseline data for our major digital health interventions. During the revision of our Health Information System strategic plan, we used the country scoring in the GDHI to serve as a baseline and set targets in different areas.”

- **NETSANET ANIMUT,**
FEDERAL MINISTRY OF HEALTH,
ETHIOPIA

The inaugural State of Digital Health 2019 report provides the first ever snapshot of digital health ecosystems throughout the world and lays the foundation for better informed and coordinated investments in digital health. Furthermore, this initial effort is intended to catalyze other countries to contribute their data to the Index so that future analyses can be even more comprehensive and actionable. The report presents the data collected from these 22 countries across 6 different regions, analyzes emerging trends, and sets benchmarks to consider when charting future growth and contextualizes the findings in relation to digital health milestones and other global trends analyses.

Integrating technologies such as mobile phones, tablets, remote patient monitoring devices, and sensors into health systems can save lives, extend the reach of healthcare

services, and reduce healthcare costs—yet many countries face persistent challenges in implementing sustainable digital health solutions at scale. Key findings from the State of Digital Health 2019 report reveal that the average digital health ecosystem maturity is phase three out of five around the world, with leadership and governance being the strongest digital health ecosystem component measured by the GDHI.¹ However, there is still a significant amount of work to be done to improve the digital health ecosystem, with the two weakest areas in standards and interoperability and digital health workforce development. Countries throughout the world lack national digital health architectures, health information exchanges, and data standards, which can slow progress in the digital health space. In addition, our analysis finds that countries in Africa lag behind global averages, indicating a need for a particular focus on investment in that region.

The State of Digital Health 2019 report aims to motivate global leaders with a unified call to action. We cannot wait for the technology revolution to come to us in digital health; it's already happening. What we can do is play a role in improving the data on existing digital health ecosystems, which will in turn provide clear paths forward for improving them. Encouraging countries to participate in the Index is the first step on this path towards progress, and towards catalyzing and maintaining the momentum. Let us commit to working together to ensure our world is healthier, stronger, and on its way towards a brighter future with the help of robust digital health ecosystems.

We cannot wait for the technology revolution to come to us in digital health; it's already happening.

1 GDHI's maturity model is a roadmap for a country's digital health growth, recognizing the diversity that could exist within each phase of digital health development. GDHI uses a capability-based approach, with five phases of the maturity model corresponding to different capability sets, thus allowing countries to identify and improve specific weaknesses in capability.

Introduction

The World Health Organization (WHO) Resolution on Digital Health that passed in May 2018 championed countries' embrace of the rapid adoption of technology to strengthen health systems and achieve universal health coverage (UHC). To do so, countries require appropriately designed and scalable digital health solutions, supportive policies, regulatory environment and infrastructure, increased opportunities for financing, and sustainable local capacity.

While every country's digital health ecosystem is unique, each rests on the same underlying components. Currently, most countries do not have the enablers in place to maximize the benefits of digital health to improve health outcomes and health systems. The lack of visibility or roadmap towards the maturity of digital health has led to persistent fragmentation and inefficiencies at the national and sub-national level, impeding countries from maximizing their investments in digital health. There is an opportunity to support countries to design and scale digital health solutions, develop supportive digital health policies, increase opportunities for financing, and build local capacity to sustainably implement digital health.

"The GDHI's visual map graphics are very helpful. The index provides a quick snapshot of digital health ecosystem maturity at the global and national levels that can be easily shown at presentations and events. These indicators help inform strategic and constructive discussions around Chile's digital health ecosystem."

- MAURIZIO GIORGIO MARIO MATTOLI
CHIAVARELLI, INSTITUTO DE CIENCIAS
E INNOVACIÓN EN MEDICINA (ICIM),
FACULTAD DE MEDICINA CLÍNICA
ALEMANA-UNIVERSIDAD DEL DESARROLLO

The **Global Digital Health Index (GDHI) and Maturity Model** has been working with countries and collaborating partners throughout the world to track and measure global progress in digital health. Data from the first 22 GDHI countries are presented here in the inaugural State of Digital Health Report and provide an overview of the current state of digital health in the world. They are also contextualized within key digital health milestones and other global trends analyses. In the future, the GDHI aims to grow the number of participating countries to increase the comprehensiveness of the data and presentation of trends included in this annual report.

The GDHI is an interactive digital resource that enables countries to assess their maturity in digital health and benchmark themselves against other countries. Recognizing the value of leveraging and triangulating with existing data sources, the GDHI was intentional in its design process to engage with different data producers and data users. Designed using the **WHO/ITU eHealth Strategy Toolkit**, the GDHI empowers health ministries, funders, policymakers, and industry players with data to make informed strategic decisions and investments in the enablers of digital health such as governance, interoperability,

privacy and security policies, workforce, and infrastructure as they strive to build sustainable digital health solutions at scale. The GDHI launched alongside the World Health Organization Resolution on Digital Health in May 2018.

The GDHI has three main objectives:

- **Empower:** The Index is an interactive database that provides visibility into the status, maturity, and historical progression of key digital health performance indicators at a national and global level.
- **Evaluate:** The Index benchmarks countries along a maturity model against standardized digital health indicators. It assesses the presence of national policies and strategies, investment risks, and coverage of key digital health platforms and provides a roadmap for maturing over time.
- **Motivate:** The Index helps countries track progress and identify weaknesses within their digital health ecosystems. It incentivizes improvements in national digital health systems and more targeted global digital health investments that can benefit multiple countries. It facilitates learning and sharing of resources from and by countries that are further ahead in specific areas.

The GDHI was developed as a global public good and open knowledge platform in alignment with the Principles for Digital Development and Digital Square Global Goods. It is a multi-stakeholder initiative currently incubated by the Global Development Incubator with technical leadership provided by HealthEnabled and governed by a Steering Committee comprised of representatives from the Asia eHealth Information Network, Bill & Melinda Gates Foundation, Commonwealth Medical Association, HIMSS, International Development and Research Centre, Johns Hopkins Bloomberg School of Public Health, Johnson & Johnson, International Society for Telemedicine and eHealth, Ministry of Public Health of Mali, Ministry of Public Health of Thailand, PATH, Royal Philips, USAID, and WHO. In addition to the Steering Committee, a broad range of collaborating partners have engaged in the design, development, and testing of the Index, including over 20 Ministries of Health, PAHO, and ITU.

“Using the GDHI, we were able to identify areas of digital health in our country, Sri Lanka, where we have made progress or where we are lacking. This information empowers better decision making on our allocation of resources and effort. The GDHI also helped us identify countries we can learn from that are performing well in the indices we are lagging behind in.”

- DR. RYTHMI RAGUNATHAN, INSTITUTE OF MEDICINE, UNIVERSITY OF COLOMBO

Year in Digital Health

2018 was a banner year for digital health globally. Several milestones in 2018 or that are planned for 2019 are creating a solid foundation for the field of digital health as it matures. Global trends and emerging innovations are shaping the field in new and exciting ways. These milestones and trends are creating the conditions for which the GDHI can help advance the field by helping to inform global and regional strategies as well as monitor the overall maturity of digital health globally and by country.

Digital Health Milestones

The most noteworthy milestone in 2018 was the adoption of the WHO Resolution that aligns the use of technology with the achievement of the **Sustainable Development Goals (SDGs)**, including SDG 3: Good Health and Wellbeing. The Resolution calls for advancements in digital health related to scale with a focus on equity, support for national and global health priorities, promotion of evidence and interoperability, dissemination of best practices and sharing of experiences, public health resilience, health and digital health workforce development, public engagement and trust in digital health, protective policies, and strategic collaborations. It also calls on the WHO to develop a global digital health strategy and define its role in the field; elevate its strategic capacity in digital health; provide technical assistance and normative guidance to Member States; build on its strength in regulation related to health data protection; develop a repository of regulations, evidence, and best practices; monitor developments and trends; and promote collaboration with a report back on progress in 2020. In alignment with the WHO Resolution, WHO is leading other efforts including the **Classifications for Digital Health Interventions** to provide a standard taxonomy and language for digital health; the **Digital Health Atlas** to enable countries to inventory and track digital health implementations and platforms; and the **Digital Health Guidelines** to provide evidence base recommendations and insights. In addition, the **WHO Declaration on Primary Health Care 2018** highlights technology as an important driver in the achievement of access to health for all.

Various collaborations are also helping to raise the bar on the field of digital health, including the Global Digital Health Partnership, which facilitates cross-country partnerships, and the Health Data Collaborative Digital Health and Interoperability Working Group, with its strategic focus and the development of tools to support countries in the areas of interoperability and continuous improvement for HIS. In 2018, the Broadband Commission published a report looking at the role of digital health in relationship to non-communicable diseases, including diabetes. In addition, in October 2018 the Donor Alignment Principles for digital health were launched at the World Health Summit in Berlin to promote country ownership and leadership and pooled funding across donors to support national-led efforts.

The overall maturity of digital health is also being driven by the networks that help to advance the field globally and regionally, including the Global Digital Health Network, Asia eHealth Information Network, African Alliance of Digital Health Networks, International Society for Telemedicine and eHealth, Commonwealth Medical Association Centre for Digital Health, Eastern Mediterranean Public Health Network, and Central American Health Informatics Network.

“I learned that my country, Chile, does not have records of what percentage of public spending is earmarked for digital health. Our government spending classification does not include such specification nor granularity level. The process of collecting country data for the GDHI has confirmed some of the gaps we still have, including that perhaps we should suggest classification system changes in order to monitor digital health spending in the future.”

- MAURIZIO GIORGIO MARIO MATTOLI
CHIAVARELLI, INSTITUTO DE CIENCIAS
E INNOVACIÓN EN MEDICINA (ICIM),
FACULTAD DE MEDICINA CLÍNICA
ALEMANA-UNIVERSIDAD DEL DESARROLLO

GDHI Methodology

The GDHI strives to raise the bar on the field of digital health and is largely driven by the following theory of change and use cases, which are prioritized through a participatory design, development, and testing process involving a broad range of government, private sector, academic, NGO, and other key digital health stakeholders from around the world.

THEORY OF CHANGE

If countries are able to measure and monitor their progress and maturity in digital health,



... then they can identify key gaps to inform the development of policies, scale up and integration of systems, and investment in human and financial capital.



This contributes to a supportive enabling environment and the availability, quality, and use of data to measure and track the strength of the health system and the ability for countries to achieve Universal Health Coverage and improved health outcomes.

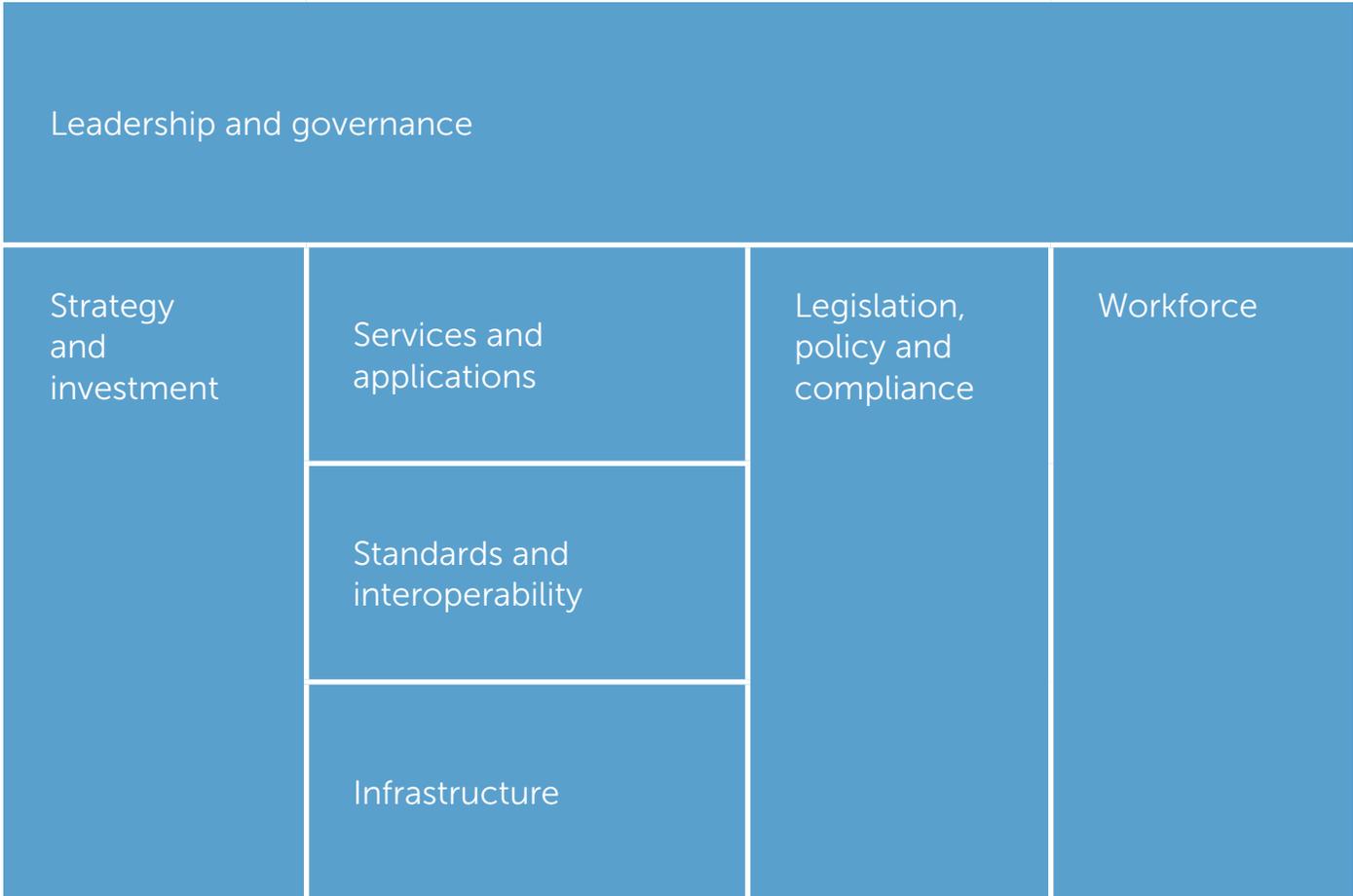
GDHI USE CASES

USE CASES	EXAMPLES OF USERS
Benchmark a country on a spectrum of adoption of digital technologies for health, and help countries track progress and maturity over time.	<ul style="list-style-type: none"> • Governments • International Organizations and NGOs • Donors
Advocate for resources to be allocated for digital health at a country and international level to promote donor, public, and private sector investments.	<ul style="list-style-type: none"> • Governments • Private companies • Donors • International Organizations and NGOs
Create an avenue to find countries performing well or with key lessons learned to facilitate cross-country learning.	<ul style="list-style-type: none"> • Governments
Support private sector entrepreneurs and investors to strategically prioritize new market entry and strategies.	<ul style="list-style-type: none"> • Private companies

The GDHI purposefully aligns with the WHO Digital Health Resolution and can serve as a baseline to inform the development and monitoring of national strategies and plans of member states as well as a global digital health strategy. This web-based resource also integrates a digital health maturity model by reflecting countries' digital health development trajectory across 5 maturity phases and enables countries to select and benchmark themselves against the global average for each indicator or other phases of maturity. It was designed to complement the data related to digital health projects and systems captured in the WHO Digital Health Atlas and align with the Measure Evaluation Interoperability Maturity Matrix. At the country level, the tools are being implemented alongside each other in various combinations. A good example of this is in Sierra Leone where the GDHI and the Atlas were implemented side-by-side to inform the development of the newly adopted National Digital Health Strategy.

The web-based GDHI platform uses 19 core indicators for measuring progress in digital health at the country level across the seven components of the WHO/ITU eHealth Strategy Framework. Through two rounds of participatory design workshops with digital health

COMPONENTS OF THE WHO/ITU EHEALTH STRATEGY FRAMEWORK



Source: WHO/ITU eHealth Strategy Toolkit

CASE STUDY 1

The Use of the GDHI in Sierra Leone's National Digital Health Strategy

The Sierra Leone National eHealth coordination hub, an inter-ministerial body hosted at the Directorate of Planning, Policy and Information, was launched in 2017 with the mandate to coordinate and regulate digital health deployments in the country. The hub commissioned the assessment of the digital health interventions in the country and the development of a national digital health strategy to support these coordination efforts.

In Sierra Leone's 2018-2023 National Digital Health Strategy, the GDHI was used as a tool alongside the Digital Health Atlas and informal stakeholder work-sessions to examine Sierra Leone's digital health enabling environment maturity phase. The maturity phase of Sierra Leone, according to the attributes that make up the seven components of the digital health enabling environment, was benchmarked against the world average using the GDHI.

This assessment found that Sierra Leone's digital health is in the "developing and building-up" phases and will transition to the "scaling-up" phase of the WHO/ITU digital health enabling environment matrix. In particular, according to the GDHI indicators, the country is below the world average in all seven digital health enabling environment components: Leadership and Governance; Strategy and Investment; Policy, Legislation, privacy and Compliance; Architecture, Standards and Interoperability; Workforce; Services and Applications; Infrastructure.

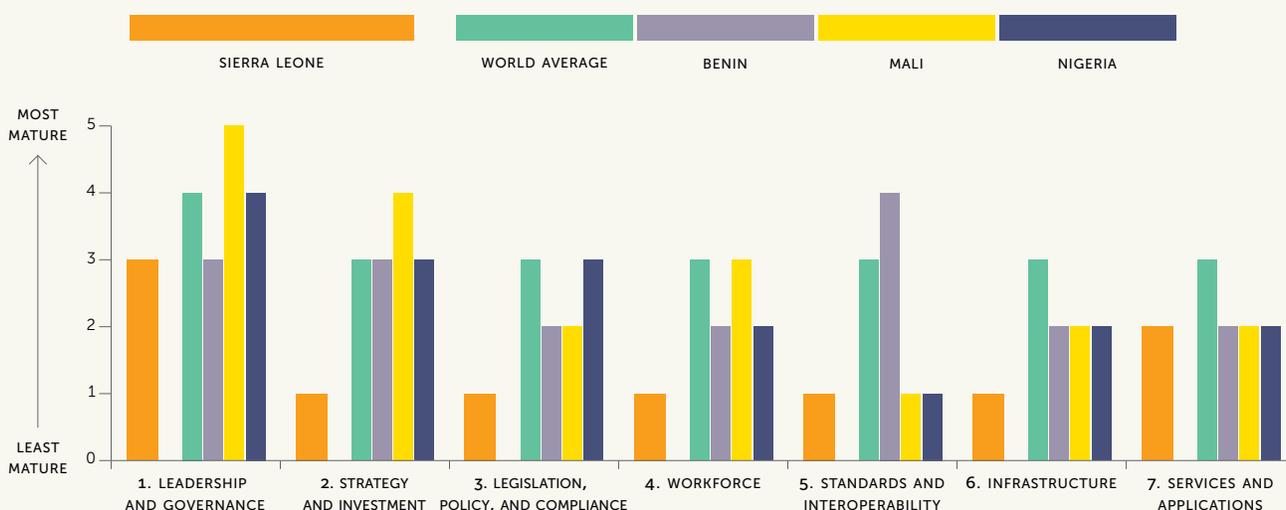
The strategy builds on the findings on Sierra Leone's digital health enabling environment and provides a guide to the deliberate and systematic scale-up of ICT adoption within Sierra Leone's health sector towards an inter-connected health system.

In particular, GDHI shows that Sierra Leone's digital health capacity building strategy and efforts are mostly non-existent. The Ministry of Health and Sanitation (MoHS) currently manages the health workforce using the iHRIS

platform and an Attendance Monitoring System (AMS), both managed by the Human Resources Directorate. The government of Sierra Leone also recently approved a cadre of ICT civil servants through an act of parliament, which is a critical first step in making available the ICT support skills required for deployed services and applications. Sierra Leone's 2018-2023 National Digital Health Strategy addresses this critical gap by making the following recommendations:

- Determine the workforce needs for digital health and ensure functions represented at all levels are aligned with relevant ministries.
- Deliberately invest in digital health expertise needed to implement the strategy and beyond. The required skills vary from standards development, to management and governance of enterprise IT, to systems application support and administration.
- Adapt mainstream digital health training for health institution curricula. This will help increase awareness of digital tools among the health workforce.
- Develop a protocol to guide digital health support and digital health user capacity building plans for new service and application deployment.
- Strengthen the community health promotion services with digital health.
- Develop a protocol for digital health cadre similar to the ICT cadre in the federal civil service.
- Assess, standardize and strengthen iHRIS to ensure linkages with other health information systems to facilitate interoperability and shared value.

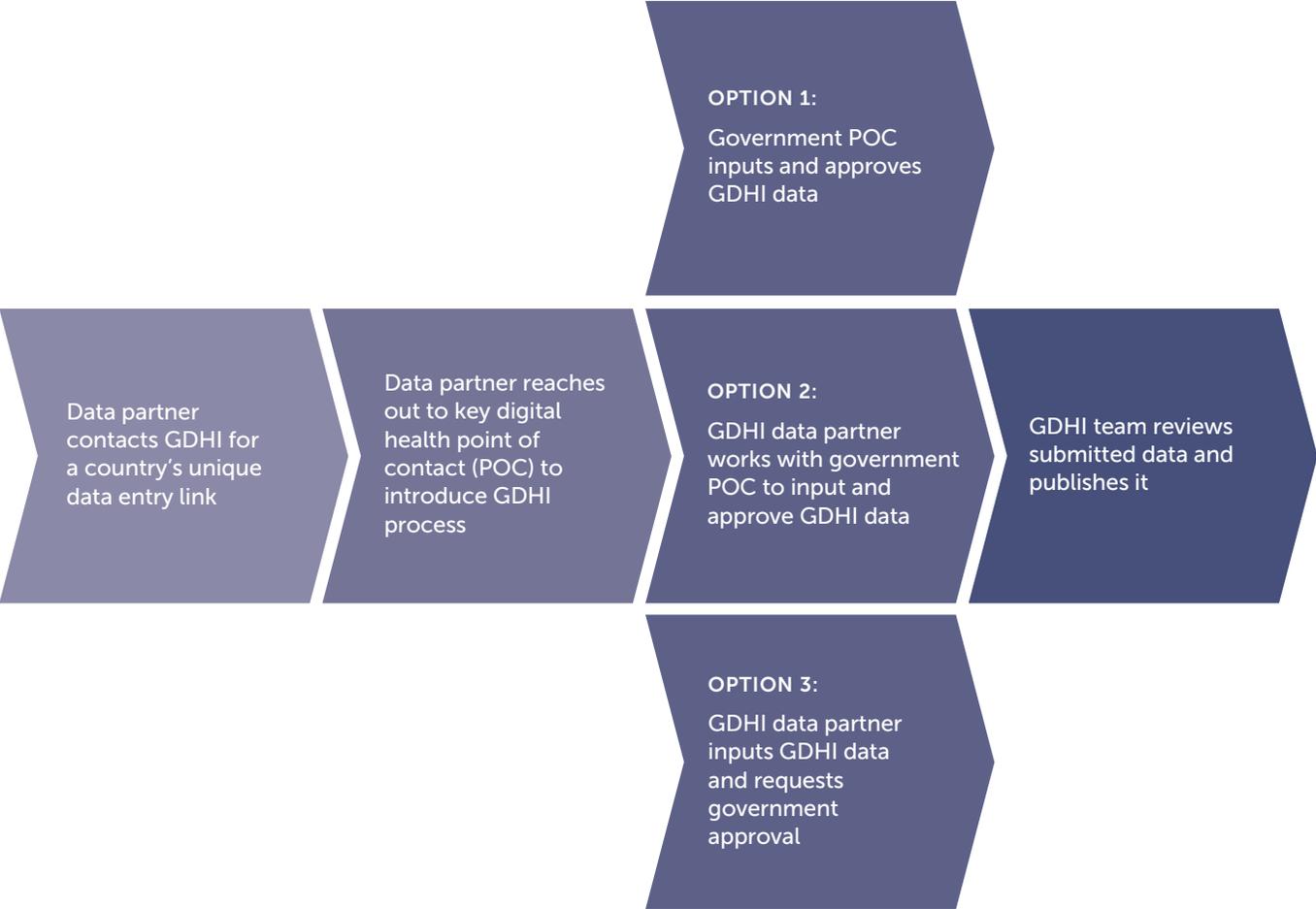
Source: Sierra Leone National Digital Health Strategy 2018-2023



practitioners and experts, the GDHI prioritized these key indicators from 155 possible indicators to reach a set of user-friendly yet representative measures of the robustness of the digital health ecosystem components within a country. The indicators were then applied to different regional and high-, middle-, and low-income country contexts and refined through user testing.

The GDHI self-assessment process is largely led by the Ministry of Health (MoH) or with the support of digital health partners in the country. In the average phase calculations, the platform rounds up as the tool is meant to help celebrate achievements, inform planning, and track progress over time. All the data posted publicly is approved by the MoH, and under the open data policy of the GDHI, the data cannot be used for commercial purposes. The following is an illustration for how countries participate in the Index.

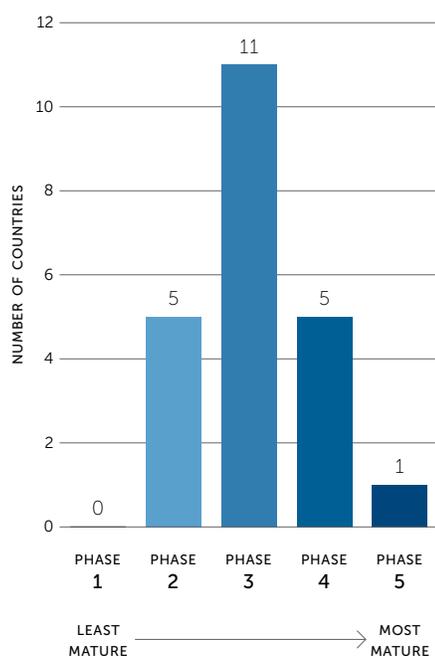
COUNTRY PARTICIPATION MODEL



The State of Digital Health 2019

From the data of the 22 current GDHI countries, trends are emerging in key areas of strength at a global level including the presence of national digital health strategies and governance. Major challenge areas include workforce, interoperability, privacy, and cross-border data policies.

DIGITAL HEALTH MATURITY PHASE DISTRIBUTION



CURRENT GLOBAL DIGITAL HEALTH INDEX COUNTRIES

WHO region:		DIGITAL HEALTH MATURITY PHASE
Africa	Benin	3
	Ethiopia	3
	Mali	3
	Nigeria	3
	Sierra Leone	2
	Uganda	2
Eastern Mediterranean	Afghanistan	2
	Jordan	4
	Kuwait	3
	Pakistan	2
Europe	Portugal	4
The Americas	Chile	3
	Peru	3
South-East Asia	Bangladesh	4
	Indonesia	3
	Sri Lanka	3
	Thailand	4
Western Pacific	Lao People's Democratic Republic	2
	Malaysia	5
	Mongolia	3
	New Zealand	3
	Philippines	4

As more countries engage and we move from a single year of data to multiple years, the value of the tool and the insights it generates will increase. The GDHI aims to have all WHO Member States participate to gain a more complete sense of the state of digital health globally.

Most countries are at average digital health maturity overall. Across the board, half of the GDHI's countries are at maturity phase 3 out of 5, with the other half almost equally split just above and below average, at maturity phases of 2 and 4. The only maturity phase 5 country is Malaysia (see case study 2), and there is great inter-country and intra-country variability depending on the indicator and ecosystem component.

CASE STUDY 2

Digital Health in Malaysia

Malaysia has a long history in digital health with multiple eHealth strategies spanning over 15 years. Its current eHealth strategy is aligned to the national 5-year rolling Malaysia Plans for social and economic transformation. For a nation that is facing the challenges of an aging population, escalating medical costs, and increasing burden from chronic diseases, the current eHealth revolution is timely.

Multiple eHealth initiatives are currently being implemented. The Malaysia Health Information Exchange, which was launched in 2009, creates a patient record interoperability platform for data sharing, a precursor to public-private integration in the Malaysian health sector. Several key solution implementations have also been launched. They include hospital information systems, currently deployed in various public hospitals; a primary care clinical system called TPC-OHCIS (Integrated Primary

Care and Oral Health Clinical Information System) being piloted in 12 clinics for eventual nationwide roll-out; and a pharmacy information system nationwide in all MOH facilities. The Malaysia Health Data Warehouse launched in 2017 serves as a key repository centre of health data for analytics, strategic planning, evidence-based decision making, and research.

In addition, Malaysia is known in the digital health field for embracing innovation and emerging technology trends including wearables and other connected medical devices.

Malaysia's GDHI scores illustrate its cultivation of leadership as well as its relatively high investment in technology and push towards scale up of services and applications, while ensuring that the enablers for digital health are in place.

MALAYSIA GDHI SCORES

COMPONENTS	DIGITAL HEALTH MATURITY PHASE				
1. Leadership and Governance	■	■	■	■	■ 5
2. Strategy and Investment	■	■	■	■	■ 5
3. Legislation, Policy, and Compliance	■	■	■	■ 4	
4. Workforce	■	■	■	■ 4	
5. Standards and Interoperability	■	■	■	■ 4	
6. Infrastructure	■	■	■	■ 4	
7. Services and Applications	■	■	■	■	■ 5

Countries' Leadership and Governance assessments are ahead of other digital health areas. Among the seven components of the WHO/ITU eHealth Strategy Framework, the global average in Leadership and Governance was higher than the global average in the other six components. On average, countries are at maturity phase 4 for Leadership and Governance, meaning:

- Digital health governance structure is fully-functional, government-led, consults with other ministries, and monitors implementation of digital health based on a work plan.
- Digital health is being implemented as part of national health or other relevant national strategies and/or plans.

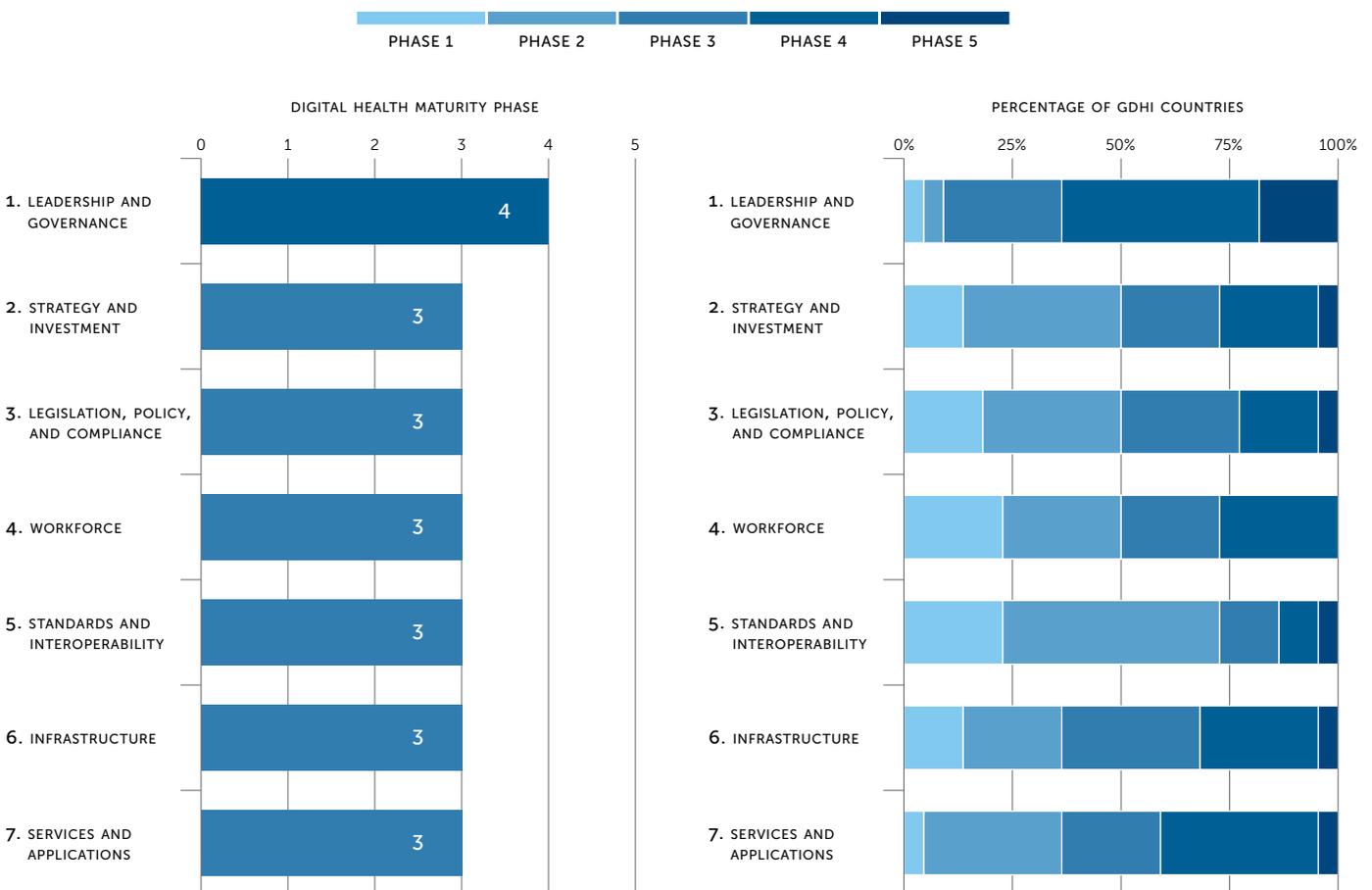
Standards and Interoperability has the lowest maturity phase overall. On average, countries throughout the world lack national digital health architectures and health information exchanges and data standards, leading to the lowest performance in this component.

No country participating in the GDHI has reached maturity phase 5 in Workforce. This reflects relatively weak pre-service and in-service training for health professionals as well as a lack of established career pathways for digital health professionals in the public health sector.

"We were focusing too much on the technology piece and neglected the governance aspect. We learned that to show progress in our digital health efforts, we need to give equal emphasis to all aspects of system implementation and usability. The Health Information System governance work is what has been lagging behind, and the GDHI helped us to prioritize these areas during annual planning."

- NETSANET ANIMUT, FEDERAL MINISTRY OF HEALTH, ETHIOPIA

DIGITAL HEALTH MATURITY PHASE BY COMPONENT (GLOBAL AVERAGES AND DISTRIBUTION)



CASE STUDY 3

Pakistan's Experience Using GDHI

"The most helpful function of the GDHI has been the comparison of Pakistan's digital health ecosystem with the global average and with countries in other maturity phases. It helped us evaluate the progress being made on several indicators and serves as an overall progress tracking system.

Through this process, we learned about several areas of weakness that Pakistan will need to address for an efficient digital health system across the country, including:

- Building a legislative framework to protect individual privacy, governing ownership, access, and sharing of individually identifiable digital health

data. We have already done some baseline work in this regard.

- Creating a digital health curriculum for health professionals as part of pre-service training requirements
- Improving the secure registry, which is currently incomplete and not regularly maintained"

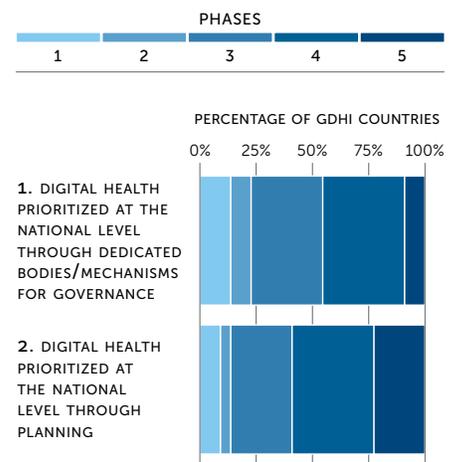
- DR. SYED MURSALIN, MINISTRY OF PLANNING DEVELOPMENT AND REFORM, GOVERNMENT OF PAKISTAN

Breakdown by Component

1. Leadership and Governance

Countries are doing well in prioritizing digital health planning at the national level, although the institutional structures lag behind in terms of the creation of dedicated digital health governing bodies.

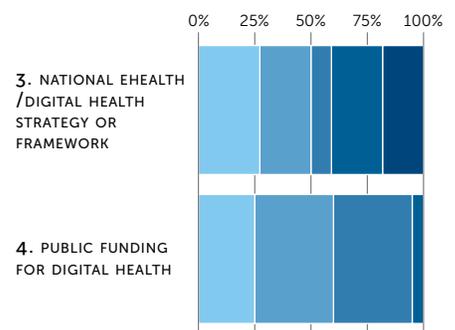
All but two GDHI countries have digital health included in their national health or relevant national strategies and plans. 17 of these 22 countries also have a functional digital health body, although only 10 of these are government-led, of which two have institutionalized the digital health governance structure.

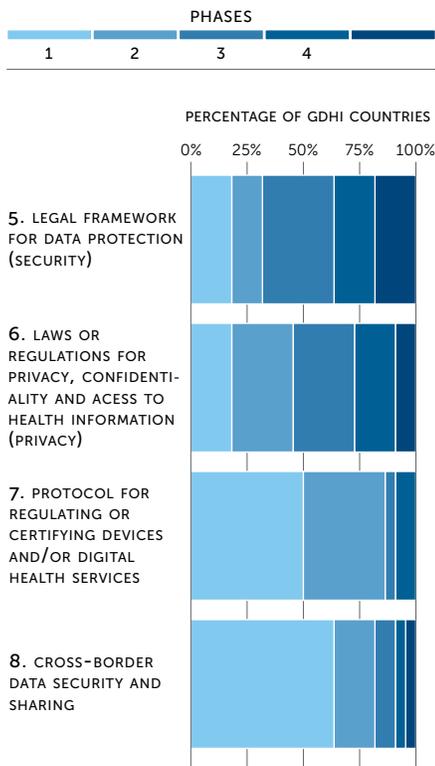


2. Strategy and Investment

National level digital health strategies vary widely. Only 9 of the 22 countries have a national digital health strategy and costed plan fully or partly implemented, while others either have no approved digital health strategy or costed digital health plan at all.

Insufficient public resources are dedicated to digital health. Malaysia reported 3-5% of the national public spending on health committed to digital health, the highest of the 22 GDHI countries. 12 of 19 countries have 0-1% of public health budget for digital health. While there are high expectations for the potential that digital health can have on health outcomes and health systems, the financial investments are not keeping pace with country aspirations.

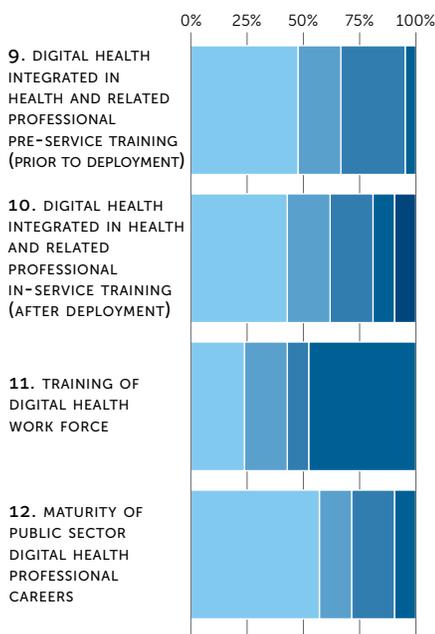




3. Legislation, Policy, and Compliance

Most countries have some laws on data security and privacy, confidentiality, and access to health information, although at different stages of implementation. 18 of the 22 countries have under review or implemented to some degree laws on data security (storage, transmission, use) and to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data. However, only four countries consistently enforce the data security law, and only two countries (Malaysia and Portugal) consistently enforce the privacy law.

Protocols for regulating and certifying digital health devices and services, as well as cross-border data security and sharing, is lacking. 4 of the 22 countries reported having approved protocols, policies, frameworks, or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity, and quality of care. 7 of the 22 countries have approved protocols, policies, frameworks, or accepted processes for cross-border data exchange and storage.

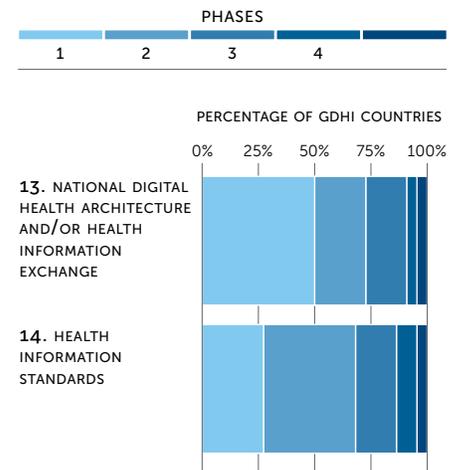


4. Workforce

Building digital health competency among health professionals is a pain point for most countries, although some countries have successfully produced digital health professionals through specialized digital health programs. Currently, 20 of the 22 countries either provide no digital health training to health professionals as part of their pre-service training requirements or only do so for less than 25% of health professionals. This is also the case for in-service training reported by 17 of the 22 countries. However, it is encouraging to see a big push towards establishing digital health, health informatics, health information systems, and biomedical informatics degree programs. These are starting to show promising results in creating specialized digital health workers, particularly in the countries reporting a Phase 4, namely Bangladesh, Chile, Ethiopia, Kuwait, Malaysia, Peru, Portugal, Sri Lanka, Thailand, and Uganda. Despite the availability of training programs, most countries report that they are insufficient for the current demands, and that the career path in the public sector has not yet been established.

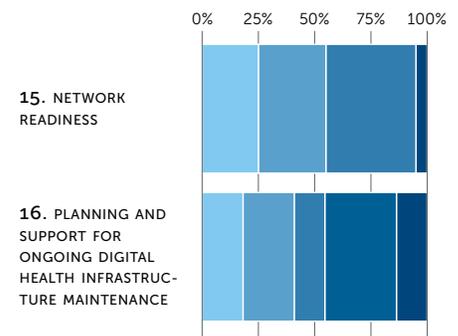
5. Standards and Interoperability

Almost half of the countries do not have national digital health (eHealth) architectural framework and/or health information exchange (HIE) established. However, more countries are implementing data standards. Interoperability is a persistent challenge in most countries. With more digital health services advancing in scale, the need to transition from siloes to integration is increasing. The only country assessing at a Phase 5 in Interoperability in the GDHI is the Philippines. As Sierra Leone was working on their digital health strategy, they were able to use the GDHI to include resources from the Philippines as part of their roadmap to support advancement in this area. The only country assessing at Phase 5 in health information standards is Benin, which has prioritized digital health as an important part of its national health priorities.



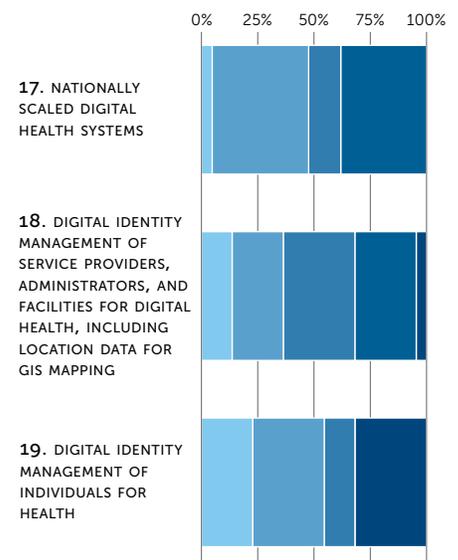
6. Infrastructure

New Zealand is the most advanced in Infrastructure. The GDHI uses the WEF Network Readiness Index to assess the factors, policies, and institutions that enable a country to fully leverage information and communication technologies (ICTs). It provides an indication as to how mature the infrastructure ecosystem is that is needed to support digital health investments. The variability among countries is significant with a more even distribution across maturity phases than other indicators. However, most countries have plans to support digital health infrastructure provision and maintenance in health facilities and offices supported by the public sector, with Bangladesh, Jordan, and Thailand assessing as Phase 5 countries.



7. Services and Applications

No countries reported having fully scaled digital health platforms to address the majority of their national health priorities. Some countries reported having electronic registries that have scaled nationally, particularly for births and immunization. Malaysia is the only GDHI Phase 5 country in this component overall, with the Philippines as the only country reporting Phase 5 for health system registries. Many more countries reported Phase 5 for individual registries, including Chile, Indonesia, Kuwait, Malaysia, New Zealand, Portugal, and Thailand. Countries reporting nationally scaled birth registries include Bangladesh, Chile, Jordan, Kuwait, Malaysia, Mongolia, New Zealand, Peru, Portugal, and Thailand, and those reporting immunization registries include Chile, Kuwait, Malaysia, New Zealand, Pakistan, Portugal, and Thailand.



Regional Digital Health Trends

Southeast Asia and Western Pacific Regions have more mature digital health ecosystems than the other regions. European, Southeast Asia and Western Pacific Regions scored 4 out of 5 on the GDHI's maturity model, and all other regions are just behind with 3 out of 5 in overall digital health maturity. While this currently provides a high-level view on overall maturity of a few countries per region, the ability to assess regional trends and to use the GDHI for regional planning will increase as more countries per region participate.

BREAKDOWN BY REGION

WHO region: DIGITAL HEALTH MATURITY PHASE

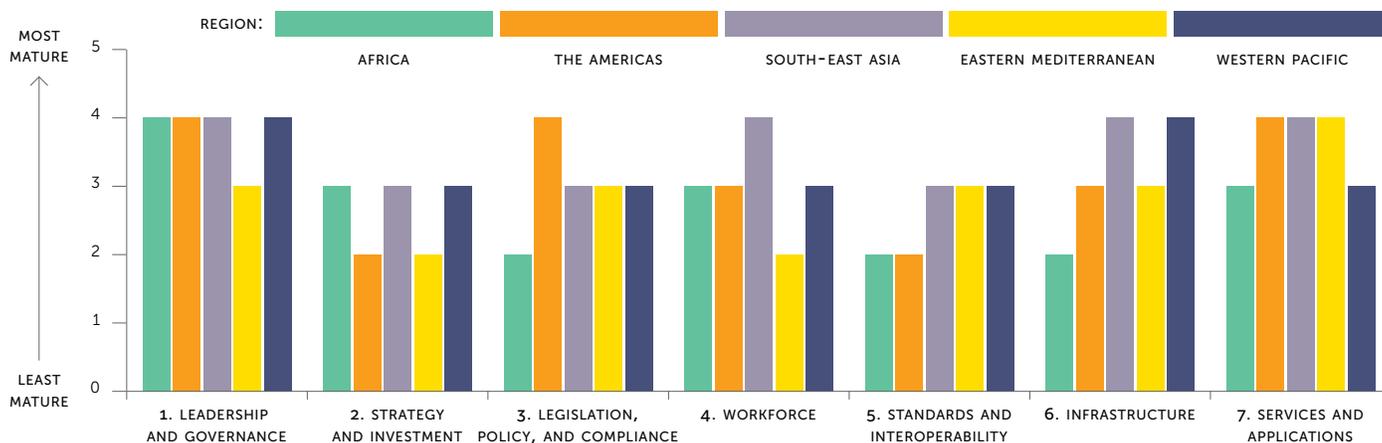
WHO region:	DIGITAL HEALTH MATURITY PHASE
Africa	3
The Americas	3
South-East Asia	4
Eastern Mediterranean	3
Europe	4
Western Pacific	4

High-level regional variations include higher maturity overall in Leadership and Governance with lower maturity in Eastern Mediterranean. We also observed average maturity in the Americas and Eastern Mediterranean at lower maturity in Strategy and Investment. In Legislation and Policy, the two countries in the Americas are at higher maturity with Africa and the Eastern Mediterranean at Phase 2 maturity. In the area of Workforce, Southeast Asia has the highest maturity, and Eastern Mediterranean has the lowest. In Standards and Interoperability, three out of five regions are at average maturity with Africa and the Americas at lowest maturity. In Infrastructure, Southeast Asia and Western Pacific are highest with Africa at the lowest. In Services and Applications, most regions are at average maturity with the Americas and Southeast Asia at higher maturity. These trends highlight some key areas that regions may want to collectively celebrate and/or address and sheds light on regions that they might look to for insights on how to advance in specific areas of need.²

For Africa, the maturity phase lags behind the global average, particularly for legislation, policy, and compliance, standards and operability, and infrastructure. For the Southeast Asia region, the maturity phase is above the global average, particularly for workforce, infrastructure, and services and applications. For the Western Pacific region, the maturity phase is above average, particularly for infrastructure. Regional trends in the Americas and Eastern Mediterranean are more variable.

² European region is excluded from the digital health ecosystem components category analysis because Portugal is currently the only country representing this region.

OVERALL AND CATEGORY PHASES BY REGION



CASE STUDY 4

Digital Health in Uganda

The Ministry of Health of Uganda launched its eHealth strategy and policy in 2018, which guides ICT use in healthcare transformation in Uganda in line with the country's health sector development plan. The GDHI was used to help track progress and identify weaknesses within Uganda's digital health initiatives so that it can mature its digital health policy and practice over time. A working group including representatives from MEASURE Evaluation, HealthEnabled, and the Ministry of Health convened to discuss Uganda's data input for the GDHI.

The GDHI Uganda working group revealed that commendable efforts have been undertaken in Uganda, especially in digital health leadership and governance structures, development and dissemination of a costed eHealth policy and strategy, and training of digital health workforce. However, even within these areas, essential gaps remain. These include compliance of legislation (such as data protection and privacy laws), digital health training among the health workforce (pre-service, in service, and post-service), interoperability aspects registries (immunization, client, provider, and facility registries), digital health workforce policies, national digital health data exchange standards, digital health infrastructure governance, and budgeting for eHealth at the national level.

Based on the results from the assessment, the GDHI Uganda working group made the following recommendations to strengthen the digital health agenda in Uganda:

- Workforce
 - Advocate for integration of digital health curriculum in the training of health professionals at all levels.
 - Introduce a human resources structure for health informatics and health information systems graduates in the public sector.
 - Train health workers like nurses and doctors/physicians on health information systems, e.g.,

DHIS2 should contribute to hours of Continuing Medical Education.

- Establish a clear career path and human resource development for health information personnel.
- Leadership and governance
 - Develop a detailed work plan for eHealth/digital health strategy implementation.
- Service and Applications
 - Focus on the client management digital health systems, i.e. how the flow should shift from paper-based to digital.

UGANDA GDHI SCORES

COMPONENTS	DIGITAL HEALTH MATURITY PHASE	
1. Leadership and Governance	3	3
2. Strategy and Investment	3	3
3. Legislation, Policy, and Compliance	2	2
4. Workforce	2	2
5. Standards and Interoperability	1	1
6. Infrastructure	1	1
7. Services and Applications	2	2

Other Digital Health Trends

In addition to advancements in the enabling environment for digital health, the field is benefiting from dramatic proliferation of advancements in technology and innovation, especially in the areas of connected health, Artificial Intelligence (AI), cognitive computing, natural language processing, and wearable technology, along with virtual reality, augmented reality, and gamification. These are leading to new opportunities to provide more personalized prevention, diagnostic, and treatment experiences and a new sub-domain within digital health of Digital Therapeutics. Through strategic collaborations with Ipsos and Royal Philips Future Health Index, the GDHI is able to contextualize its observations with other important efforts to monitor and track trends in the field of digital health.

The Future Health Index's findings on workforce and the need for investments in digital health workforce capacity building echo the GDHI's as laid out in this report. In particular, Future Health Index found that a key roadblock to connected care adoption is a simple lack of understanding with just 47% of healthcare professionals claiming to be knowledgeable about connected care technology. They also found that healthcare professionals with less years of experience are more likely to say they are knowledgeable about connected care technologies, likely as a result of increased training on digital health in the past decade and more digital natives in the health workforce—54% of those with 0-10 years' experience and 49% of those with 11-19 years' experience claim to be so, versus 42% of those with 20 or more years of experience.

The Future Health Index also highlights the major role that AI is playing in helping transform healthcare and accelerating the journey towards value-based care. Health systems that deliver effective outcomes and high levels of healthcare professional and patient satisfaction—such as those in Singapore, Sweden and the Netherlands—tend to be those with comparatively high levels of focus on advanced data collection and analytics. When asked what AI tools or technologies could have the most impact on improving healthcare, the general population chose an AI health tracker app or wearable that could automatically track key health indicators and make related suggestions and AI-enabled

healthcare tools, which provide guidance using historical medical data to give advice on health management, as the two most promising areas.

One challenge is managing perceptions towards AI, as people generally want connected care technology to enhance, rather than replace, the 'human touch' in healthcare. According to the Future Health Index, only 11% of the general population said hologram doctors would have the most impact on improving healthcare today if they were available, and 10% said the same about robot healthcare professionals. Concerns around the privacy and security of personal health data are also prominent barriers to AI implementation. While the Future Health Index identified that the general population trusts the healthcare industry most with their personal data, data privacy/security remains a concern when it comes to AI and data analytics in the healthcare industry.

Similarly, research conducted by Ipsos shows that digital health is already frequently used in healthcare throughout the world. In the Ipsos' 2017 Digital Doctor study of 18 countries across three regions of the world, Ipsos found that China is leading with 73% of doctors who use telemedicine for remote consultation. Malaysia, on the other hand, only has 7% of doctors who use telemedicine, even though Malaysia is at the highest maturity phase on the GDHI. This discrepancy is due to Malaysia's strategic decision to prioritize building digital health infrastructure, which is measured by the GDHI, before rolling out digital health services at scale. In addition, Malaysia previously had legislation to discourage digital health services when the effectiveness of digital health was yet to be proven, that has since been reversed. Ipsos' 2018 Global Advisor survey also showed that patient confidence in the data protection of their personal data by their healthcare providers. 59% of the 18,813 people surveyed indicated that they trust their healthcare providers to use their personal data in the right way.

"GDHI highlighted areas that we were already aware needed focus—governance, strategy and interoperability and we do intend to submit an update to our assessment as we make progress. Including more countries—especially those public health systems similar to us (UK, Australia, Canada) would be useful to provide a more robust benchmark."

- DARREN DOUGLASS, MINISTRY OF HEALTH, NEW ZEALAND

Building a Digitally Enabled Health Workforce

Underpinning any advancements in digital health are people—whether they are early adopters of technology, champions, pioneers, or the next generation of digital natives who are entering the workforce not remembering life before mobile phones and computers. As indicated through the GDHI, few countries reported having integrated digital health in their in-service and pre-service training for healthcare professionals, with less significant gaps among physicians and more significant gaps in training for nurses and community health workers. The full potential of digital health will only be achieved through its effective integration into the curricula and training of the health professionals that are meant to use them. In addition, as technology advances new skillsets are needed to harness the benefits of technology. In late 2018, HealthEnabled and the Digital Frontiers Institute convened a seminar series, entitled Digital Health Building a Future Proof Workforce to examine skills needs and gaps. Some of the key gaps identified included:

- Digital health leaders, managers, and policy-makers
- Digital health program designers and implementers
- Architects, programmers, engineers, and data scientists
- Digital health skills for health professionals: doctors, nurses, CHWs, and administrators

Specific skills needed for national strategy development include project and change management, technology and public health technical expertise, health economics and costing, and political savviness and skills in facilitating collaboration and coordination since digital health is multi-sectoral and multi-disciplinary. Regarding infrastructure, some of the key needs identified are skills required to deploy and maintain hardware, software, and connectivity alongside infrastructure and architecture as well as the ability to build foundational and reusable infrastructure that generates economies of scale. New roles that will be needed include:

- Data scientists
- Business intelligence
- Visualization analysts
- Enterprise architects

- Data architects and modelers
- Machine learning and natural language processing specialists
- Systems networking and communications experts, including human to machine interaction
- Security and cryptography experts

While data science is not new, there is increasing availability of data, and the need to improve its effective use are increasing the demand in health for new data modelling and integration skills. In addition, with increased adoption and use of technology for health by individuals, new approaches to data ownership and use are necessary. Similar new approaches are needed regarding AI, especially regarding new responsibilities related to ethical considerations.

Where Do We Go From Here?

This inaugural State of Digital Health Report demonstrates the potential for the GDHI to help countries increase their visibility into their digital health maturity and how they compare to others. It also provides insights into global and regional trends. As more countries participate, the GDHI will be able to provide a more detailed and accurate picture of the state of the field with a particular focus on the enablers needed for digital health to reach its full potential. We invite all interested countries to contact us at info@digitalhealthindex.org to request a country link and participate in this important effort.

With increased participation, we anticipate that the overall maturity of the field will increase as more targeted and coordinated investments are made. As digital health improves, we believe that this will in turn strengthen health systems, enable universal health coverage, and improve health and well-being for all.

Global Digital Health Index Indicator Guide

The **Global Digital Health Index** is an interactive digital resource that tracks, monitors, and evaluates the use of digital technology for health across countries. GDHI uses 19 core indicators across the seven components of the WHO/ITU eHealth Strategy Framework to track progress.

LEADERSHIP AND GOVERNANCE

INDICATOR 1: Digital health prioritized at the national level through dedicated bodies / mechanisms for governance

Does the country have a separate department / agency / national working group for digital health?

LOW ←————→ HIGH

1	2	3	4	5
No coordinating body exists and/or nascent governance structure for digital health is constituted on a case-by-case basis.	Governance structure is formally constituted though not fully-functional or meeting regularly.	Governance structure and any related working groups have a scope of work (SOW) and conduct regular meetings with stakeholder participation and/or consultation.	Governance structure is fully-functional, government-led, consults with other ministries, and monitors implementation of digital health based on a work plan.	The digital health governance structure is institutionalized, consults with other ministries, and monitors implementation of digital health. It is relatively protected from interference or organizational changes. It is nationally recognized as the lead for digital health. The governance structure and its technical working groups emphasize gender balance in membership.

INDICATOR 2: Digital health prioritized at the national level through planning

*Is digital health included and budgeted for in national health or relevant national strategies and/or plan(s)?:
The focus of this indicator is on the inclusion of digital health or eHealth in the national health strategy.*

1	2	3	4	5
Digital health is not included in the national health strategy. It is being implemented in an ad hoc fashion in health programs.	There is some discussion of inclusion of digital health in national health or other relevant national strategies or plans. Proposed language for inclusion of digital health in national health or relevant national strategies and/or plans has been made and is under review.	Digital health is included in national health or relevant national strategies and/or plans.	Digital health is being implemented as part of national health or other relevant national strategies and/or plans.	Digital health is implemented and periodically evaluated and optimized in national health or other relevant national strategies and/or plans.

STRATEGY AND INVESTMENT

INDICATOR 3: National eHealth/ Digital Health Strategy or Framework

Does the country have an eHealth or digital health strategy or framework and a costed digital health plan?

LOW ←  HIGH

1	2	3	4	5
There is no digital health strategy or framework. Draft digital health strategy or framework developed, but not officially reviewed.	National digital health strategy or framework approved.	National digital health costed plan developed and approved.	National digital health strategy and costed plan partially implemented with resources to ensure full implementation.	National digital health strategy and costed plan fully implemented with planning underway for the next 3-5 year cycle.

INDICATOR 4: Public funding for digital health

What is the estimated percent (%) of the annual public spending on health committed to digital health?

1	2	3	4	5
No budget line item for digital health available. A budget line item for digital health exists but proportion not available.	Less than 1%.	1-3%	3-5%	Greater than 5%

LEGISLATION, POLICY, AND COMPLIANCE

INDICATOR 5: Legal Framework for Data Protection (Security)

Is there a law on data security (storage, transmission, use) that is relevant to digital health?

1	2	3	4	5
There is no law on data security (storage, transmission, use) that is relevant to digital health.	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been proposed and is under review.	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been passed, but has not yet been fully implemented.	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been implemented, but not consistently enforced.	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been implemented and enforced consistently.

LEGISLATION, POLICY, AND COMPLIANCE, CONTINUES →

LEGISLATION, POLICY, AND COMPLIANCE, CONTINUED

INDICATOR 6: Laws or Regulations for privacy, confidentiality and access to health information (Privacy)

Is there a law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data?

LOW ←				→ HIGH
1	2	3	4	5
There is no law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data.	There is a law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data that has been proposed and is under review.	There is a law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data that has been passed, but not yet fully implemented.	There is a law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data that has been implemented, but not consistently enforced.	There is a law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data that has been implemented and is enforced consistently.

INDICATOR 7: Protocol for regulating or certifying devices and/or digital health services

Are there protocols, policies, frameworks or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity and quality of care?

1	2	3	4	5
There are no protocols, policies, frameworks or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity and quality of care.	Protocols, policies, frameworks or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity and quality of care have been proposed and are under review.	Protocols, policies, frameworks or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity and quality of care have been passed, but are not fully implemented.	Protocols, policies, frameworks or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity and quality of care have been implemented, but not consistently enforced.	Protocols, policies, frameworks or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity and quality of care have been implemented and are enforced consistently.

INDICATOR 8: Cross-border data security and sharing

Are there protocols, policies, frameworks or accepted processes in place to support secure cross-border data exchange and storage? Note: This includes health-related data coming into a country, going out of a country, and/or being used in a country related to an individual from another country.

1	2	3	4	5
There are no protocols, policies, frameworks or accepted processes in place to support secure cross-border data exchange and storage.	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been proposed and are under review.	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been passed, but are not fully implemented.	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been implemented, but not consistently enforced.	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been implemented and enforced consistently.

WORKFORCE

INDICATOR 9: Digital health integrated in health and related professional pre-service training (prior to deployment)

Is digital health part of curriculum for health and health-related support professionals in training, in general?

LOW ←  HIGH

1	2	3	4	5
There is no digital health curriculum for health professionals as part of pre-service training requirements.	Digital health curriculum proposed and under review as part of pre-service training requirements.	Digital health curriculum implementation underway covering an estimated 0-25% of health professionals in pre-service training.	Digital health taught in relevant institutions with an estimated 50-75% health professionals receiving pre-service training.	Digital health taught in relevant institutions with >75% of health professionals receiving pre-service training.

INDICATOR 9A: Digital health integrated in health and related professional pre-service training (prior to deployment)

Specifically, is digital health part of curriculum for doctors/physicians in medical training?

1	2	3	4	5
There is no digital health curriculum for doctors/physicians as part of pre-service training requirements.	Digital health curriculum proposed and under review as part of pre-service training requirements for doctors/physicians.	Digital health curriculum implementation underway covering an estimated 0-25% doctors/physicians in pre-service training.	Digital health taught in relevant institutions with an estimated 50-75% of doctors/physicians receiving pre-service training.	Digital health taught in relevant institutions with >75% of doctors/physicians receiving pre-service training.

INDICATOR 9B: Digital health integrated in health and related professional pre-service training (prior to deployment)

Specifically, is digital health part of curriculum for nurses in pre-service training?

1	2	3	4	5
There is no digital health curriculum for nurses as part of pre-service training requirements.	Digital health curriculum proposed and under review as part of pre-service training requirements for nurses.	Digital health curriculum implementation underway covering an estimated 0-25% or health professionals in pre-service training.	Digital health taught in relevant institutions with an estimated 50-75% of nurses receiving pre-service training.	Digital health taught in relevant institutions with >75% of nurses receiving pre-service training.

WORKFORCE, CONTINUES →

WORKFORCE, CONTINUED

INDICATOR 9C: Digital health integrated in health and related professional pre-service training (prior to deployment)

Specifically, is digital health part of curriculum for health and health-related support professionals in training for community health workers?

LOW ←—————→ HIGH

1	2	3	4	5
There is no digital health curriculum for health professionals as part of pre-service training requirements for community health workers.	Digital health curriculum proposed and under review as part of pre-service training requirements for community health workers.	Digital health curriculum implementation underway covering an estimated 0-25% of community health workers in pre-service training.	Digital health taught in relevant institutions with an estimated 50-75% of community health workers receiving pre-service training.	Digital health taught in relevant institutions with >75% of community health workers receiving pre-service training.

INDICATOR 10: Digital health integrated in health and related professional pre-service training (prior to deployment)

Specifically, is digital health part of curriculum for health and health-related support professionals in the workforce in general? [Defined as community health workers, nurses, doctors, allied health, health managers/administrators, and technologists]

1	2	3	4	5
There is no digital health curriculum as part of in-service (continuing education) training for health professionals in the workforce.	Digital health curriculum proposed and under review as part of in-service (continuing education) training for health professionals in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 0-25% health professionals in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 50-75% health professionals in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% health professionals in the workforce.

INDICATOR 10A: Digital health integrated in health and related professional pre-service training (prior to deployment)

Specifically, is digital health part of curriculum for doctors/physicians in the workforce?

1	2	3	4	5
There is no digital health curriculum as part of in-service (continuing education) training for doctors/physicians in the workforce.	Digital health curriculum proposed and under review as part of in-service (continuing education) training for doctors/physicians in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 0-25% of doctors/physicians in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 50-75% of doctors/physicians in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% of doctors/physicians in the workforce.

WORKFORCE, CONTINUED

INDICATOR 10B: Digital health integrated in health and related professional pre-service training (prior to deployment)

Specifically, is digital health part of curriculum for nurses in the workforce?

LOW ←					→ HIGH
1	2	3	4	5	
There is no digital health curriculum as part of in-service (continuing education) training for nurses in the workforce.	Digital health curriculum proposed and under review as part of in-service (continuing education) training for nurses in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 0-25% of nurses in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 50-75% of nurses in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% of nurses in the workforce.	

INDICATOR 10C: Digital health integrated in health and related professional pre-service training (prior to deployment)

Specifically, is digital health part of curriculum for community health workers in the workforce?

1	2	3	4	5
There is no digital health curriculum as part of in-service (continuing education) training for community health workers in the workforce.	Digital health curriculum proposed and under review as part of in-service (continuing education) training for community health workers in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 0-25% of community health workers in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for 50-75% of community health workers in the workforce.	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% of community health workers in the workforce.

INDICATOR 11: Training of digital health work force

In general, is training in digital health / health informatics / health information systems / biomedical informatics degree programs (in either public or private institutions) producing trained digital health workers?

1	2	3	4	5
There is no training available for digital health workforce available in the country.	Digital health workforce needs assessed, gaps identified and training options under development.	Professional training is available, but graduates are not yet deployed.	Trained digital health professionals available and deployed, but essential personnel gaps remain.	Sufficient numbers of trained digital health professionals available to support national digital health needs.

WORKFORCE, CONTINUES →

WORKFORCE, CONTINUED

INDICATOR 11A: Training of digital health work force

Specifically, is training in health and/or biomedical informatics (in either public or private institutions) producing trained informaticists or health information systems specialists?

LOW ←				→ HIGH
1	2	3	4	5
There is no training available in informatics or health information systems available in the country.	Health informatics workforce needs assessed, gaps identified and training options under development.	Professional training in health informatics is available, but graduates are not yet deployed.	Trained informatics professionals available and deployed, but essential personnel gaps remain.	Sufficient numbers of trained health informatics professionals available to support national health information system needs.

INDICATOR 12: Maturity of public sector digital health professional careers

Are there public sector professional titles and career paths in digital health?

1	2	3	4	5
No workforce strategy, policy, or guide that recognizes digital health is in place. Distribution of digital health work force is ad hoc.	A national needs assessment shows the number and types of skills needed to support digital health with an explicit focus on training cadres of female health workers.	Digital health staff roles and responsibilities are mapped to the government's workforce and career schemes and 25-50% of needed public sector digital health workforce in place.	An HR policy and strategic plan exists that identifies skills and functions needed to support digital health with an explicit focus on training cadres of female health workers and an estimated 50-75% of public sector digital health workforce in place.	A long-term plan is in place to grow and sustain staff with the skills needed to sustain digital health at national and subnational levels with an explicit focus on training cadres of female health workers with an estimated >75% of positions needed filled. Performance management systems are in place to ensure growth and sustainability of the digital health workforce with sufficient supply to meet digital health needs and little staff turnover.

STANDARDS AND INTEROPERABILITY

INDICATOR 13: National digital health architecture and/or health information exchange

Is there a national digital health (eHealth) architectural framework and/or health information exchange (HIE) established?

LOW ←				→ HIGH
1	2	3	4	5
There is no national digital health (eHealth) architectural framework and/or health information exchange (HIE) established.	A national digital health architecture and/or health information exchange (HIE) has been proposed, but not approved including semantic, syntactic, and organizational layers.	The national digital health architecture and/or health information exchange (HIE) is operable and provides core functions, such as authentication, translation, storage and warehousing function, guide to what data is available and how to access it, and data interpretation.	The government leads, manages, and enforces implementation of the national digital health architecture and/or the health information exchange (HIE), which are fully implemented following industry standards.	The national digital health architecture and/or health information exchange (HIE) provides core data exchange functions and is periodically reviewed and updated to meet the needs of the changing digital health architecture. There is continuous learning, innovation, and quality control. Data is actively used for national health strategic planning and budgeting.

INDICATOR 14: Health information standards

Are there digital health / health information standards for data exchange, transmission, messaging, security, privacy, and hardware?

1	2	3	4	5
There are no digital health / health information standards for data exchange, transmission, messaging, security, privacy, and hardware.	There are some digital health / health information standards for data exchange, transmission, messaging, security, privacy, and hardware that have been adopted and/or are used.	Digital health / health information standards for data exchange, transmission, messaging, security, privacy, and hardware have been published and disseminated in the country under the government's leadership.	Digital health / health information industry-based technical standards for data exchange, transmission, messaging, security, privacy, and hardware are in use in the majority of applications and systems to ensure the availability of high-quality data. Conformance testing is routinely carried out to certify implementers.	Data standards are routinely updated and data is actively used for monitoring and evaluating the health system and for national health strategic planning and budgeting.

INFRASTRUCTURE

INDICATOR 15: Network readiness

Extract the *WEF Network Readiness Index* score

LOW ←						→ HIGH
1	2	3	4	5		
1.0 - 3.3	>3.3 - 4.0	>4.0 - 5.0	>5.0 - 5.4	>5.4 - 7.0		

INDICATOR 16: Planning and support for ongoing digital health infrastructure maintenance

Is there an articulated plan for supporting digital health infrastructure (including equipment—computers/tablets/phones, supplies, software, devices, etc.) provision and maintenance?

1	2	3	4	5
There is no articulated plan for supporting digital health infrastructure (including equipment—computers/tablets/phones, supplies, software, devices, etc.) provision and maintenance.	A plan for supporting digital health infrastructure (including equipment—computers/tablets/phones, supplies, software, devices, etc.) provision and maintenance has been developed, but not implemented.	A plan for supporting digital health infrastructure (including equipment—computers/tablets/phones, supplies, software, devices, etc.) provision and maintenance has been implemented partially, but not consistently with estimated 0-25% of necessary digital health infrastructure needed in public healthcare service sector available and in use.	A plan for supporting digital health infrastructure (including equipment—computers/tablets/phones, supplies, software, devices, etc.) provision and maintenance has been implemented partially and consistently with estimated 25-50% of necessary digital health infrastructure needed in public healthcare service sector available and in use.	Digital health infrastructure (including equipment—computers/tablets/phones, supplies, software, devices, etc.) is available, in use, and regularly maintained and upgraded in >75% of public healthcare service sector.

SERVICES AND APPLICATIONS

INDICATOR 17: Nationally scaled digital health systems

Public sector priorities (e.g. 14 domains included in ISO TR 14639) are supported by nationally-scaled digital health systems

1	2	3	4	5
National priority areas are not supported by digital health at any scale.	Few national priority areas are supported by digital health, and implementation initiated (< 25% priority areas).	Some national priority areas supported by scaled digital health systems (25-50% of priority areas).	The majority, but not all national priority areas (50-75% of priority areas) supported by scaled digital health systems.	All nationally prioritized areas supported by national-scale digital health systems (>75%) with monitoring and evaluation systems and results.

SERVICES AND APPLICATIONS, CONTINUES →

SERVICES AND APPLICATIONS, CONTINUED

INDICATOR 18: Digital identity management of service providers, administrators, and facilities for digital health, including location data for GIS mapping

Are health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) available, accessible and current? Is the data geotagged to enable GIS mapping?

1	2	3	4	5
Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are not available, accessible and current.	Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are being developed but are not available for use.	Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are available for use, but incomplete, partially available, used sporadically, and irregularly maintained.	Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are available, used, and regularly updated and maintained. The data is geo-tagged to enable GIS mapping.	Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are available, up-to-date with geo-tagged data, and used for health system and service strategic planning and budgeting.

INDICATOR 19: Digital identity management of individuals for health

Are secure registries or a master patient index of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	2	3	4	5
No secure registry or master patient index exists.	A secure registry exists, but is incomplete / partially available, used, and irregularly maintained.	A secure registry exists, is available and in active use and includes <25% of the relevant population.	A secure registry exists, is available and in active use and includes 25-50% of the relevant population.	A secure registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

INDICATOR 19A: Digital identity management of individuals for health

Specifically, is there a secure master patient index of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	2	3	4	5
No secure master patient index exists.	A master patient index exists, but is incomplete / partially available, used, and irregularly maintained.	A master patient index exists, is available and in active use and includes <25% of the relevant population.	A master patient index exists, is available and in active use and includes 25-50% of the relevant population.	A master patient index exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

SERVICES AND APPLICATIONS, CONTINUES →

SERVICES AND APPLICATIONS, CONTINUED

INDICATOR 19B: Digital identity management of individuals for health

Specifically, is there a secure birth registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

LOW ← → HIGH

1	2	3	4	5
No secure birth registry exists.	A secure birth registry exists, but is incomplete / partially available, used, and irregularly maintained.	A secure birth registry exists, is available and in active use and includes <25% of the relevant population.	A secure birth registry exists, is available and in active use and includes 25-50% of the relevant population.	A secure birth registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

INDICATOR 19C: Digital identity management of individuals for health

Specifically, is there a secure death registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	2	3	4	5
No secure death registry exists.	A secure death registry exists, but is incomplete / partially available, used, and irregularly maintained.	A secure death registry exists, is available and in active use and includes <25% of the relevant population.	A secure death registry exists, is available and in active use and includes 25-50% of the relevant population.	A secure death registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

INDICATOR 19D: Digital identity management of individuals for health

Specifically, is there a secure immunization registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	2	3	4	5
No secure immunization registry exists.	A secure immunization registry exists, but is incomplete / partially available, used, and irregularly maintained.	A secure immunization registry exists, is available and in active use and includes <25% of the relevant population.	A secure immunization registry exists, is available and in active use and includes 25-50% of the relevant population.	A secure immunization registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

ABOUT THE ORGANIZATIONS

GLOBAL DIGITAL HEALTH INDEX

The [Global Digital Health Index \(GDHI\)](#) is an interactive digital resource that tracks, monitors, and evaluates the use of digital technology for health across countries. The GDHI is a multi-stakeholder initiative led by a Steering Committee with representation of Ministries of Health, WHO, the Commonwealth Medical Association (CMA), Asia eHealth Information Network (AeHIN), Johnson & Johnson, Royal Philips, the Bill and Melinda Gates Foundation, and USAID. The GDHI is incubated by the Global Development Incubator (GDI) with digital health technical leadership and facilitation provided by HealthEnabled in collaboration with Dalberg's Design Impact Group (DIG), ThoughtWorks, and representatives from 20+ countries and 50+ international agencies and organizations.

Learn more at DigitalHealthIndex.org.



The [Global Development Incubator \(GDI\)](#) builds startups and partnerships to address some of the world's toughest global development challenges. We provide strategic guidance and implementation support to get high-potential social impact ideas off the ground over 12-36 months. Throughout each stage of our process, we bring together the right partners across sectors — including corporations, nonprofits, governments, and foundations — to help new initiatives scale their impact and prepare for long-term success. Above all, we turn talk into action by matching ambitious leaders, strong concepts, and funding with the executional power required to launch and scale social impact efforts.

Learn more at GlobalDevIncubator.org.

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[HealthEnabled](#) is an Africa-based not-for profit that helps governments integrate proven life-saving digital health interventions into their health systems. Arising from the mHealth Alliance in 2014, we have built upon the former organization's mission and work to further accelerate the impact of digital health in the 'Global South'.

We are accomplishing our mission by partnering with national governments and other large health implementers to develop and operationalize their digital health strategies. In particular, we work at the country level to: 1) support policy development for digital health integration and acceleration, 2) build coalitions for effective and efficient digital health, 3) ensure implementation through appropriate resource allocation and accountability frameworks, and 4) strengthen mechanisms for long-term capacity.

At the global level, we drive digital health progress through advocacy and thought leadership, collective action, and evaluation of the state of the field through our work on the Global Digital Health Index and other multi-stakeholder collaborations.

Learn more at HealthEnabled.org.



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