



TRANSFORMING HEALTH CARE IN LESOTHO

Using Digital Health to Overcome Health System Challenges



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Transforming Health Care in Lesotho:

Using Digital Health to Overcome Health System Challenges

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ABBREVIATIONS

AfDB	African Development Bank
AU	African Union
CoE	Center of Excellence
DHIS-2	District Health Information System
eHealth	electronic health
EMR	electronic medical record
GDP	gross domestic product
GoL	Government of Lesotho
HIV	human immunodeficiency virus
HMIS	Health Management Information System
ICT	information and communication technologies
ID	identification document
IHR	International Health Regulations
IoT	Internet of Things
LIC	low-income countries
LIMC	lower-middle-income countries
LMDA	Lesotho Millennium Development Agency
MCC	Millennium Challenge Corporation
MCST	Ministry of Communications, Science, and Technology
MoH	Ministry of Health
NICR	National Identity and Civil Registry
PHC	primary health care
PIH	Partners in Health
PPP	public-private partnerships
QMMH	Queen Mamohato Memorial Hospital
SLA	service level agreements
TB	tuberculosis
USAID	United States Agency for International Development
WBG	World Bank Group
WHO	World Health Organization

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This study is the result of a collaboration between the Lesotho's Ministry of Health and various individuals whom all made essential contributions to the work presented in this report. Contributors within each organization are listed in alphabetical order.

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BRIEF SUMMARY

Healthcare access and service delivery quality have been a persistent challenge in Lesotho. The COVID-19 pandemic has added new challenges and opportunities for change. Among those changes is the need to include digital health solutions and think about how new digital health interventions can be a tool for enhancing efficiency and transforming the way primary healthcare is being provided or delivered in the country. This report, prepared by the World Bank for Lesotho's Ministry of Health, documents the outcome of an assessment of Lesotho's digital health system using a unique digital health assessment toolkit produced by the World Bank. The agreed objectives of the assessment were to 1) Clarify the current digital health landscape in Lesotho, 2) Develop a maturity score for Lesotho's digital health system, 3) Define the strengths, weaknesses, opportunities, and threats (SWOT) facing digital health in Lesotho and 4) Using the results of the assessment, provide recommendations and a phased roadmap of action to define the key strategic actions to move Lesotho's digital health ecosystem to the next phase of its evolution. Based on the assessment results, 16 strategic recommendations have been made on foundational, functional, and frontier investments to advance the digital health agenda and improve service delivery. The prioritization of the actions has been based on this set of criteria: the most urgent to support PHC transformation, the incomplete actions from the current draft of the e-Health Strategy (2019–2023), and those with the most important long-term impact. This report is a call-to-action to upgrade the current eHealth strategy to a comprehensive digital health strategy with priority interventions, a costed implementation plan, and provisions for future impact assessment geared toward delivering better health in a digital world.



#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
DIGITAL ENVIRONMENT					
R1	Need for leadership and ownership of digital health strategy	Restructure the IT department within MOH and expand its role beyond ICT maintenance to promote inclusive digital health policies and strategies across internal and external stakeholders. Assign a dedicated budget for digital health with defined objectives and priorities; align and funnel investments to the right interventions; provide adequate skill mixes; and evaluate interventions.	Positioning of the MoH as the guidance, coordination, and regulatory body on digital health	Start Now >	- IT Department - Ministry of Health - Ministry of Finance
R2	Extensive use of mobile, however mobile coverage and internet connectivity is not equally distributed, unstable electricity supply	Enrich the Lesotho ICT policy 2021 by conducting a health sector infrastructure assessment. Conduct a sectoral assessment of infrastructure and connectivity to implement some of the recommendations made by the Lesotho ICT policy 2021 (currently in draft form).	Improvement of connectivity and electricity supply to ensure the functioning of systems and the implementation of digital health interventions	Start Now >	- Ministry of Health - Ministry of Communications, Science, and Technology

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#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
R3	Few courses that can provide digital health skills at levels of pre/in-training	Collaborate with the Ministry of Education and Training to implement pre-service education of health professionals and health workers on digital health, as well in service health professionals. The curriculum should include topics in health informatics, data science for health care, development and implementation of digital health interventions, and entrepreneurship to create a pre-trained cadre to assist the work of the MoH. Leverage regional knowledge by coordinating with other digital health capacity-building initiatives.	Creation of a pre-trained cadre to assist the work of the MoH. Potential to leverage regional knowledge by coordinating with other digital health capacity-building initiatives or through the digital health hub (R4).	Start Next ⌚	- Ministry of Health - Ministry of Education and Training
R4	Lack of interoperability with other sectors that are connected to health (i.e., education, housing, transportation), limiting a holistic perspective of patients	Promote digital health within the broader e-government context to enhance the digital economy, including promoting digital ID. The African Union's Agenda 2063, ratified by all African countries, aims to ensure that "99.9% of people in Africa have a digital legal identity as part of a civil registration process by 2030." The MoH must coordinate with other governmental bodies to implement digital ID to empower patients by linking patient information across facilities.	Develop policies and guidelines for facilitating the dialogue and policy making around potential investments, research centers, and coordination with universities for local development of digital health to enhance the digital economy	Start Next ⌚	All government
R5	Limited human resources as people move to neighboring countries to study and work	Formalize digital health collaboration with countries within the SADC region to form a regional digital health hub, like Digital REACH Initiative proposed by USAID for the East Africa Community. Lesotho could coordinate efforts and collaborate with neighboring countries through a regional digital health hub, that will facilitate sharing of human resources, skills, knowledge, and better practices to improve preparedness and resilience for future health events such as pandemics.	Economies of scale and human resources, skills, knowledge, and better practices to improve readiness to manage future events, because Lesotho is fully dependent on South Africa	Start Later ⏸	- Ministry of Health - AU specific Regional Economic Communities - AU



ARCHITECTURE AND DATA

R6	Nascent development safeguards and preparedness for digitalization	Conduct a cybersecurity assessment to improve cybersecurity and data privacy. Provide technical assistance to develop policies and guidelines for data privacy, cybersecurity, and data transfer to reduce vulnerability to cyber-attacks that could disrupt the provision of care or jeopardize the privacy of patients' data.	Creation of the necessary safeguards to protect the privacy and security of data and systems and avoid the disruption of health care delivery	Start Now ➡	- Ministry of Health - Ministry of Communications, Science, and Technology - Ministry of Justice
R7	Limited Standard and operating procedures. Lack of standards for data governance	Develop health data governance legislation. Develop data governance legislation and standards and define data ownership, data transparency, data governance, and data management sharing information rules within the health information exchange architecture.	Improved interoperability between the MoH and partners and information transfer from facilities and partner's programs into the MoH	Start Next ⌚	- Ministry of Health - Ministry of Justice, Human Rights & Correctional Services

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#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
R8	Limited interoperability between health facilities and between MoH and partners	Expand the health information exchange architecture to build a digital health platform (infostructure). Apply the recent WHO guideline "Building a Digital Information Infrastructure (Infostructure) for Health" to build a digital health platform using accepted standards and connect with other MoH applications, such as pharmacy systems, DHIS-2, and future human resources and logistics management applications.	Facilitation of continuity of care by sharing data among users, health care providers, health systems managers, and health data services	Start Next 	- Ministry of Health - Partners



ANALYTICS

R9	Inefficient use of data systems to monitor, evaluate, analyze, and improve health care	Design and implement a health facility report card based on selected indicators for quality improvement. Indicators could include service delivery, patient satisfaction, resources, and wait times to provide insight and transparency regarding the quality of care at each health facility.	Creation of evidence-based inputs to support decision-making and resource allocation	Start Now 	Ministry of Health
R10	Lack of targeted digital health interventions	Commission an assessment of primary health care challenges to identify areas that can be improved with digital health mechanisms. To be effective and impactful, digital health interventions or applications should respond directly to primary care challenges that can be identified through assessments like the World Bank's vital signs profile for primary health care performance improvement (PHCPI).	Matching of digital health interventions to primary care challenges and generation of impactful outcomes	Start Now 	Ministry of Health
R11	Data is being collected however, quality is low and not always reliable	Commission a data quality assessment. As part of the effort to strengthen surveillance and data collection, the World Bank is currently conducting a process mining analysis from data collection to data reporting and analysis. This can contribute to a more extensive data quality assessment quality across the health care sector.	Improved decision making using timely and complete data and information	Start Now 	Ministry of Health



APPLICATIONS

R12	Lack of a costed implementation plan of digital health interventions/applications	Design a prioritized and costed plan for digital health applications. This plan should determine which interventions are relevant, provide an estimate of costs and benefits, assign responsible parties, and provide a clear monitoring and evaluation plan. The WHO Digital implementation investment guide (DIIG) could be a valuable resource to guide this work.	Completion of a costed implementation plan	Start Now 	- Ministry of Health - Partners
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#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
R13	Fragmentation and dependency on partners for digital health development Lack of private investment and entrepreneurship	Commission technical assistance to support public-private partnerships (PPP) and service level agreements (SLA) for digital health interventions. SLAs could address the lack of digital health skills and skilled resources in the short term. These should be accompanied by a mid-term strategy to create skilled, in-house resources. Coordination with WHO and IFC could support this activity.	Lesotho currently enjoys significant public investment. The current global discussions about PPPs could generate enough incentive to attract private sector investment in the country.	Start Now 	Ministry of Health
R14	Limited number of digital health interventions at the community level Limited programs within e-Register	Design a plan to scale up e-Register gradually over the next three years to transform all existing health programs and into a comprehensive EMR. Expand the e-Register to include aspects such as family planning, chronic diseases, children's health, among others to assure comprehensive care for all.	Provision of comprehensive care for all	Start Next 	Ministry of Health
R15	Lack of impact evaluation of digital health investments	Establish an innovation testing environment for the various interventions and evaluate impact and feasibility. Testing environments, such as an innovation and regulatory sandbox or living lab, can provide a framework to test solutions in a responsible, monitored, and real-world environment.	Generation of evidence, measurement of social response, elimination of failed interventions, and reduction of future implementation costs.	Start Next 	- Ministry of Health - Private sector - Universities
R16	Lack of evidence on the cost and effectiveness of digital health interventions	Commission feasibility and economic evaluation studies of priority digital health interventions. Build evidence on the cost-effectiveness and cost benefit of digital health interventions such as eRegister, DHIS-2, ECHO to prioritize future investment.	Creation of evidence to guide the MoH on future investments	Start Later 	- Ministry of Health - Partners



EXECUTIVE SUMMARY

Healthcare access and service delivery quality have been a persistent challenge in Lesotho; the COVID-19 pandemic has added new challenges and opportunities for change. **The pandemic has increased the need for digital health solutions and how new digital health interventions can be a tool for changing the way primary healthcare is being provided or delivered in the country.**

This report, prepared by the World Bank for Lesotho's Ministry of Health (MoH), documents the outcomes of an assessment of Lesotho's digital health system.¹ The agreed objectives of the assessment were the following:

- Clarify the current digital health landscape in Lesotho
- Develop a maturity score for Lesotho's digital health system
- Define the strengths, weaknesses, opportunities, and threats (SWOT) facing digital health in Lesotho
- Using the results of the assessment, provide recommendations and a phased roadmap of action to define the key strategic actions to move Lesotho's digital health ecosystem to the next phase of its evolution

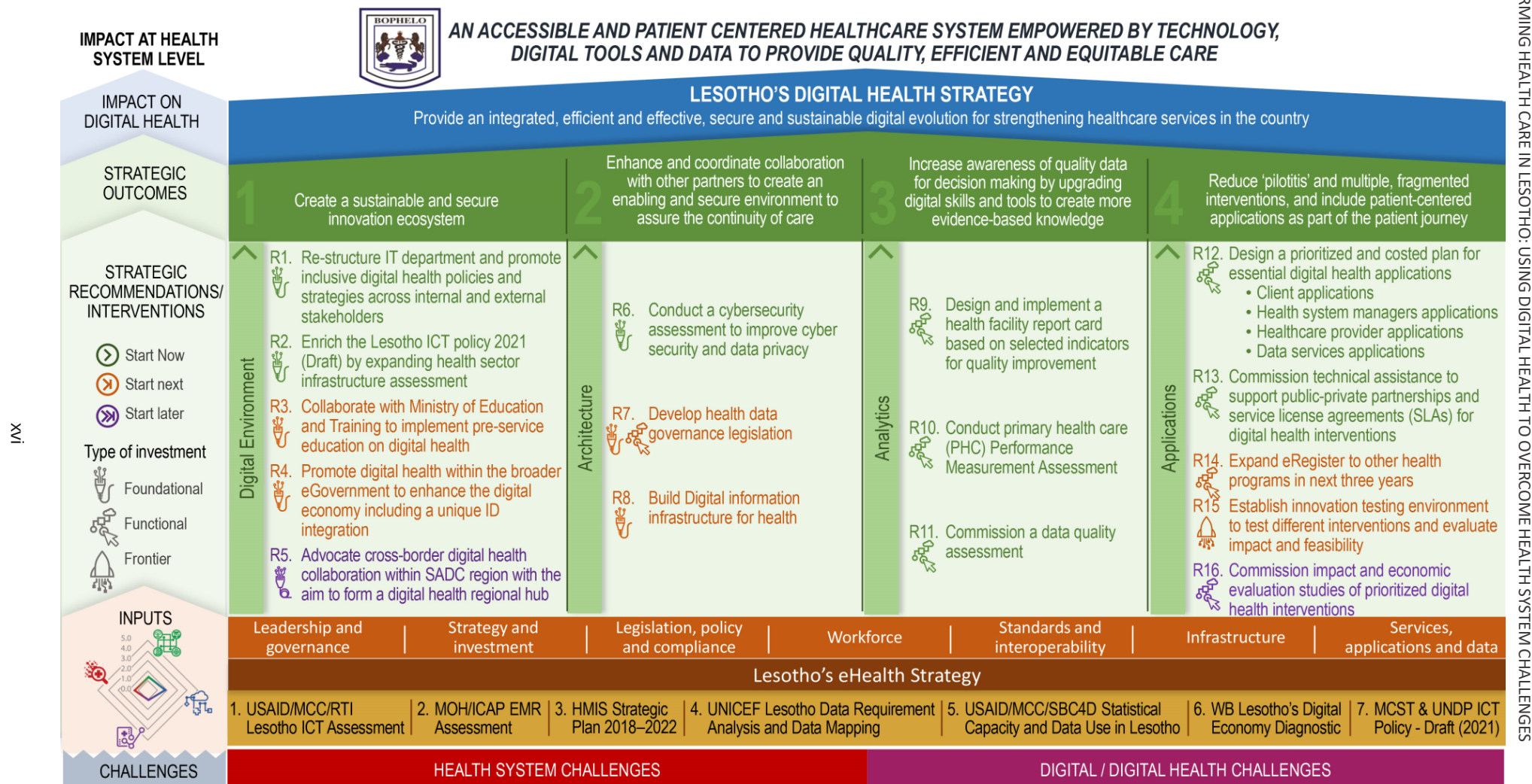
While digital health assessments have been undertaken previously in Lesotho, this assessment adds to the existing body of knowledge by achieving the following:

- Provides a comprehensive view of digital health status in Lesotho
- Integrates and builds on outcomes of prior assessments to determine the maturity and readiness of all aspects of the digital health ecosystem
- Focuses on providing a set of phased recommendations for implementation, emphasizing the ways that digital health systems can support the transformation of primary health care in Lesotho

[An assessment toolkit](#) developed by the World Bank was used to determine the maturity of Lesotho's digital health ecosystem. The toolkit focuses on four digital health dimensions—**digital environment, architecture and data, applications, and analytics**—and draws from other existing digital health assessment tools. The toolkit includes a set of quantitative indicators that define the digital health landscape, desk review and interviews with key informants, and a scoring tool with several indicators that were used that explore issues such as leadership and governance, strategy and investment, legislation, policy and compliance, workforce, standards and interoperability, infrastructure, services, and applications.

¹ The report does not provide a comprehensive review of the health sector and health system in Lesotho, as the audience for this assessment is familiar with the country's context.

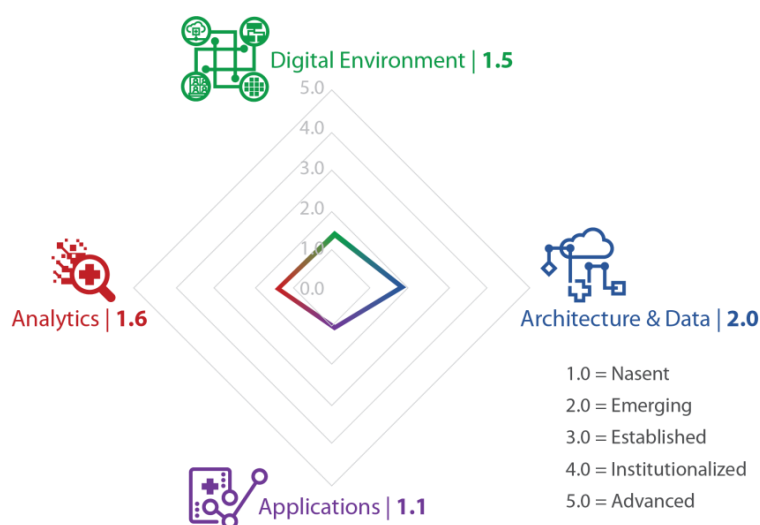
A graphic summary of the Digital Health Strategic Outcomes and Recommendations



FINDINGS: MATURITY OF LESOTHO'S DIGITAL HEALTH SYSTEM

The maturity of Lesotho's digital health ecosystem is in the Nascent/Emerging stage with a score of 1.5 out of 5.0.² The Architecture and Data dimension, which represents foundational investments that are essential building blocks for the Applications and Analytics dimensions, demonstrates the highest level of maturity. Implementation of digital health applications and analytics display low maturity and readiness levels for implementation. The Digital Health Environment dimension—which enables the functioning of the others—also requires significant strengthening.

Figure 0.1 Maturity score by digital health area



Source: World Bank.

Areas that require the most significant strengthening are:



DIGITAL ENVIRONMENT

- **Absence of a unified, e-government framework to guide alignment and coordination of existing digital interventions.** The absence of a comprehensive e-government strategy causes fragmentation in the country's digital health system, and misalignment between MoH, other ministries, and partners promotes duplication.
- **Lack of a legal or policy framework to facilitate data sharing.** This often means data is not available in the format, disaggregation, or time frame user demands. There is also no Freedom of Information law nor a government-wide unique ID operating across the system, which could enable coordination beyond the health sector and further efforts to achieve people-centered integration of services.
- **Suboptimal data hosting by MCST.** Constant electricity cuts, connection problems at MoH, and the lack of an uninterruptible power supply (UPS) limit systems' efficient use and pose significant cybersecurity risks and challenges for the continuity of services.



ARCHITECTURE AND DATA

- **Limited interoperability of systems among different health institutions.** Due to the lack of comprehensive guidelines or standards for electronic medical record (EMR) systems, many applications used within or across facilities operate in isolation. For example, even within the MoH information system, there are various unlinked registries (e.g., laboratory results systems and DHIS-2). Moreover, at some partner-run facilities, there is duplication of systems, (e.g., EMRx from the Baylor College of Medicine Children's Foundation Lesotho and e-Register from the MoH), which hampers efforts to provide optimum care to patients.



ANALYTICS

² 1=Nascent 2=Emerging 3=Established 4=Institutionalized 5=Advanced

- **Inexistent community-level data collection.** Incomplete population health information is compounded by the inability of village health care workers, who serve the majority of the rural population, to gain access to information systems.
- **Inadequate digital health literacy among health care workers and decision-makers.** The shortfalls are notable in the district and health facilities, where limited effort is made to use digital health solutions such as eRegister and DHIS-2.
- **Inefficient use of health data systems.** Most interventions focus on reporting and are not used to evaluate and analyze health care or improve health care service delivery as there is limited capacity building in areas such as quality of data and data analysis.



APPLICATIONS

- **Duplication of efforts due to vertical health programs run by different partners.** Some of these programs (mainly focused on HIV and TB) use digital health interventions and information health systems that are not always interoperable with government systems.
- **E-government projects funded by partners focused on infrastructure.** While this is important, enhancing and funding digital health applications is essential to promote evidence-based public health service delivery. Less effort has been exerted to improve data collection and data quality, to improve electronic medical records and underlying health systems, which are the foundation for developing smart and innovative algorithms for data-driven decision making.
- **Numerous manual processes and paper-based patient registries.** The co-existence of print and electronic systems in some facilities imposes a burden on health workers. Using both systems is time-consuming and creates opportunities for inaccuracy in the use of health information.
- **Limited availability of patient-level digital health applications.** Use of digital health applications would improve outreach and communications.
- **A shortage of impact evaluations.** The inability to efficiently assess the effectiveness, costs, and benefits of digital health interventions, along with the lack of an approved plan and awareness of past failures, resulted in low implementation and hampered the scalability of digital health interventions (at the facility and programmatic level).

Improved outcomes could result from expanded and more equitable access to services, improved health service quality, and enhanced readiness for future health-related challenges. Acting on the opportunities (i.e., better infrastructure and connectivity, better governance and structural changes at the IT department in MOH, improve digital health and use of data, development of digital health applications) to better integrate digital health within the health sector could help Lesotho to enhance service delivery. However, the following threats or risks could jeopardize the evolution of digital health in the country:

- The mountainous geography can limit the setting up of Internet connectivity and electricity access to health services.
- Political instability and a lack of political support delay the advancement of the current eHealth strategy

- Limited household Internet use that may limit users' ability to use various digital health products. Internet is not readily available to households in rural areas, and it is expensive.
- Limited financial resources reduce opportunities for government-led investments and upgrading of legacy systems and IT hardware
- Lack of appropriate human resources increases the low value-added workload of health care workers
- Misconceptions and fear about technology among health care workers, and especially among village health care workers, create reluctance to change

“ Acting on the opportunities—better infrastructure and connectivity, better governance and structural changes at the IT department in MOH, improve digital health and use of data, development of digital health applications—to better integrate digital health within the health sector could help Lesotho to enhance service delivery ”



RECOMMENDATIONS: IMPROVING DIGITAL HEALTH IN LESOTHO

Based on the assessment analysis, 16 strategic recommendations that span foundational, functional and frontier (innovations) investments have been made, grouped by the digital health system dimension. For each dimension's strategic recommendations, a roadmap of short-, medium- and long-term actions has been proposed. The prioritization of these actions is based on this set of criteria: the most urgent action to support PHC transformation, the incomplete actions from the current eHealth Strategy (2019–2023), and those actions with the most important long-term impact.

Grounded on the most urgent health system challenges and a rapid but impactful approach, the MOH will need to prioritize the following areas in the following years³:

FOUNDATIONAL INVESTMENTS

- Structural and governance changes at the MoH to position it and promote digital health (R1, R4, R5, R7)
- Assessment, planning, and investment in infrastructure enablers such as connectivity, electricity, and data hosting, i.e., cloud (R2, R6, R8)
- Development of digital health skills within the MoH system by collaborating with university programs (R3)

FUNCTIONAL INVESTMENTS

- the scale-up of the register towards a complete electronic medical record system, together with the strengthening of a digital health platform to connect with other information systems (R7, R14)
- processes to improve data collection, reporting, and utilization of data for creating insights into systems evidence base, that will support the strengthening of areas such as public health surveillance, that is a priority of the ministry (R9, R10, R11)
- scale-up current digital health applications and prioritize the implementation of SMS and mobile technology to increase service delivery through automatic scheduling, referral, and health promotion (R12, R13, R16)

FRONTIER INVESTMENTS

- Beyond the basic solutions, Lesotho also needs to invest in innovative digital health solutions that could support the efficient delivery of service, improve the quality and results, streamline process, increase access, and reduce costs. These solutions must be evaluated for feasibility and in post implementation (R15).

The drafted 2019–2023 eHealth strategy has been a welcome starting point. However, it has become outdated given that the scenario had changed with the pandemic, relevance of health system resilience and primary healthcare, cyberattacks, and new digital health innovations. It does not include the results of the latest assessments conducted in the country. By joining the dots between the different evaluations conducted in Lesotho, this digital health assessment will be an input to a new digital health strategy (2024–2028) and help prioritize interventions that can be costed and implemented in the next couple of years to improve

³ The R# in each priority refers to the specific strategic recommendation in the document.

service delivery and promote primary healthcare (PHC) transformation using digital health solutions.

The new strategy will:

- Create a sustainable and innovative ecosystem with multiple stakeholders such as the private sector, academy, donors and partners, and other government offices
- Enhance and coordinate collaboration with other partners, to reduce fragmentation and create alignment around a government-owned strategy and priorities
- Increase awareness of the importance of quality data for decision making, accomplished by upgrading digital skills and tools create to more evidence-based knowledge
- Design a prioritized and costed plan for digital health interventions using an agile methodology and reducing short and non-scalable projects that generally are duplicated efforts (a phenomenon called “pilotitis”)
- Develop and include patient-centered applications as part of the patient journey to increase access, enhance patient empowerment, and improve the quality of care for all

This report calls for action to upgrade the current eHealth strategy into a digital health strategy with prioritization of interventions, a costed implementation plan, and measure their impact in the future to deliver better health in a digital world.

“ This Digital Health Strategy will prioritize interventions that can be costed and implemented in the next couple of years to improve service delivery and promote primary healthcare (PHC) transformation using digital health solutions ”

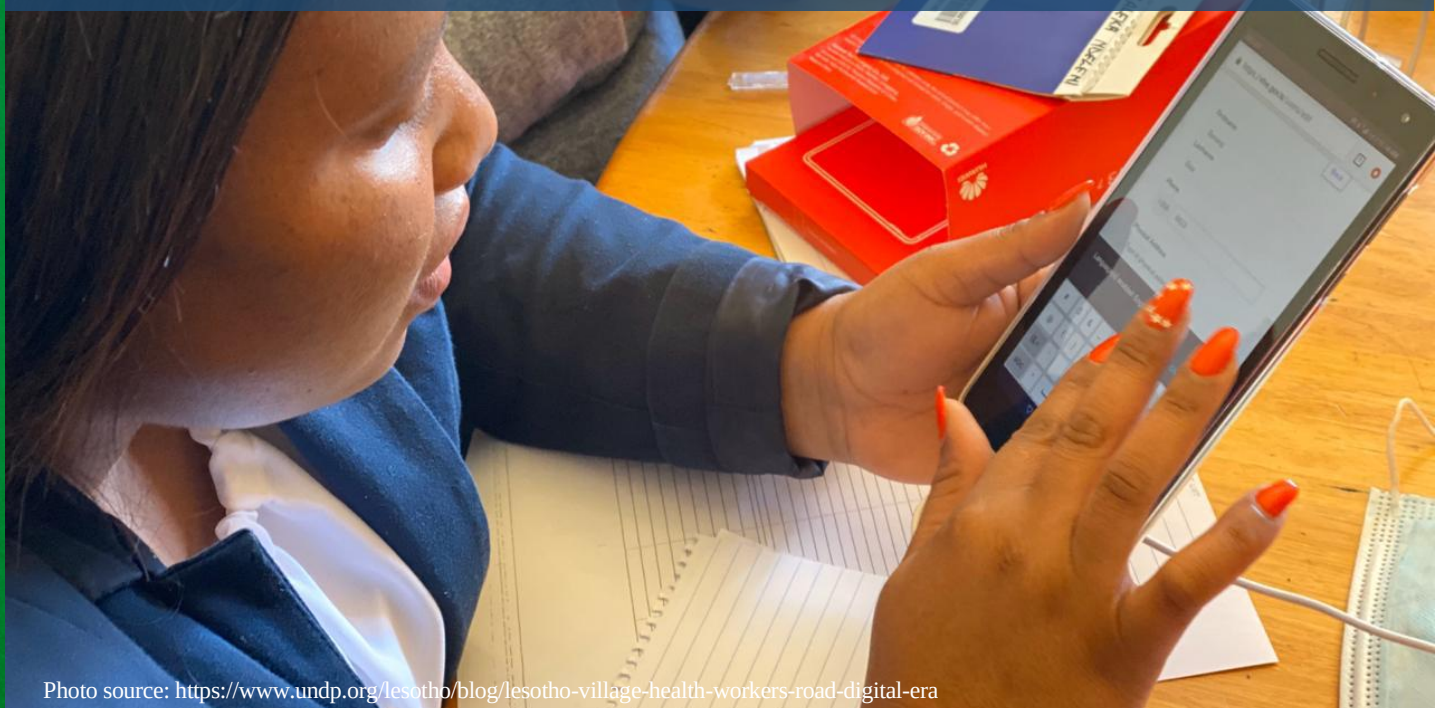
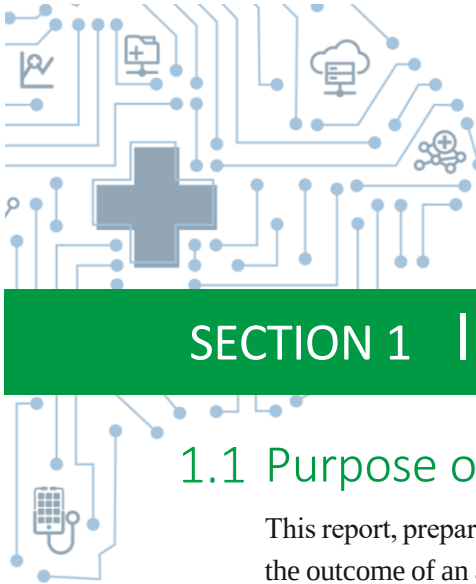


Photo source: <https://www.undp.org/lesotho/blog/lesotho-village-health-workers-road-digital-era>

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SECTION 1 INTRODUCTION

1.1 Purpose of the Report

This report, prepared by the World Bank for Lesotho's Ministry of Health (MoH), documents the outcome of an assessment of Lesotho's digital health ecosystem. The agreed objectives of the assessment were the following:

- Clarify the current digital health landscape in Lesotho
- Develop a maturity score for Lesotho's digital health system
- Define the strengths, weaknesses, opportunities, and threats (SWOT) facing digital health in Lesotho
- Using the results of the assessment, provide recommendations and a phased roadmap of action to define the key strategic actions to move Lesotho's digital health ecosystem to the next phase of its evolution

While digital health assessments have been previously undertaken in Lesotho, this assessment adds to the existing body of knowledge in that it achieves the following:

- Provides a comprehensive view of digital health status in Lesotho
- Integrates and builds on outcomes of prior assessments to determine the maturity and readiness of all aspects of the digital health ecosystem
- Focuses on providing a set of phased recommendations for implementation, emphasizing the ways that digital health systems can support the transformation of primary health care in Lesotho

1.2 Digital Health in Africa

As nations race to implement the 2030 Agenda for Sustainable Development (UN, 2015), the COVID-19 pandemic has set back efforts potentially by decades. Yet, due to unprecedented demand, it has also created an opportunity for Africa to rapidly develop digital solutions for health care and enhanced data-driven and evidence-based action. In the grip of the pandemic, digital health has been, is and will be a critical tool for most patients and health service providers and professionals to connect amid stringent lockdown measures, as well as to navigate social distance as the new normal.

By the end of 2019, 33 World Health Organization (WHO) Member States in the African region had developed digital health strategies (WHO, 2021). There has been significant progress in utilizing digital health solutions; however, in most of these countries, digital health solutions are still in the pilot phase. In addition, only a few Member States have complied with the implementation methodology recommended in the WHO National eHealth Strategy Toolkit, which aims to facilitate the scale-up and sustainability of digital health (WHO, 2012).

Challenges in the region include insufficient digital health leadership capacity at the national level, limited multisectoral arrangements for digital health, inconsistent

adoption of standards and interoperability frameworks, and limited data protection and system security regulations. Other notable challenges include inadequate financial resources and the low level of health worker involvement in digital health. At the regional level, a failure to share evidence limits the development of best practices. To mitigate these challenges, WHO adopted a global digital health strategy in 2020 (WHO, 2021) to advance and apply digital health technologies toward achievement of Goal 3 of the Sustainable Development Goals (SDG), namely “good health and well-being,” as well as the other health-related SDGs (UN, 2015). It also aims to promote research, improve evidence and information sharing, as well as promote best practices in digital health to ensure a solid foundation for national scale-up of digital health services.

As part of the African Union’s Agenda 2063: The Africa We Want, the Digital Transformation Strategy for Africa (AU, 2015) will build on the existing initiatives and frameworks, such as the Policy and Regulatory Initiative for Digital Africa (PRIDA), the Program for Infrastructure Development in Africa (PIDA), the African Continental Free Trade Area (AfCFTA), the African Union Financial Institutions (AUFIs), and the Free Movement of Persons (FMP), to support the development of a Digital Single Market (DSM) for Africa, as part of the integration priorities of the African Union.

The Digital Transformation Strategy is also designed explicitly to support and connect with the AfCFTA. Its central objective is for Africa to use digital technologies and innovation to transform the continent, generate inclusive growth, create jobs, and ensure African ownership of digital technologies. To do this, it aims to spur the creation of a Digital Single Market in Africa by 2030. The following are some of its digital health-related strategic objectives:

- Entry into force of the African Union Convention on Cyber Security and Personal Data Protection by 2020 and adoption by all Members States of a complete set of legislation covering e-Transactions, Personal Data Protection and Privacy, Cybercrime, and Consumer Protection
- Development of inclusive digital skills and human capacity across the digital sciences, judiciary, and education, both technical and vocational, to lead digital transformation, including coding, programming, analysis, security, blockchain, machine learning, artificial intelligence, robotics, engineering, innovation, entrepreneurship, and technology policy and regulation
- Design of a sector approach to the digitalization of the agriculture, health, and education sectors
- Creation of enabling conditions so that 99.9 percent of citizens of African countries have a digital legal identity as part of a civil registration process by 2030

Africa’s digital landscape has many internal and external stakeholders. The World Bank Group (WBG) Digital Economy for Africa (DE4A) flagship initiative supports the digital transformation strategy prepared by the African Union (AU) (World Bank Group, 2021) and aims to ensure that every individual, business, and government will be digitally enabled by 2030. The DE4A initiative recognizes that the digital economy can help accelerate achievement of the UN Sustainable Development Goals (SDGs) and the World Bank Group’s twin goals.

The WHO has developed a framework to guide the implementation of the global digital strategy among its Member States in Africa (WHO, 2021). The framework considers Member State and regional contexts and presents overarching goals, SMART objectives, and strategic targets for actualizing elements of the global strategy in the African region. It outlines guiding principles, including action points, to ensure effective implementation among the Member States. In addition, Article 7 of the Southern African Development Community (SADC) Protocol on Health (SADC, 1999) requires the sharing of health data and the establishment of a regional indicators database (SADC, 1999), requirements that are ever more important as the regional economy becomes more integrated.

The COVID-19 pandemic has exposed health system failures worldwide, generating powerful momentum for change. Africa is proving fertile ground for telehealth providers as the pandemic response has enabled the rapid expansion of telemedicine services, by 50 to 175 times the pre-pandemic number of telehealth patients (Henry, 2020). Increasingly, social media tools such as WhatsApp are also being used to provide these services. In Kenya for example, telemedicine is being used as a mental health tool to help citizens through daily strains, such as isolation, unemployment, and a disrupted social life, triggered by the pandemic (Adepoju, 2020). Digitization also offers African countries the opportunity to strengthen health systems and reimagine primary health care services.

1.3 Health Sector in Lesotho

This section contains relevant information for achieving the report's objectives; however, it does not provide a comprehensive review of the health sector and health system in Lesotho, as the audience for this assessment is familiar with the country's context.

Lesotho has a population of 2.1 million, 71 percent of whom live in rural areas (2020).⁴ The per capita gross national income was US\$ 3,030 in 2021 (in PPP current international dollars).⁵ Approximately 75 percent of Lesotho's population live or are at risk of living in poverty. The country has close economic and geographic linkages to South Africa.

Total government health spending has increased in the past decade and is higher than in many other African countries. Health expenditure as a percentage of GDP reached 9.28 percent in 2018, which is considerably higher than the average for Sub-Saharan Africa (5.16 percent) and upper-middle-income countries (5.82 percent).⁶

Despite high levels of expenditure on health, health care access and service delivery quality have posed a persistent challenge in Lesotho. As Table 1.1 shows, Lesotho ranks below many of its peers in terms of morbidity and mortality. Given its considerably higher expenditure on health, Lesotho could significantly improve the quality and efficiency of health care in the country and increase the value of investment in this area.

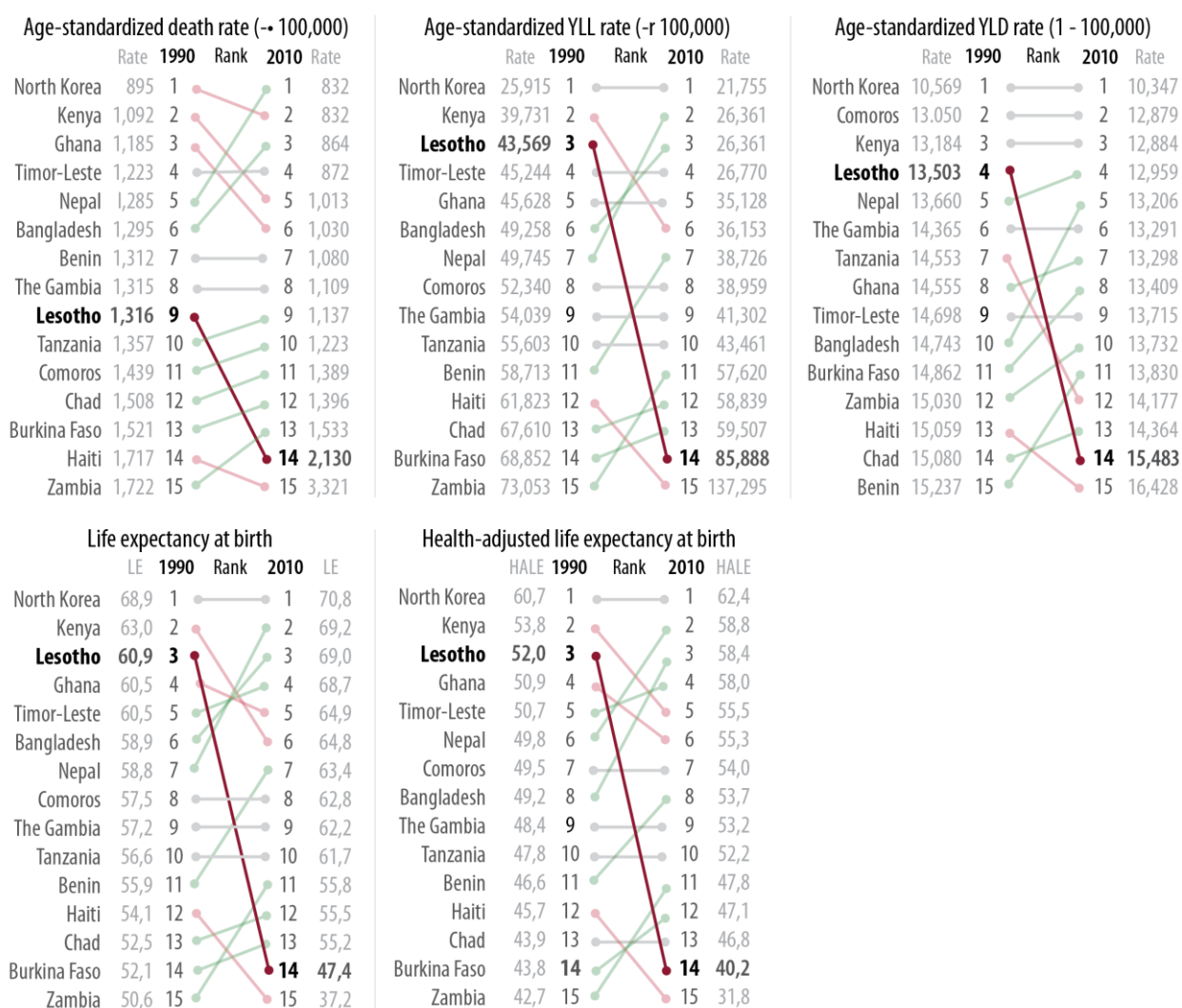
⁴ World Bank Group, World Development Indicators database, Population, total-Lesotho: Various sources, 2020.

⁵ World Bank Group: GNI per capita, PPP (current international \$) – Lesotho: International Comparison Program, World Bank | World Development Indicators database, World Bank | Eurostat-OECD PPP Programme.

⁶ World Bank Group: Current health expenditure (% of GDP) – Lesotho: World Health Organization Global Health Expenditure database.

Table 1.1 Morbidity and Mortality: Lesotho compared with Peer Countries

Age-standardized death rates, YLL rates, YLD rates, and life expectancy at birth and health-adjusted life expectancy at birth for 1990 and 2010, both sexes combined

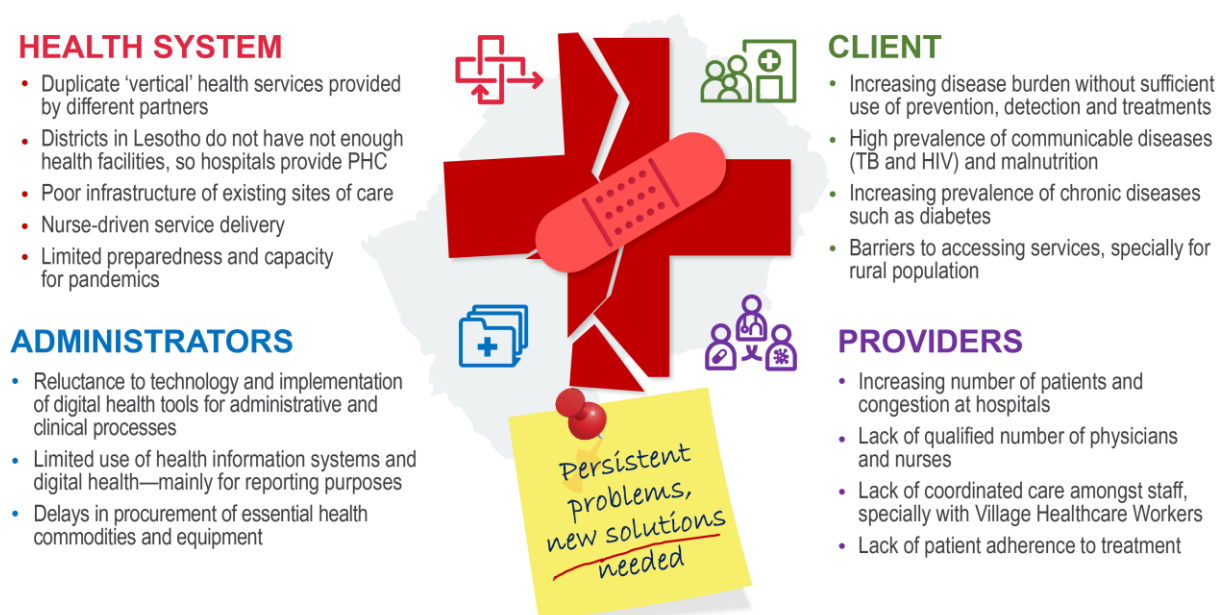


Source: Adapted from Institute for Health Metrics and Evaluation (IHME) (2020).⁷

Note: HALE = Health-adjusted life expectancy; LE = Life expectancy; YLD = Years lived with disability; YLL = Years of life lost.

Achieving universal, comprehensive primary health care in Lesotho has been a government priority at various points over the past two decades. The MoH has adopted the Framework for the implementation of the Ouagadougou Declaration on Primary Health Care and Health Systems in Africa (World Health Organization 2009). The National Health Policy 2016 and the National Health Strategic Plan (NHSP 2017–22) were both developed based on the principles of the Ouagadougou framework.

⁷ Global Burden of Disease (2010), GBD Profile: Lesotho, https://www.healthdata.org/sites/default/files/files/country_profiles/GBD/ihme_gbd_country_report_lesotho.pdf

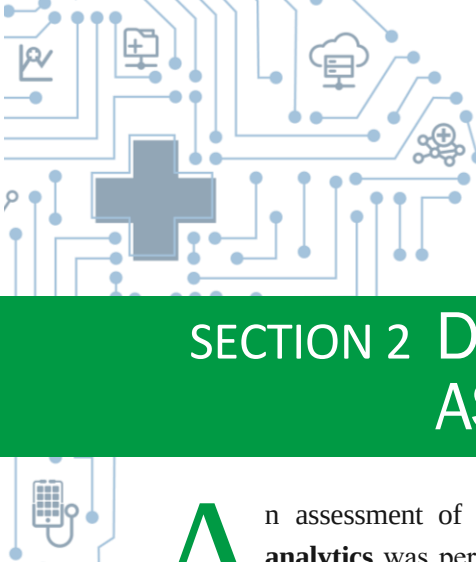
Figure 1.1 Main PHC challenges in Lesotho

Source: Prepared by the authors based on previous World Bank assessments, discussions with MoH, and key stakeholder interviews.

The government is the primary provider of health care services in Lesotho. Other providers are privately owned or run by smaller, nongovernmental organizations and consist of a network of private surgeries, nurse clinics, and pharmacies providing health care, including dispensaries of medicines. Each of Lesotho's ten administrative districts has at least one secondary-level hospital, which is physician-led and serves as a referral facility for all health centers in the district. Instead of offering specialized services, most district hospitals offer primary health care (PHC) services, which are supposed to be provided by health centers and health posts. The national tertiary care hospital in Maseru, the capital, is the only government hospital offering intensive care. Health care in Lesotho is predominantly nurse-driven, with an average of 11.58 nurses per doctor. About 90 percent of private, for-profit health facilities are situated in the four large districts of Maseru, Berea, Mafeteng, and Leribe, making access to health services difficult for people who cannot afford private care or who live in rural areas.

Although the role of community health workers (CHWs) who provide PHC services in the country dates back as far back as 1979, access to critical primary health care services remains low. Lesotho's health care access and quality score in 2016 was 32 (as measured by the Institute for Health Metrics and Evaluation (IHME) on a scale of 0 to 100), indicating considerable room for improvement. Digital health, combined with clearly defined and reimagined policies and outcomes, can be a tool for effecting change in how primary health care and health other services are delivered. Implementing digital health interventions can support the transformation of the country's health care service delivery to ensure more inclusive, comprehensive, patient-centered quality care for all, and reduce inequity.

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SECTION 2 DIGITAL HEALTH MATURITY: ASSESSMENT AND RESULTS

An assessment of the **digital environment, architecture and data, applications, and analytics** was performed to determine the maturity and readiness of the country's digital health system for implementing and advancing digital health for healthcare services delivery.

2.1 Digital Health Assessment Approach

In deciding on an assessment approach, the World Bank aimed to build on existing assessments, take a comprehensive approach to digital health maturity, ensure that the assessment would yield a digital health maturity index for Lesotho (to contribute to the [Global Digital Health Index](#) scores for multiple countries), and focus on priority areas for the implementation plan.

With these principles in mind, the World Bank developed a hybrid digital health maturity assessment tool that draws on several existing digital health tools.⁸ More details about the World Bank's approach to the assessment are available in its [Digital Health Assessment Toolkit Guide](#).

The score derived from the assessment reflects the digital health maturity across four dimensions: Digital Environment, Architecture and Data, Applications, and Analytics. Within each dimension, several indicators were used (75 in total, some drawn from existing digital health assessments tools and others developed where gaps existed) that explore various topics such as leadership and governance, strategy and investment, legislation, policy and compliance, workforce, standards and interoperability, infrastructure, and services. Based on the status of each aspect of the digital health system, the indicator is allocated a score (out of 5). Scores are aggregated and normalized, to derive an average score out of 5 for each of the four dimensions and for the overall digital health system. In addition, using the indicators drawn from the Global Digital Health Index, Lesotho's digital health index is calculated for comparison against other countries. Appendix A contains more information about the assessment methodology and information sources.

The World Bank team—working closely with the MoH—used inputs from various digital health assessments that have already been completed in the country, as well as a desk review of existing documents and reports and key informant interviews, with the following objectives:

- a. Populate a digital health landscape profile about the key features of digital health in Lesotho (see section 2.3)
- b. Rate each of the 75 indicators across the four dimensions to determine a digital health maturity score for Lesotho as a whole and for each of the four dimensions

⁸ See the Navigator for Digital Health Capability Models for more information about each of the existing tools. https://wiki.digitalsquare.io/index.php/Navigator_for_Digital_Health_Capability_Models.

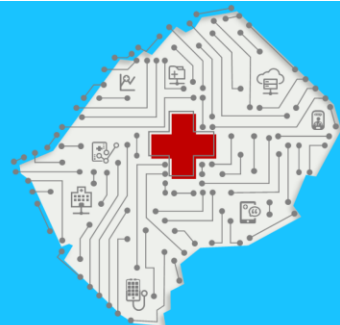
- (section 2.4), and describe key aspects of each dimension and digital health readiness (section 2.5 and section 3)
- Determine Lesotho's Digital Health Index, per the global set of indicators (section 2.4)
 - Using the results documented in sections 2.3 and 2.4, undertake a SWOT (strengths, weaknesses, opportunities, and threats) analysis of the digital health system in Lesotho (section 3)
 - Propose strategic outcomes, recommendations, and priority actions for implementation (section 4)

2.2 Digital Health Assessments Conducted

Various digital health assessments have been undertaken in Lesotho (figure 2.1). These assessments have had specific areas of emphasis, but none has focused on the overall digital health system writ large. For example, the UNICEF Lesotho Data Requirements Analysis and Data Mapping (UNICEF, 2018) focuses on analytical maturity and data use in the country. Similarly, the USAID/MCC/RTI Lesotho ICT Assessment is focused primarily on the ICT infrastructure and architecture, although it explores data use and different digital health interventions or applications. The ICAP–MOH Rapid assessment (ICAP) of the HMIS in Lesotho examined policies and guidelines, data flow and quality, paper and electronic health information systems, infrastructure and human resource capacities at the central, district, and health facility levels, to identify areas requiring an HMIS Strategic Plan 2018–2022 focused on HMIS usage and improvements in the country. Appendix B compiles the findings and recommendations for some of these assessments.

Figure 2.1 Purpose of Lesotho's Digital Health Assessments

	MOH/ICAP EMR Assessment (2017)	- To assess key areas impacting EMR suboptimal implementation (the EMR system, environment and users) - This assessment added value to understand the failure of the EMR system and can be of value to incorporate inputs for a better implementation strategy for future digital health interventions
	HMIS Strategic Plan (2018–2022)	To assess HMIS policies and guidelines, data, flow and quality, paper and electronic health information systems, infrastructure and human resource capacities at central, district and health facility levels to identify areas requiring enhancement
	UNICEF Lesotho Data Requirement Analysis and Data Mapping (2018)	- Focus on analytical capability and data maturity across sectors, with a description of challenges and barriers on data quality - Describes data and statistics capability at national, district and facility level
	USAID/MCC/RTI Lesotho ICT Assessment (2020)	- Analyze data flows - Provide recommendations
	USAID/MCC/RTI Lesotho ICT Assessment (2020)	- Extensive assessment of the ICT maturity in Lesotho - Main objective is to provide areas of investment for next MCC's Compact 2 - It provides valuable inputs on the area of health information systems, ICT skills, security, privacy, and interoperability <i>Less focus on analytics capacity or digital health interventions for PHC transformation</i>
	WB Lesotho's Digital Economy Diagnostic (2020)	- Provides a comprehensive assessment of the different digital initiatives in Lesotho, infrastructure maturity, digital skills and platforms - Cross-sector focus, not health sector specific - Valuable input to build a digital health strategy in coordination with other national efforts
	MSCT & UNDP ICT Policy (Draft 2021)	- Evaluates existing ICT policy in Lesotho (from two decades), identify gaps and propose recommendations - Propose a draft ICT policy for 2021



THIS CURRENT DIGITAL HEALTH ASSESSMENT ADDS TO THE ASSESSMENTS ALREADY DONE BY:

- Analyzing digital health maturity from a PHC transformation perspective
- Analyzing the role of digital health applications at community level
- Compiling the different initiatives and joining-the-dots, encouraging collaboration
- Providing a comprehensive perspective of digital health towards the building of a roadmap for implementation
- Materializing the findings into a score to measure current status and progress

Source: World Bank

2.3 Digital Health Landscape

As part of the assessment toolkit, a landscape profile was conducted that collects sociodemographic data, digital indexes, and connectivity and quantitative systems indicators that helped contextualize the findings from the desk review and interviews and the maturity score (section 2.4).⁹ A detailed landscape profile that compares Lesotho to other countries in the region, can be found in appendix D.

Lesotho possesses an extensive, although not always reliable, mobile infrastructure. One of the strongest elements of the digital health landscape is that Lesotho has extensive mobile coverage, especially for 2G and 3G networks (approximately 90 percent). Other networks, such as 4G, are being used in parts of the country (45 percent), and 5G and fiber optic technologies are emerging. Around 60 percent of Basotho have smartphones, and two mobile companies are currently providing infrastructure and connectivity. These types of phones help boost the use of social media platforms.

While Lesotho has a large network and mobile coverage, Internet use by individuals is limited (30 percent) and access to electricity (47 percent) are still low compared to other countries in the area (50 percent and 72 percent on average, respectively).¹⁰ The country also ranks low on global digitalization indexes such as the UN e-government development index (135 of 193) and the ITU–ICT development index (133 of 176).

Most digital health interventions in Lesotho are related to health information systems, such as the DHIS-2 (used for program monitoring and reporting), and an electronic medical record (EMR) system called e-Register that covers only HIV- and TB-related programs and patients. All 182 health facilities have an Internet connection and use standardized operating procedures for data collection and transfer between the health facility, district, and national levels at the MoH. –A Health Information Exchange is now fully operational, so data at local Health Facilities servers is shared across all Health Facilities, through e-Register. While e-Register is not yet linked to laboratory information, radiology images, or other relevant patient-level information and programs, it is expected to do so in the near future¹¹. In addition, at the national level, electronic medical billing is inexistent, logistics management systems are only partially digitalized and human resources systems are manual and rarely updated. There is currently an initiative to connect pharmacy information and drug procurement to the e-Register and a plan to move to a paperless system at health facilities, using specific parameters and data quality standards established by the MoH. Finally, as shown in section 2.5, there are few applications available to provide patients with appointment reminders, telehealth, treatment adherence and decision support systems, intelligent dashboards, or patient monitoring solutions at the health facility or national level.

There is a nascent use of cloud services. The MoH is currently using Amazon Web Services cloud (through ICAP) to host the Health Information Exchange, including an interoperability

⁹ For a full list of the indicators and their value see appendix B.

¹⁰ Average of Botswana, Eswatini, Namibia, and South Africa.

¹¹ Previous experiences with EMR systems have prompted the need to build the EMR in smaller modules and individual programs. It is expected to scale up the system in the near future.

server, Master Patient Index, shared health records, and the DHIS-2. Only some information that supports the e-Register is hosted there, which means there is still data on local servers at health facilities that is not being shared across facilities. With support from Microsoft, the MoH is piloting the transfer of data to Microsoft Azure cloud services, under a government initiative to transfer data into one cloud instead of siloed initiatives and improve data sharing.

Some local universities offer information systems degrees. The National University of Lesotho and Botho University offer information systems and computer science degrees. The National Health Training College also provides in service training. Still, these degrees or trainings do not focus on digital health implementation, data science for data analysis, or digital health leadership. In addition, continuous education and post training should be strengthened.

Use of data mainly for reporting purposes. While data is collected at several points and then transferred to district and national level, the use of it is mainly for reporting or descriptive purposes and data is shown at aggregated level. The use of data for predictive analytics, decision support or prescriptive recommendations is inexistent, limiting the potential value of it. Above all, data quality is generally low and reliability is not always high.

2.4 Digital Health System Maturity in Lesotho: Overview

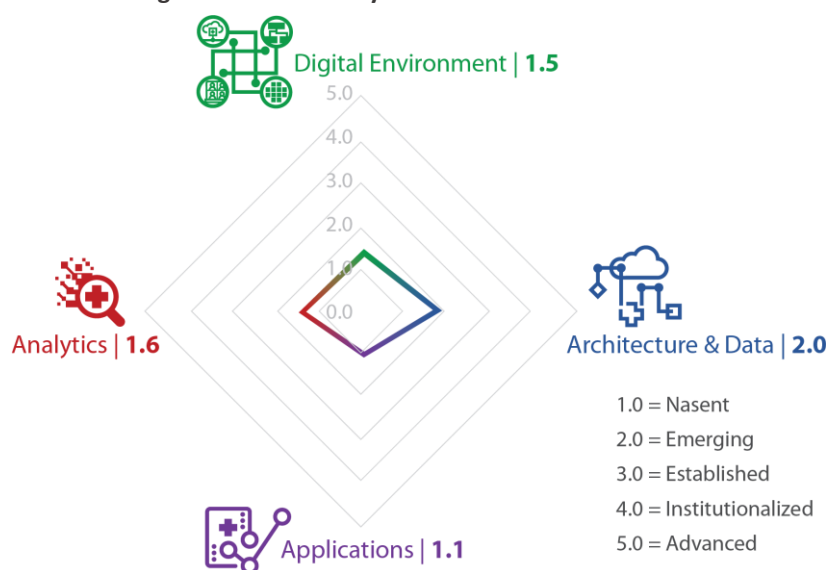
A maturity score for Lesotho was produced using the digital health assessment tool created by the World Bank. The score for each of the 75 indicators can be found in appendix C (or click [here](#) to open the Excel file), and the digital health maturity score is summarized in figure 2.4. The assessment revealed the following:

- a. “Architecture and Data” has the highest level of maturity: these foundational investments are essential building blocks for the Applications and Analytics dimensions.

World Bank Digital Health Maturity Score (0 to 5)		1.5
Digital Environment		1.5
Architecture and Data		2.0
Applications		1.1
Analytics		1.6

- b. Implementation of both digital health applications and analytics is at a low level of maturity.
- c. The Digital Environment dimension—which enables the other dimensions—is also weak.
- d. Lesotho’s overall digital health maturity is at the Nascent to Emerging stage, with a score of 1.5.

Figure 2.2 Lesotho's Digital Health Maturity Score



Source: World Bank

- e. Lesotho's digital health index receives a score of 1.5 and it can be translated into Phase 2 (according to the [Global Digital Health Index](#) framework), with it scoring as follows in relation to each one of the Global Digital Health Index dimensions

Global Digital Health Index overall (out of 5)	Phase 2
Leadership and governance	Phase 2
Strategy and investment	Phase 1
Legislation, policy, and compliance	Phase 1
Workforce	Phase 1
Standards and interoperability	Phase 2
Infrastructure	Phase 1
Services and applications	Phase 3

2.5 Digital Health Maturity: Key Aspects

One of the key features of the Digital Environment dimension is the existence of a drafted digital health strategy in Lesotho.

2.5.1 Digital Health Strategy

Lesotho's eHealth Strategy 2019–2023 was drafted to guide the application of eHealth initiatives to improve service delivery and health outcomes.¹² The eHealth Strategy focused on seven priority strategic areas: ICT Services and Applications, Leadership and Governance, Strategy and Investment, Infrastructure, Standards and Interoperability, Legislation, Policy, Compliance, and Workforce. Appendix E summarizes key achievements in each of these seven strategic areas.

¹² Lesotho has no official digital health strategy currently, however, there has been efforts to implement some of the actions during the past years.

Development of the eHealth Strategy was preceded by a rapid assessment of eHealth readiness conducted by WHO during a scoping mission, along with other assessments and recommendations made by various entities, such as the African Development Bank (AfDB) e-Government project.

As the drafted strategy covered the period 2019–2023, the following elements should be taken into account during the preparation/development of any succeeding future strategy:

- The strategy was designed prior to the COVID-19 pandemic and thus did not include the new challenges and needs imposed by the pandemic and future health emergencies
- The current strategy does not focus on primary care transformation and system re-design, but on ICT, systems, and infrastructure, which are essential, but not comprehensive. Aspects of the digital health ecosystem that are critical to the success of efforts to transform health care in Lesotho, that are not included in the current strategy, include the following:
 - Data governance standards, associated regulations, and security measures to share and protect health data
 - Approaches to leveraging the use of digital health interventions/applications for clients, providers, and health care administrators, and
 - The use of data, advanced analytics, and algorithms for evidence-based decision making
- The strategy lacks a robust assessment of cybersecurity and cloud services, which are currently of interest to the government
- The strategy lacks a costed implementation plan
- The strategy has not received final approval but has been publicly disseminated among stakeholders and partners.

The IT department has been implementing ad-hoc the current drafted strategy since 2019–20. Thus, a midterm and final review are highly recommended as part of the next steps, prior to the subsequent strategy cycle.

2.5.2 Scope of Current Digital Health Applications in Lesotho

Some digital health interventions or applications are currently being implemented in Lesotho, as detailed in table 2.1. As is clear from the list, few of the interventions have been nationally implemented.

Table 2.1 Existing Digital Health Applications in Lesotho

NAME	STATUS AS OF NOVEMBER 2022	TYPE OF DIGITAL HEALTH INTERVENTION	DESCRIPTION
DHIS-2	Running (national level)	Health Information Management System	DHIS-2 is the primary reporting system in Lesotho. The information is entered by health facilities, validated by district managers, and used nationally for decision making. It is fully integrated with e-Register. Data is shown as aggregated and not at the patient level. Patient level data is in the eRegister which aggregates that data monthly and posts it into the DHIS2
DISA	Running (national level)	Laboratory information system	The system shows patient-level laboratory information and is connected to DHIS-2 through aggregated indicators and not at the patient level.
BSIS	Running (national level)	Blood safety and inventory information system	Reports on blood supplies and distribution. Not currently connected to DHIS-2
e-Register	Running (national level)	Proxy for EMR	The e-Register is used to enter information at the patient level. It is used in all health facilities; however, it only includes TB and HIV patients and related information on other programs that cross issues with TB and HIV. It is connected to information collected by pharmacies.
EMRx	Running at Baylor College of Medicine Children's Foundation Lesotho	EMR	There are plans to connect EMRx with e-Register. Currently, data clerks must enter information manually in both systems.
OpenMRS	Running at Partners in Health (PIH) facilities	EMR	There are plans to connect OpenMRS with e-Register. Currently, data clerks must enter information manually in both systems.
U-report	Running throughout the country	Reporting of health system feedback by clients	U-report uses SMS technology to engage young people to provide feedback on several health-related topics.
Algorithms for radiology	Running at some PIH facilities	Screen clients by risk or another health status	Some partners are using artificial intelligence algorithms to detect TB by X-ray as a decision support system.
COVID Citizen App	In implementation phase (national level)	Transmits untargeted health information to an undefined population Transmits targeted alerts and reminders to client(s)	Considering the pandemic, the National COVID-19 Secretary (NACOSEC) will start implementing a community engagement app (COVID Citizen App) to provide information on COVID-19 cases, notifications, results, and other information.
BKM (Bophelo ka Mosebeletsi) App	Running (Quthing and Mokhotlong) extended to Mochale, Maseru, Leribe Pilot	Surveillance/HMIS System	The first zero rated android system used by Village Health Care Workers with provided tablets for capturing COVID-19 alerts at community level. Currently all VHW tools have been developed into the app whereby monthly reports are then posted to DHIS2 aggregated report at facility level monthly
BONOLOMED	Pilot	Pharmacy system	A system that sends patients' medication to lockers in specific locations so they can avoid going into a health facility or to the pharmacy. The patient receives a code with which to activate and open the locker.

Table continued on next page

Table 2.1 Existing Digital Health Applications in Lesotho (continued)

NAME	STATUS AS OF NOVEMBER 2022	TYPE OF DIGITAL HEALTH INTERVENTION	DESCRIPTION
M-mama	Pilot	Coordinates emergency response and transport	"A groundbreaking emergency transport system utilizing mobile technology and [the] mobile money system M-Pesa to reduce maternal and neonatal mortality rates. It provides a toll-free number and 24/7 call center to connect women who experience complications in pregnancy, labor, or with a newborn to either an ambulance or to a fleet of 'ambulance taxis.'" (Vodafone, 2020)
ECHO	Pilot	Consultations for case management between health care provider(s)	ECHO is a tele-mentoring application that connects experts and health care workers (learners) to share support, guidance, and feedback on patients' cases.
VAXPass	Not yet implemented	Digital vaccination certification	This system was recently developed to provide digital vaccination certificates.

Source: World Bank.

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SECTION 3 IMPROVING DIGITAL HEALTH IN LESOTHO

Based on the results discussed in section 2, the assessment team conducted a SWOT analysis of Lesotho's current digital health system.

Figure 3.1 SWOT Analysis of Digital Health System

STRENGTHS	OPPORTUNITIES
- High mobile coverage - Wide use of DHIS-2 - SOP for data collection - Draft ICT Policy 2021 - Short digital health courses - Plans for cloud services and paperless facilities	- Structural changes at the MOH for government-led initiatives - Expansion of national ID across systems - Accelerate the development of human-designed interventions - COVID opening development of many applications
WEAKNESSES	THREATS
- Lack of data privacy policy - Data hosting not reliable - Several manual/paper processes - Lack of interoperability systems - Lack of evidence and impact evaluation on DH	- Low internet penetration - Political instability - Limited coordination between MOH and partners - Limited financial resources - Low digital skills - Limited community level data collection

Source: World Bank.

The SWOT analysis identified weaknesses and threats that, if addressed, would enable Lesotho to move into the next stage of digital health maturity, enhancing the country's ability to further leverage digital health to advance its health priorities and improve outcomes. The following key aspects of the weaknesses and threats were identified:

3.1 DIGITAL ENVIRONMENT

- **Absence of a unified, e-government framework to guide alignment and coordination of existing digital interventions.** The absence of a comprehensive e-government strategy causes fragmentation in the country's digital health system, and misalignment between MoH, other ministries, and partners promotes duplication.
- **Lack of a legal or policy framework to facilitate data sharing.** This often means data are not available in the format, disaggregation, or time frame user demand. There is also no Freedom of Information law nor a government-wide unique ID operating across the system, which could enable coordination beyond the health sector and further efforts to achieve people-centered integration of services.

- **Suboptimal data hosting by MCST.** Constant electricity cuts, connection problems at MoH, and the lack of an uninterruptible power supply (UPS) limit systems' efficient use and pose significant cybersecurity risks and challenges for the continuity of services.

3.2 ARCHITECTURE AND DATA

- **Limited interoperability of systems among different health institutions.** Due to the lack of comprehensive guidelines or standards for electronic medical record (EMR) systems, many applications used within or across facilities operate in isolation. For example, even within the MoH information system, there are various unlinked registries (e.g., laboratory results systems and DHIS-2). Moreover, at some partner-run facilities, there is duplication of systems, (e.g., EMRx from the Baylor College of Medicine Children's Foundation Lesotho and e-Register from the MoH), which hampers efforts to provide optimum care to patients.

3.3 ANALYTICS

- **Inexistent community-level data collection.** Incomplete population health information is compounded by the inability of village health care workers, who serve the majority of the rural population, to gain access to information systems.
- **Inadequate digital health literacy among health care workers and decision makers:** The shortfalls are notable at the district and health facility levels, where limited effort is made to use data to improve quality of care.
- **Inefficient use of health data systems:** Most interventions focus on reporting and are not used to evaluate and analyze health care or improve health care service delivery.

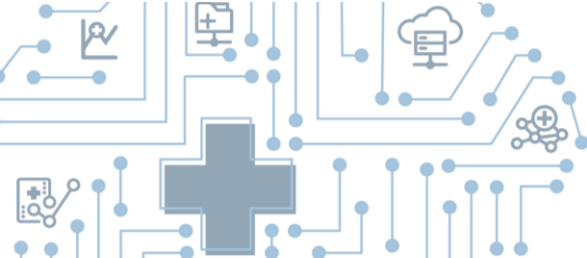
3.4 APPLICATIONS

- **Duplication of efforts due to vertical health programs run by different partners.** Some of these programs (mainly focused on HIV and TB) use digital health interventions and information health systems that are not always interoperable with government systems.
- **E-government projects funded by partners focused on infrastructure.** While this is important, enhancing and funding digital health applications is essential to promote evidence-based public health service delivery. Less effort has been exerted to improve data collection and data quality, to improve electronic medical records and underlying health systems, which are the foundation for developing smart and innovative algorithms for data-driven decision making.
- **Numerous manual processes and paper-based patient registries.** The co-existence of print and electronic systems in some facilities imposes a burden on health workers. Using both systems is time-consuming and creates opportunities for inaccuracy in the use of health information.
- **Limited availability of patient-level digital health applications.** Use of digital health applications would improve outreach and communications.
- **A shortage of impact evaluations.** The inability to efficiently assess the effectiveness, costs, and benefits of digital health interventions, along with the lack of an approved plan and awareness of past failures, resulted in low implementation

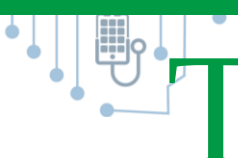
and hampered the scalability of digital health interventions (at the facility and programmatic level).

Acting on opportunities to better integrate and leverage digital health within the health sector could help Lesotho move quickly to the next digital health maturity stage and enhance service delivery. Improved outcomes could result from expanded and more equitable access to services, improved health service quality, and enhanced readiness for future health-related challenges. However, the following threats or risks could jeopardize the evolution of digital health in the country:

- The mountainous geographical characteristics limit access to health services in distant areas and reliable infrastructures, such as Internet connectivity and electricity
- There is limited household Internet use
- Political instability and a lack of political support delay the advancement of the current eHealth strategy
- Misalignment between MoH and partners' needs and objectives impede buy-in and promotion of any national strategy
- Limited financial resources reduce opportunities for government-led investments and upgrading of legacy systems and IT hardware
- Limited human resources increase the low value-added workload of health care workers
- Misconceptions and fear about technology among health care workers, and especially among village health care workers, create reluctance to change
- Limited data collected at the community level results in incomplete information and population health analytics



SECTION 4 GOING FORWARD: STRATEGIC RECOMMENDATIONS AND IMPLEMENTATION ROAD MAP



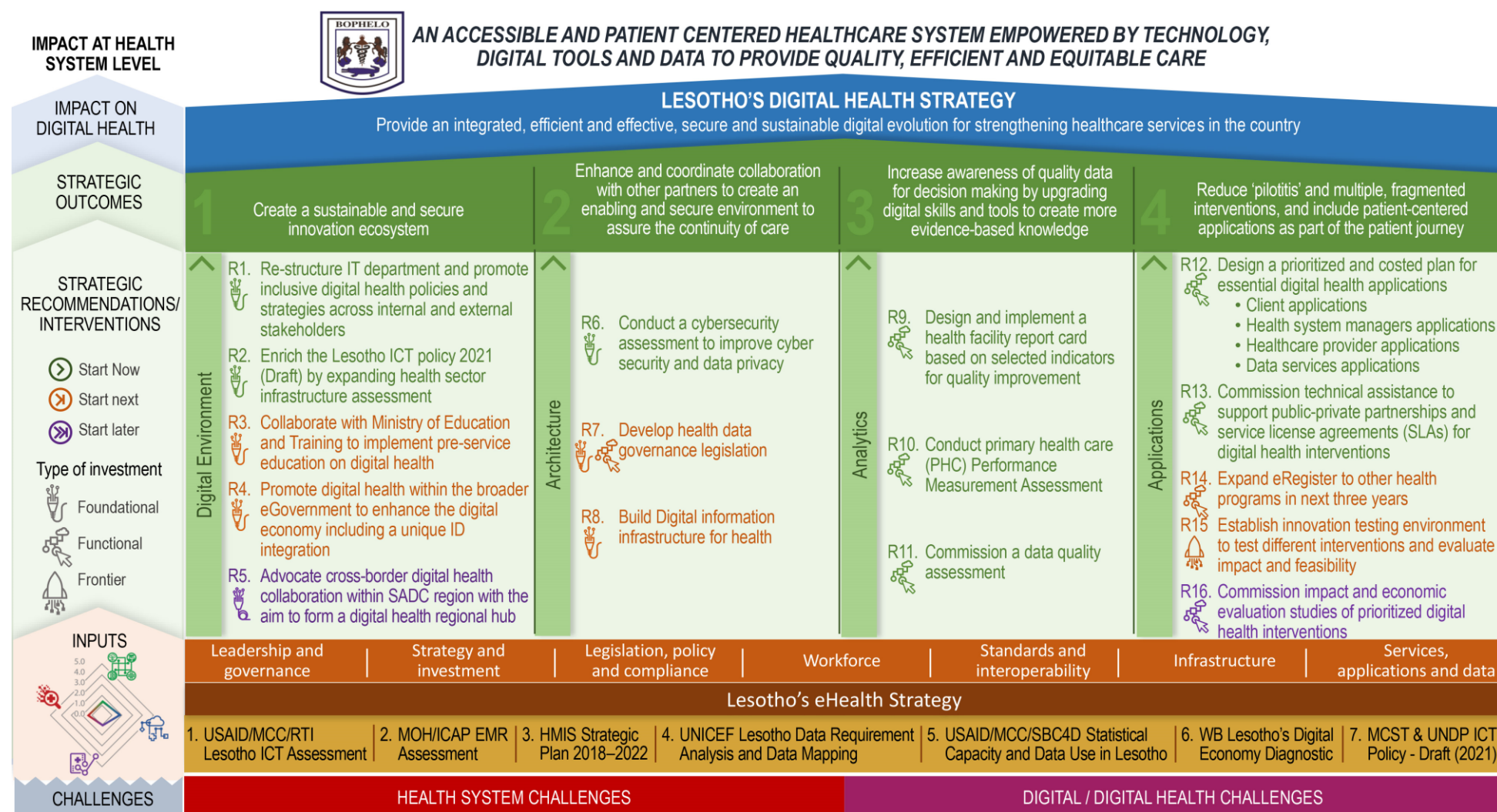
The current 2019–2023 eHealth strategy has been a welcome starting point. This digital health assessment will provide input for the development of the next digital health strategy (2024–2028) and help the government prioritize interventions geared toward improving service delivery and promoting primary health care transformation.

The new strategy should include the following objectives:

- Create an interoperable ecosystem with multiple stakeholders, such as the private sector, academia, donors and partners, and other government offices
- Enhance collaboration with partners to reduce fragmentation and create alignment around a government-owned strategy and priorities
- Increase awareness of the importance of quality data for decision making, accomplished by upgrading digital skills and tools to create more evidence-based knowledge
- Design a prioritized and costed plan for digital health interventions using an agile methodology and reducing “pilotitis”
- Develop and include patient-centered applications as part of the patient journey to increase access, enhance patient empowerment, and improve the quality of care for all

Based on the SWOT analysis, 16 strategic recommendations have been made, grouped by digital health system dimension (figure 4.1). For each dimension’s strategic recommendations, a roadmap of short-, medium-, and long-term actions has been proposed. The recommendation number (R#) can be used to link the recommendations to the priorities discussed and the actions associated with each dimension. Prioritization of these actions is based on the following criteria: most urgent action to support PHC transformation, incomplete actions from the drafted eHealth Strategy (2019–2023), and actions with the most significant long-term impact. Appendix E provides a summary of all recommendations.

Figure 4.1 Digital Health Strategic Outcomes and Recommendations



Source: World Bank.

4.1 DIGITAL HEALTH DIMENSION 1: DIGITAL ENVIRONMENT

4.1.1 Strategic Outcome 1

Create a sustainable and innovative ecosystem with clear guidance from the government, involving multiple stakeholders, such as the private sector, academia, donors and partners, other government offices, and collaboration with neighboring countries (i.e., South Africa, Eswatini) to strengthen, develop, and advance digital health and provide an institutionalized framework with the necessary incentives to foster collaboration.

4.1.2 Recommendations

- R1. **Restructure the IT department within MOH and expand their role beyond ICT maintenance to promote inclusive digital health policies and strategies across internal and external stakeholders.** Assign a dedicated budget for digital health with defined objectives and priorities to provide direction; align and funnel investments to the right interventions; provide adequate skill mixes; and evaluate interventions. Appendix D describes some participatory design principles that are relevant for this recommendation.
- R2. **Enrich the Lesotho ICT policy 2021 by conducting a health sector infrastructure assessment.** Conduct a sectoral assessment of infrastructure and connectivity to implement some of the recommendations made by the Lesotho ICT policy 2021 (currently in draft form). This assessment should explore plans to move to sustainable green energy to enable a consistent electricity supply for facilities and data centers, while reducing the climate impact.
- R3. **Collaborate with the Ministry of Education and Training to implement pre-service education of health professionals and health workers on digital health, as well in service health professionals.** The curriculum should cover health informatics, data science for health care, development and implementation of digital health interventions, and entrepreneurship to create a pre-trained cadre to assist the work of the MoH. Leverage regional knowledge by coordinating with other digital health capacity-building initiatives.
- R4. **Promote digital health within the broader e-government to enhance the digital economy, including promoting digital ID.** The African Union's Agenda 2063, ratified by all African countries, aims to ensure that "99.9% of people in Africa have a digital legal identity as part of a civil registration process by 2030." The MoH must coordinate with other governmental bodies to implement digital ID to empower patients by linking patient information across facilities.
- R5. **Formalize digital health collaboration with countries within the SADC region to form a regional digital health hub, like Digital REACH Initiative proposed by USAID for the East Africa Community.** Lesotho could coordinate efforts and collaborate with neighboring countries through a regional digital health hub, that will

facilitate sharing of human resources, skills, knowledge, and better practices to improve preparedness and resilience for future health events such as pandemics

4.1.3 Roadmap of Actions

➤ START NOW	➤ START NEXT	➤ START LATER
R1. Establish MoH coordination structures to evaluate the actions taken so far in digital health and guide the development of the subsequent strategy (2024–28) R1. Establish a Technical Working Group to coordinate implementation activities for the new digital health strategy (2024–28) R1. Determine the cost of the new digital health strategy (2024–28) R1. Review the current national health policy to include digital health R1. Develop a monitoring and evaluation framework for the new eHealth strategy R2. Commission a health sector infrastructure assessment R4. Promote the digital health strategy to seek buy-in across all MoH departments and government sectors and stakeholders)	R1. Develop standard operating procedures (SOPs) for the current eHealth strategy R4. Establish a national digital health standards body R5. Source funding from stakeholders and development partners to develop a resource mobilization plan R5. Develop and implement a plan for digital health advocacy campaigns	R3. Establish synergies with institutions of higher learning to promote training in digital health skills R4. Collaborate with the Ministry of Home Affairs to link shared health records and the Home Affairs NICR system to enable unique identification/digital ID of patients via ID cards R4. Document requirements for digital health integration into e-governance R5. Develop a retention policy for the digital health workforce

4.2 DIGITAL HEALTH DIMENSION 2: ARCHITECTURE AND DATA

4.2.1 Strategic Outcome 2

Enhance and coordinate the collaboration with other partners to create an enabling and secure environment that will assure the continuity of care. The fragmented landscape with multiple vertical programs, each using a different system, adds complexity when identifying patient journeys and providing continuity of care and obstructs a holistic perspective of patients. Efforts to make systems interoperable must learn from experiences with previous initiatives, considering standards, data privacy, and the security of data flows.

4.2.2 Recommendations

- R6. Conduct a cybersecurity assessment to improve data privacy.** Provide technical assistance to develop policies and guidelines for data privacy, cybersecurity, cloud services and data transfer, to reduce vulnerability to cyber-attacks that could disrupt the provision of care or jeopardize the privacy of patient data.
- R7. Develop legislation for health data governance.** Develop data governance legislation and standards and define data ownership, data transparency, and data management, sharing information rules within the health information exchange architecture.

- R8. Expand the health information exchange architecture to build a digital health platform (infostructure).** Apply the recent WHO guideline “Building a Digital Information Infrastructure (Infostructure) for Health” to build a digital health platform using accepted standards, and connect with other MoH applications, such as pharmacy systems, DHIS-2, and future human resources and logistics management applications.

4.2.3 Roadmap of Actions

🕒 START NOW	🕒 START NEXT	🕒 START LATER
R7. Develop national digital health standards (R7) R7. Conduct an audit of all laws and policies pertaining to health service delivery in the country to identify areas to incorporate digital health R8. Assess the requirements for digital health interoperability R8. Upgrade mail systems to accommodate both voice and video conferencing, and train users on their use R7/8. Incorporate digital health in training programs for health personnel offered by higher education institutions	R6. Assess compliance with cybersecurity standards R6/8. Establish a secondary or failover cloud hosting platform for high demanding systems by Mirror Cloud servers with local servers R6/8. Improve network and infrastructure monitoring, support, security, and maintenance reporting by exploring different monitoring software R8. Extend the network to all health facilities R8. Improve government network uptime to over 95% by December 2023	R7. Establish an accreditation system for organizations and institutions to foster compliance with digital health standard operating procedures

4.3 DIGITAL HEALTH DIMENSION 3: ANALYTICS

4.3.1 Strategic Outcome 3

Increase awareness of data utilization and data quality for decision making by upgrading digital skills and tools and creating more evidence-based knowledge. There is a critical need to build a cadre of well-informed, effective leaders who are trained to understand the potential of data and the impact of digital health, and who can successfully lead and execute digital health transformation initiatives. This includes improvement of the data collection process and data quality measures that can support surveillance activities as well as potential analytics (supply- and demand-side) for informed decision making.

4.3.2 Recommendations

- R9. Design and implement a health facility report card based on select indicators of quality improvement.** Indicators could include service delivery, patient satisfaction, resources, and wait times to provide insight and transparency in terms of the quality of care at each health facility.
- R10. Commission an assessment of primary health care challenges to identify areas that can be improved with digital health mechanisms.** To be effective and impactful, digital health interventions or applications should respond directly to primary care challenges that can be identified through assessments like the World Bank’s vital signs profile for primary health care performance improvement (PHCPI).

R11. Commission a data quality assessment. As part of the effort to strengthen surveillance and data collection, the World Bank is currently conducting a process mining analysis, from data collection to data reporting and analysis. This can contribute to a larger assessment of data quality across the health care sector.

4.3.3 Roadmap of Actions

🕒 START NOW	🕒 START NEXT	🕒 START LATER
R9. Train data capturers on data management and mandate data use certifications for managers as a mandatory requirement R10. Conduct primary health care (PHC) performance measurement assessment to discover new healthy system challenges R11. Commission a data quality assessment to improve data quality at the source	R9. Provide ongoing mentorship data management at national and subnational levels Conduct routine data quality reviews quarterly R11. Provide in-service training to health care workers using e-learning and digital resources)	R9. Provide accreditation to health care institutions that comply with the Digital Health Standard Operating Procedures R10. Develop an application/platform for e-learning

4.4 DIGITAL HEALTH DIMENSION 4: APPLICATIONS

4.4.1 Strategic Outcome 4

Reduce “pilotitis” and fragmentation of interventions. As mentioned in the situational analysis, some digital health intervention pilots are being conducted in the country. However, these are not necessarily guided or coordinated by the MoH nor is their management transferred to it. In addition, they may not always respond to the urgent needs and objectives set by the government.

A limited electronic health records (EHR) complicates efforts to trace patients within a facility, across facilities, or over time. Typically, an HMIS digitizes health data at the district level and does not include patient-level EHR. Moreover, unique identifiers for patients do not exist or are not used, adding to the challenge of tracing patients through the system, from one facility to another, or over time.

The development of patient-centered applications is a vital consideration to improve the patient journey in seeking and accessing health care and enhance patient empowerment. The COVID-19 pandemic exposed the importance and relevance of digital health solutions to improve and overcome some of the persistent challenges of primary care and the need to accelerate the development of simple digital health applications that respond to end users’ needs.

4.4.2 Recommendations

R12. Design a prioritized and costed plan for digital health applications. This plan should determine which interventions are relevant, provide an estimate of costs and benefits, assign responsible parties, and provide a clear monitoring and evaluation plan. [The WHO Digital implementation investment guide \(DIIG\)](#) could be a useful resource to guide this work.

Based on R12, the following is an initial list of digital health applications or interventions recommended for scale up in the short-, medium-, and long term. These interventions have been proposed based on the current primary health care challenges facing Lesotho and could offer immediate and measurable impact. Appendix H connects these applications to specific health system challenges and classifies them according to the WHO Classification of Digital Health Interventions.

SHORT TERM	PRIORITY: MEDIUM/HIGH	LEVEL OF EFFORT: LOW
Rapid implementation, minimal effort, ability to leverage the current infrastructure and technology in Lesotho		

RECOMMENDATION	END USER
SMS technologies for automatic appointment scheduling, appointment reminders (for priority diseases) and notification of non-sensitive lab-test results (e.g., COVID negative results).	▪ Patient
Health promotion messaging through SMS, WhatsApp, or other digital means or social platforms for preventive care and public health topics to increase awareness and self-management	▪ Patient
Operationalize and digitalize feedback mechanism through SMS such as the World Bank-supported Citizen Feedback Mechanism	
Incorporate all Village Healthcare Workers data capturing tools into Bophelo ka Mosebeletsi App	▪ Health care provider and workers
Patient portal for education, access to patient information, two-way communication	▪ Patients ▪ Health care provider ▪ Data services
Disease outbreak notifications, early warning applications, emergency health preparedness and resilience using geospatial data and notification by SMS or IVR technology	▪ Health care provider ▪ Patients
Implementation of intelligent, interactive, and user-friendly dashboards at the national, district, and health facility levels (where computers are available). Central intelligence dashboards that capture patterns and clusters for timely national pandemic response and action. While this intervention is easy to develop, its effectiveness depends on the quality of data and the capacity to collect data at a more granular level.	▪ Data services
Rule-based system development in health information systems (HIS) and EMR to control the integrity and quality of data entry	▪ Data services
Expansion of e-Register to mobile devices to allow real-time access to community-level data (instead of month-long wait times) to inform programming, progress, early diagnosis, and early intervention	▪ Data services

MEDIUM TERM	PRIORITY: MEDIUM	LEVEL OF EFFORT: HIGH
Needed in the short-to-medium term, but for which development depends on different enablers, such as data quality, connectivity and electricity, hardware (computers and tablets), and digital skills		

RECOMMENDATION	END USER
Telemedicine and telecare services to facilitate access in remote areas. Initially, telemedicine efforts can be focused on following up on treatment of HIV and TB patients.	▪ Patients
Expansion and implementation (beyond the pilot stage) of tele mentoring programs to support health care workers at health facilities and village health care workers, as well as for task shifting	▪ Health care providers and workers

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RECOMMENDATION	END USER
Implementation of referral systems to support the transfer and reference of patient information across facilities and networks, without the need for the BOKANA (patient booklet)	Health care providers and workers
Automated and paperless administrative and clinical management processes	Health care providers and workers
Interfacing with hospitals' management systems to improve efficiency	- Patients - Health care providers

LONG TERM	PRIORITY: HIGH	LEVEL OF EFFORT: HIGH
Critical interventions, but which require foundational elements and complex development approaches that cannot be implemented in the short term		

RECOMMENDATION	END USER
Expansion of the e-Register to include programs to improve quality and continuity of care. The e-Register currently includes only HIV and TB patients and additional cross-cutting programs	Health care providers and workers
Automatic Medical Triage applications based on similar cases	Health care providers and workers

R13. Commission technical assistance to support public-private partnerships (PPP) and service level agreements (SLA) for digital health interventions. This should be accompanied by a mid-term strategy to create skilled, in-house resources. Coordination with WHO and IFC could support this activity.

R14. Design a plan to scale up e-Register gradually over the next three years to transform all existing health programs and into a comprehensive EMR. Expand e-Register to include aspects such as family planning, chronic diseases, children's health, among others to assure comprehensive care for all.

R15. Establish an innovation testing environment for the various interventions and evaluate impact and feasibility. Testing environments, such as an innovation and regulatory sandbox or living lab, can provide a framework to test solutions in a responsible, monitored, and real-world environment. With flexible regulations, these environments can generate evidence, measure social response, eliminate failed interventions, and reduce future implementation costs. The National University of Lesotho is developing innovation hubs that could be useful for integration.

R16. Commission feasibility and economic evaluation studies of priority digital health interventions. Build evidence on the cost-effectiveness and cost benefit of digital health interventions such as eRegister, DHIS-2, ECHO to prioritize future investment.

4.4.3 Roadmap of Actions

➤ START NOW	➤ START NEXT	➤ START LATER
R12. Include digital health in annual budget allocations for 2024-2028 R12. Select and implement the best solution for an Open Health Information Exchange R14. Expand the e-Register to other health programs R13/15. Assess PPP opportunities to expand potential digital health interventions	R12. Improve digitalization of health workers' records and the remuneration system by customizing and implementing Human Resources Information Systems (HRIS) R12. Train users in IHRIS and pilot the system	R12. Roll out HRIS to all District Health Management Teams (DHMT) R16. Commission evaluation studies (R16)

Based on the most urgent health system challenges, the MOH should prioritize the following areas over the next five years:

Foundational Investments

- Structural and governance changes at the MoH to promote digital health (R1, R4, R5, R7)
- Assessment, planning, and investment in infrastructure enablers such as connectivity, electricity, and data hosting (R2, R6, R8)
- Development of digital health skills within the MoH system through collaboration with university programs (R3)

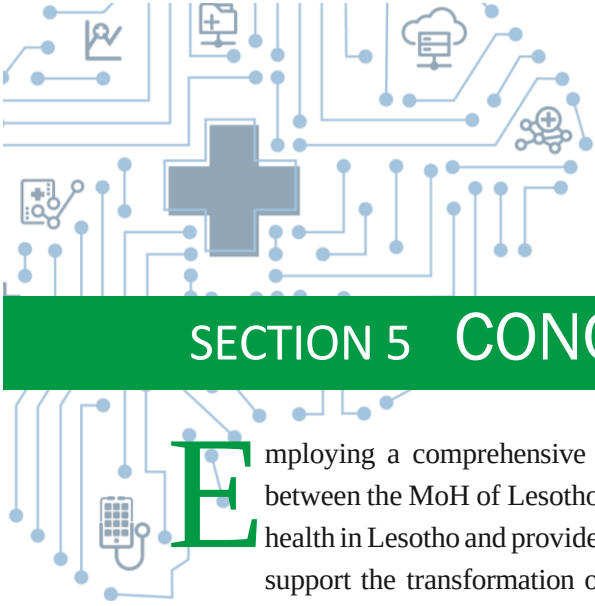
Functional Investments

- Scale-up of e-Register toward development of a comprehensive electronic medical record system, along with strengthening of the digital health platform to connect other information systems (R7, R14)
- Implementation of processes to improve data collection, reporting, and use, enabling insight into systems, provide evidence base public health and strengthening public health surveillance (R9, R10, R11)
- Scale-up of current digital health applications and prioritization of the implementation of SMS and mobile technology to enhance service delivery through automatic scheduling, referral, and health promotion (R12, R13, R16)

Frontier Investments

- Investment in innovative digital health solutions and incorporation of effective assessment mechanisms (R15)

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SECTION 5 CONCLUSION

Employing a comprehensive analysis using interviews and desk reviews, this joint report between the MoH of Lesotho and the World Bank summarizes the current maturity of digital health in Lesotho and provides a comprehensive view of the digital health landscape that could support the transformation of primary care and redesign service provision. By identifying strengths, weaknesses, opportunities and threats, the report aims to position Lesotho to continue its digital health journey to improve health care service delivery. The report took in consideration the extensive work done by different partners in Lesotho to reach a comprehensive conclusion and to set a maturity score for the country.

The country's infrastructure, mobile coverage, and extensive utilization of information health systems create a sound baseline to launch this evolution and increase awareness of digital health. However, there is a risk that the opportunity to leap forward in digital health transformation will be lost without solid commitment and ownership of a clear strategy as well as a roadmap for the implementation of digital health interventions and support for alignment with current initiatives.

The COVID-19 pandemic exposed the importance and relevance of digital health solutions to improve and overcome persistent challenges facing primary care. Most current digital health interventions in Lesotho are related to health information systems, such as Logistic Management Information Systems (LMIS) or DHIS-2 for reporting, and a limited EMR system (e-Register) that covers only HIV- and TB-related programs. However, to reduce inequity and provide comprehensive care, it is necessary to integrate and empower patients in the digital transformation. For this purpose, awareness of the importance of digital health, structural changes in the governance apparatus, and the diffusion and communication of the benefits of digital health are critical to overcome reluctance to change.

This report is a call to action to upgrade the current eHealth strategy to a comprehensive digital health strategy with priority interventions, a costed implementation plan, and provisions for future impact assessment, geared toward delivering better health in a digital world.

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GLOSSARY

([According to the WHO Global Strategy on Digital Health 2020–2025](#))¹³

Artificial intelligence	An area of computer science that emphasizes the simulation of human intelligence processes by machines that work and react like human beings
Big data	The emerging use of rapidly collected, complex data in such unprecedented quantities that terabytes (10 ¹² bytes), petabytes (10 ¹⁵ bytes) or even zettabytes (10 ²¹ bytes) of storage may be required. The unique properties of big data are defined by four dimensions: volume, velocity, variety, and veracity. As more information is accruing at an accelerating pace, both volume and velocity are increasing.
Digital divide	Refers to the gap between demographics and regions that have access to modern information and communications technology and those that do not or have restricted access. This technology can include the telephone, television, personal computers, and the Internet.
Digital health	The field of knowledge and practice associated with the development and use of digital technologies to improve health. Digital health expands the concept of eHealth to include digital consumers, with a wider range of smart-devices and connected equipment. It also encompasses other uses of digital technologies for health such as the Internet of things, artificial intelligence, big data, and robotics.
eHealth	The cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health care services, health surveillance, health literature, and health education, knowledge, and research.
Health data	The systematic application of information and communications technologies, computer science, and data to support informed decision making by individuals, the health workforce, and health systems, to strengthen resilience to disease and improve health and wellness. It includes all data pertaining to the health status of a data subject which reveal information relating to the past, current or future physical or mental health status of the data subject. This includes information about the natural person collected during registration for, or the provision of, health care services to that natural person; a number, symbol or assigned to a natural person to uniquely identify the natural person for health purposes.

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¹³ World Health Organization (2021).

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Health information system	A system that integrates data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services.
Internet of things	A system of interrelated computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to computer interaction.
Interoperability	The ability of different applications to access, exchange, integrate and cooperatively use data in a coordinated manner using shared application interfaces and standards, within and across organizational, regional, and national boundaries, to provide timely and seamless portability of information and optimize health outcomes.
Multistakeholder groups	These include, but are not limited to, intergovernmental and international organizations; non-State actors such as nongovernmental and civil society organizations, donors and aid agencies, foundations and development banks; universities and research institutions; faith-based organizations, health insurance groups and other health-care funders; the private sector; technology developers; and the health care community in particular health care providers and health care professionals, patients and the public.
Telemedicine	The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communications technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and the continuing education of health care workers, with the aim of advancing the health of individuals and communities.

APPENDICES

APPENDIX A ASSESSMENT METHODOLOGY

The assessment was conducted using a maturity model methodology. In general, maturity models focus on people, processes, technology, and organizational capabilities to help understand current conditions and determine a future goal. Low maturity levels show an opportunity for investment, while higher maturity levels illustrate a greater probability of success for disruptive interventions.

To collaborate with other donors and organizations and reduce fragmentation, the assessment integrated and combined different digital health assessment tools and indicators into one digital health assessment toolkit—a hybrid approach that can be used to complete other tools or source input using different mechanisms:

1. **Digital health landscape profile:** A set of quantitative indicators including basic sociodemographic information, coverage of information and communication technologies (ICT), types of digital health interventions, and quantitative information on exposure to digital health within the workforce
2. **Digital health maturity score and questionnaire:** A maturity score framework was built that analyzes the maturity of digital health across four areas: Digital Environment, Architecture and Data, Applications, and Analytics. Within each area, several indicators are presented (75 in total) that explore topics such as leadership and governance, strategy and investment, legislation, policy and compliance, workforce, standards and interoperability, infrastructure, and services. The indicators are extracted from the following digital assessment tools and then mapped within the scoring tool:

[Global Digital Health Index](#)

[University of Chicago Data Framework](#)

[Measure Evaluation HIS Framework](#)

[USAID Digital Health Investment Review Tool](#)

[Global Observatory of eHealth](#)

[Broadband Commission](#)

[WHO/ITU eHealth Strategy Toolkit](#)

[IS4H Maturity Assessment tool](#)

[University of Oxford Cybersecurity Capacity Maturity Model](#)

3. **In-depth interviews and desk review:** This mechanism aims to collect primary and secondary source information to understand some of the topics covered in more depth. In addition, this mechanism will be used to discuss the results, establish the maturity

level, and generate input for a future digital health roadmap strategy and interventions. A total of 16 interviews were conducted online in English using a purposive sample composed of stakeholders from the MoH and other health care providers, partners, organizations, and academia. The content was analyzed by identifying and extracting topics such as maturity, enablers, barriers and challenges, strategy, applications, and data. Relevant subtopics were then identified and mapped to the four dimensions of the digital health assessment.

APPENDIX B MAIN DIAGNOSTICS AND MOST RELEVANT RECOMMENDATIONS FROM PREVIOUS ASSESSMENTS CONDUCTED IN LESOTHO

Appendix table B.1 Diagnostics and recommendations from previous assessments

ASSESSMENT	DIAGNOSTIC	MOST RELEVANT RECOMMENDATIONS
1. USAID/MCC/RTI Lesotho ICT Assessment of the Health Sector (2020)	▪ No official eHealth strategy approved, different plans are out of date, ICT department current structure is not supportive ▪ Lack of coordination and alignment between MOH and implementing partners ▪ Lack of financial resources to cover ICT requirements ▪ Out of date systems and hardware ▪ Limited number of Standard Operating procedures ▪ No data sharing policy ▪ There is limited use of DHIS2 data visualization and report development modules at the subnational level. Also limited understanding of data collection by health workers at various levels ▪ Duplication of systems and existent fragmentation ▪ Longitudinal patient data viewing and graphing functions are nonexistent in eRegister ▪ Limited functionalities within eRegister and few programs covered ▪ Limited interoperability across information systems ▪ Most respondents appreciate the importance of data, although some complained that data recording added more work for them. Great disappointment was expressed concerning the lack of visible usage and action of the data by management ▪ Limited training ▪ Large number of paper-based registries that increases manual workload	▪ Facilitate the launching of the eHealth Strategy and fast-track the launch ▪ Coordination and partnership framework to align initiatives ▪ Form a unit to develop Standard Operations Procedures ▪ Re-structure the ICT department to have a Director of ICT and expand training opportunities ▪ Update the ICT infrastructure ▪ Increase data supply in DHIS-2 ▪ Work with MoH and HFs to develop a health indicator guide that indicates what data are collected at each tier of the health system ▪ Strengthen DHIS-2 architecture, indicators and ICT infrastructure to enable better connectivity ▪ More-focused requirements gathering should be pursued to determine that eRegister can work its way toward covering a range of disease conditions. There are a strong desire and need to evolve the eRegister into an EHR. Include reminders and notifications ▪ Greater flexibility should be offered for data analysis of patient data by allowing graphing and charting of some patient data ▪ Increase interoperability across systems (DHIS-2, eRegister, DISA) ▪ Need for pre-service and in-service training on digital health, ICT and information systems ▪ Digitalize most of the process taking care of data quality

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Appendix table B.1 Diagnostics and recommendations from previous assessments (continued)

ASSESSMENT	DIAGNOSTIC	MOST RELEVANT RECOMMENDATIONS
2. MOH/ICAP EMR Assessment (2017)	The system was designed: ▪ without much interoperability with other systems ▪ without a user-centered design ▪ with limited functionality ▪ non-functional interfaces ▪ no skill transfers ▪ no technical support ▪ no system roles defined The results: Physicians returned to manual work and the system was withdrawn	▪ Move to open source and web based ▪ MOH should take ownership of the design and customization ▪ Include open-standards ▪ Discourage the local server approach ▪ Strengthen the user technical support ▪ Engage stakeholders in the development of the application
3. HMIS Strategic Plan (2018–2022)	▪ Existence of a central HMIS unit with capacity in core health information sciences to meet the national health information needs ▪ An existing relatively robust public internet network provides an opportunity to build a single integrated web-based health data warehouse ▪ While HMIS policies and plans were in place, they failed to address strategic information coordination mechanisms and one agreed upon national indicator dataset ▪ Data management practices which constrain information dissemination and use compounded -further by gaps in human resources capacity for HMIS ▪ While some information systems exist at district level, there are no HMIS organizational structure and reporting lines/linkages; ▪ Human resource capacity in data management and information systems support is limited ▪ Existence of parallel reporting lines with a hybrid of paper and electronic systems	▪ A review of HMIS policies and guidelines, including the development of a national indicator data set and streamlining of data collection tools to produce information which will inform policy and improve programs ▪ Urgent need to integrate current parallel and fragmented information systems through establishment of a user-friendly data warehouse that supports interoperability with electronic medical records (EMR) and other data sources ▪ Systems that promote data quality checks and analytics, data display information dissemination capability accessible to users across all levels of the health system, enhance the use of quality information to inform planning, resource allocation and monitoring of program implementation and to support optimization of the EMR system to generate routine MOH reports ▪ Innovative strategies to build human resource capacity for data management and use at national, district and facility level

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Appendix table B.1 Diagnostics and recommendations from previous assessments (continued)

ASSESSMENT	DIAGNOSTIC	MOST RELEVANT RECOMMENDATIONS
3. HMIS Strategic Plan (2018–2022)	Several gaps and challenges were observed at the six hospitals where EMR was implemented, including inadequate use of the system by clinicians and pharmacists. This is partly due to system design issues, user competency and lack of user motivation, lack of infrastructure, integration with other systems and generation of accurate routine and need based reports.	
4. UNICEF Lesotho Data Requirement Analysis and Data Mapping (2018)	▪ Data demand and culture for data is limited due to lack of leadership and political turnover, policy compliance, delayed implementation of policies that would generate priority data ▪ Focus on data collection and not interpretation and use ▪ Health sector has a robust data supply systems and collection methods, but lack on indicators of quality ▪ However, data access is complex, no standards or protocols to share microdata ▪ Gap between data demands from users (donors) and data supply. This is less of a challenge in the healthcare sector ▪ More disaggregation of data is needed ▪ Delays in data delivery. Data may be located in local servers instead of centralized database ▪ Data quality and capacity for good data collection are also challenges ▪ Lack of online dissemination	▪ National results framework to measure progress will incentive the use of data ▪ Explore mechanisms for sustaining Statistician roles at ministries ▪ Advocate Government of Lesotho to make data visualization tools available to the public (i.e., making some access to the Health Situation Room) ▪ Support the development microdata sharing policies and national data management policies ▪ Explore potential engagement with partners to leverage and scale up information systems and systems like eRegister ▪ Expanding the capabilities for GIS data analysis ▪ Support the utilization of mobile devices for data collection (i.e., tablets) ▪ Encourage linkages between NICR and administrative data systems
5. USAID/MCC/SBC4D Statistical Capacity and Data Use in Lesotho (2020)	▪ Infrastructure and technology maturity are not a barrier for the wide use of ICT ▪ Implementation of data policies is being challenged by a lack of leadership and leadership support ▪ Limited demand of advanced skills and data science skills; however basic ICT skills are present	▪ Better integration of data systems and improvement of data flows between the different stakeholders with the inclusion of Village Health Workers in the process ▪ More granular data analysis is needed to support decision and policymaking. This needs to be strengthened by the development of advanced data science skills

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Appendix table B.1 Diagnostics and recommendations from previous assessments (continued)

ASSESSMENT	DIAGNOSTIC	MOST RELEVANT RECOMMENDATIONS
5. USAID/MCC/SBC4D Statistical Capacity and Data Use in Lesotho (2020)	- Data is not being used for policymaking - There is a lack of offer and demand of data, with both affecting the development of the other	- Increase data access to other non-government actors and vice-versa to support health policies - Improvement of gender-data practices
6. World Bank Lesotho's Digital Economy Diagnostic (2020)	- Potential is still very much underutilized. Lesotho has been able to expand access to digital infrastructure and services, but domestic demand remains modest - Digital potential is not being reached due to the current fragmentation lack of coordination and capacity hamper the government's efforts in the implementation of digital government platforms - Digital skills constitute a clear bottleneck for Lesotho and an area where policy and institutional reforms are needed - Private digital platforms have not yet found a proper footing in Lesotho and very few locally developed platform-based, business models exist	Priority 1: Improve the enabling environment for the digital economy - guide the deployment of digital infrastructure deployment and bridge the digital divide - Improve the legal and regulatory environment by addressing identified gaps in legislation, with immediate priority given to passing the bills on cybersecurity and e-transactions Priority 2: Drive digital transformation and demand by strengthening public sector platforms and Infrastructure - deepen the approaches to digitization in the identified sectoral and thematic priority areas - Ensuring that government has the necessary infrastructure and connectivity and that these are widely used - Increasing interoperability between platforms for increased efficiency and service delivery by leveraging experiences from the national identity system and enhancing the digital payment infrastructure - Developing citizen-facing digital public services to drive demand, access, and efficiencies Priority 3: Strengthen the digital ecosystem through digital skills and entrepreneurship - Developing a strategy and defining the implementation mechanisms for digital skills development in Lesotho - Improving digital infrastructure and connectivity in research and educational institutions by establishing a National Research and Education Network in Lesotho - Improve the coordination and implementation of the digital entrepreneurship agenda

APPENDIX C DETAILED SCORING FOR LESOTHO

Appendix table C.1 Indicators of Digital Maturity in Lesotho

A. DIGITAL HEALTH ENVIRONMENT INDICATORS		SCORE	SOURCE
DIGITAL HEALTH ENVIRONMENT (TOTAL SCORE) the following indicators focus on the macro level of digital health in terms of strategy, guidelines, curriculum, and prioritization		1.48	
LEADERSHIP AND GOVERNANCE		1.7	
01	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?	2.0	Global Digital Health Index
	No coordinating body exists and/or nascent governance structure for digital health is constituted on a case-by-case basis	1.0	
	Governance structure is formally constituted though not fully functional or meeting regularly	2.0	
	Governance structure and any related working groups have a scope of work (SOW) and conduct regular meetings with stakeholder participation and/or consultation	3.0	
	Governance structure is fully functional, government-led, consults with other ministries, and monitors implementation of digital health based on a work plan	4.0	
	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	5.0	
02	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	2.0	Global Digital Health Index
	Digital health is not included in the national health strategy. It is being implemented in an ad-hoc fashion in health programs	1.0	
	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	2.0	
	Digital health is included in national health or relevant national strategies and/or plans	3.0	
	Digital health is being implemented as part of national health or other relevant national strategies and/or plans	4.0	
	Digital health is implemented and periodically evaluated and optimized in national health or other relevant national strategies and/or plans	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

A. DIGITAL ENVIRONMENT INDICATORS		SCORE	SOURCE
03 AWARENESS RISING OF CYBERSECURITY		1.0	University of Oxford - Cyber Maturity Model
The need for awareness of cybersecurity threats and vulnerabilities across the health sector is not recognized or is only at initial stages of discussion			
Awareness raising programs, courses, seminars, and online resources are available for target demographics from public, private, academic, and/or civil society sources, but no coordination or scaling efforts have been conducted.		2.0	
A national program for cybersecurity awareness raising in health care, led by a designated organization (from any sector) is established, which addresses a wide range of demographics and issues, but no metrics for effectiveness have been applied.		3.0	
Metrics for effectiveness are established and evidence of application and lessons learnt are fed into future programs. The evolution of the program is supported by the adaptation of existing materials and resources, involving clear methods for obtaining a measure of suitability and quality.		4.0	
Awareness raising programs are adapted in response to performance evidenced by monitoring which results in the redistribution of resources and future investments. Metrics contribute toward national cybersecurity strategy revision processes.		5.0	
STRATEGY AND INVESTMENT		1.0	
04 NATIONAL EHEALTH/ DIGITAL HEALTH STRATEGY OR FRAMEWORK		1.0	Global Digital Health Index
Does the country have an eHealth or digital health strategy or framework and a costed digital health plan?			
There is no digital health strategy or framework. Draft digital health strategy or framework developed, but not officially reviewed.		1.0	
National digital health strategy or framework approved.		2.0	
National digital health costed plan developed and approved.		3.0	
National digital health strategy and costed plan partially implemented with resources to ensure full implementation.		4.0	
National digital health strategy and costed plan fully implemented with planning underway for the next 3–5-year cycle.		5.0	
05 PUBLIC FUNDING FOR DIGITAL HEALTH		1.0	Global Digital Health Index
What is the estimated percent (%) of the annual public spending on health committed to digital health?			
No budget line item for digital health available. A budget line item for digital health exists but proportion not available.		1.0	
Less than 1%		2.0	
1–3%		3.0	
3–5%		4.0	
Greater than 5%		5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

DIGITAL ENVIRONMENT INDICATORS		SCORE	SOURCE
06	HEALTH SYSTEM PLAYERS ARE MAKING USE OF INCENTIVE STRUCTURES, BEYOND TAX BENEFITS TO ALSO INCLUDE INNOVATION PARKS, GRAND CHALLENGES, AND OTHER INITIATIVES, WHILE SYSTEMATICALLY INCORPORATING THEM INTO BUSINESS MODELS	1.0	Broadband Commission - AI
	No incentives structures exist	1.0	
	Limited incentives, such as tax benefits, are in place	2.0	
	Usage remains low due to the technical nature of applying for incentives	3.0	
	Health system players are making use of incentive structures, e.g., tax benefits, tax immunity, or government grants, and are incorporating these into business models	4.0	
	Health system players are making use of incentive structures, beyond tax benefits to also include innovation parks, grand challenges, and other initiatives, while systematically incorporating them into business models	5.0	
LEGISLATION AND POLICY		1.0	
07	LEGAL FRAMEWORK FOR DATA PROTECTION (SECURITY)	1.0	Global Digital Health Index
	Is there a law on data security (storage, transmission, use) that is relevant to digital health?		
	There is no law on data security (storage, transmission, use) that is relevant to digital health.	1.0	
	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been proposed and is under review.	2.0	
	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.	3.0	
	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been implemented, but not consistently enforced.	4.0	
	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been implemented and enforced consistently	5.0	
08	LAWS OR REGULATIONS FOR PRIVACY, CONFIDENTIALITY, AND ACCESS TO HEALTH INFORMATION (PRIVACY)	1.0	Global Digital Health Index
	Is there a law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data?		
	There is no law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data.	1.0	
	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.	2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

DIGITAL HEALTH ENVIRONMENT INDICATORS		SCORE	SOURCE
LAWS OR REGULATIONS FOR PRIVACY, CONFIDENTIALITY, AND ACCESS TO HEALTH INFORMATION (PRIVACY) (continued)			
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.		3.0	
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.		4.0	
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.		5.0	
09 CROSS-BORDER DATA SECURITY AND SHARING	Are protocols, policies, frameworks, or accepted processes in place to support secure cross-border data exchange and storage? 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.	1.0	Global Digital Health Index
	There are no protocols, policies, frameworks, or accepted processes in place to support secure cross-border data exchange and storage.	1.0	
	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been proposed and are under review.	2.0	
	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been passed but are not fully implemented.	3.0	
	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been implemented, but not consistently enforced.	4.0	
	Protocols, policies, frameworks or accepted processes for cross border data exchange and storage have been implemented and enforced consistently.	5.0	
10 TRUST AND CONFIDENCE ON THE INTERNET:	USER TRUST AND CONFIDENCE ON THE INTERNET	1.0	University of Oxford - Cyber Maturity Model
	Most Internet users have blind trust on websites and regarding what they see or receive online.	1.0	
	A very limited proportion of Internet users critically assess what they see or receive online and believe that they can use the Internet and protect themselves online.	2.0	
	A growing proportion of Internet users critically assess what they see or receive online, based on identifying possible risks. User-consent policies are in place designed to notify practices on the collection, use or disclosure of sensitive personal information.	3.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

DIGITAL HEALTH ENVIRONMENT INDICATORS		SCORE	SOURCE
TRUST AND CONFIDENCE ON THE INTERNET: USER TRUST AND CONFIDENCE ON THE INTERNET (continued)			
Most Internet users critically assess what they see or receive online, based on identifying possible risks. Most Internet users feel confident while using the Internet and could recognize non-legitimate websites (including mimicry attempts), and have a sense of control over providing personal data online.		4.0	
Individuals assess the risk in using online services, including changes in the technical and cybersecurity environment and continuously adjust their behavior based on this assessment.		5.0	
11	TRUST AND CONFIDENCE ON THE INTERNET: USER TRUST IN E-GOVERNMENT SERVICES	1.0	
	Government offers no or limited e-services but has not publicly promoted the necessary secure environment. If e-government services are provided, users are unfamiliar with or lack trust in them.	1.0	
	Government continues to increase e-service provision, but also recognizes the need for the application of security measures to establish trust in these services. The need for security in e-government services is recognized by stakeholders and users. A limited proportion of users trust in the secure use of e-government services.	2.0	
	E-government services have been fully developed. High-level risks affecting e-government services are prioritized to reduce occurrences. The public sector promotes use of e-government services and trust in these services through a coordinated program, including the compliance to web standards that protect the anonymity of users.	3.0	
	Public authorities are routinely publishing certain information about their activities. Privacy-by-default is promoted as a tool for transparency in e-government services. Most users trust in the secure use of e-government services and make use of them.	4.0	
	E-government services and promotion thereof are continuously improved and expanded to enhance transparent/open and secure systems and user trust. Impact assessments on data protection in e-government services are consistently taking place and feed back into strategic planning.	5.0	
12	TRUST AND CONFIDENCE ON THE INTERNET: USER UNDERSTANDING OF PERSONAL INFORMATION PROTECTION ONLINE	1.0	
	Users and stakeholders within the public and private sectors have no or minimal knowledge about how personal information is handled online, nor do they believe that adequate measures are in place to protect their personal information online. There is no or limited discussion regarding the protection of personal information online. Discussions may have begun and involve multiple stakeholders, but no privacy standards are in place.	1.0	
	Users and stakeholders within the public and private sectors may have general knowledge about how personal information is handled online; and may employ good (proactive) cybersecurity practices to protect their personal information online. Discussions have begun regarding the protection of personal information and about the balance between security and privacy, but this has not resulted in concrete actions or policies.	2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

DIGITAL HEALTH ENVIRONMENT INDICATORS		SCORE	SOURCE
TRUST AND CONFIDENCE ON THE INTERNET: USER UNDERSTANDING OF PERSONAL INFORMATION PROTECTION ONLINE (continued)			
A growing proportion of users have the skills to manage their privacy online, and protect themselves from intrusion, interference, or unwanted access of information by others. There is constant public debate regarding the protection of personal information and about the balance between security and privacy, which informs privacy policies within public and private sectors.		3.0	
All stakeholders have the information, confidence, and the ability to take measures to protect their personal information online and to maintain control of the distribution of this information. Users and stakeholders within the public and private sectors widely recognize the importance of protection of personal information online and are sensitized to their privacy rights. Mechanisms are in place in private and public sectors to ensure that privacy and security are not competing. Privacy by default as a tool for transparent		4.0	
Users have the knowledge and skills necessary to protect their personal information online, adapting their abilities to the changing risk environment. There is a wide recognition of the need to ensure security and protection of personal information. Policies are in place in private and public sectors to ensure that privacy and security are not competing in a changing environment and are informed by user feedback and public debate. Assessments of personal information protection in eservices are regularly conducted and feed back into policy revision.		5.0	
WORKFORCE		1.0	
13	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?	1.0	Global Digital Health Index
	There is no digital health curriculum for health professionals as part of pre-service training requirements.	1.0	
	Digital health curriculum proposed and under review as part of pre-service training requirements.	2.0	
	Digital health curriculum implementation underway covering an estimated 0–25% of health professionals in pre-service training.	3.0	
	Digital health taught in relevant institutions with an estimated 50–75% health professionals receiving pre-service training.	4.0	
	Digital health taught in relevant institutions with >75% of health professionals receiving pre-service training.	5.0	
14	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?	1.0	Global Digital Health Index
	There is no digital health curriculum for doctors/physicians as part of pre-service training requirements.	1.0	
	Digital health curriculum proposed and under review as part of pre-service training requirements for doctors/physicians.	2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

DIGITAL HEALTH ENVIRONMENT INDICATORS		SCORE	SOURCE
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? (continued)			
Digital health curriculum implementation underway covering an estimated 0–25% doctors/physicians in pre-service training.		3.0	
Digital health taught in relevant institutions with an estimated 50–75% of doctors/physicians receiving pre-service training.		4.0	
Digital health taught in relevant institutions with >75% of doctors/physicians receiving pre-service training.		5.0	
15	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?	1.0	Global Digital Health Index
There is no digital health curriculum for nurses as part of pre-service training requirements.		1.0	
Digital health curriculum proposed and under review as part of pre-service training requirements for nurses.		2.0	
Digital health curriculum implementation underway covering an estimated 0–25% of health professionals in pre-service training.		3.0	
Digital health taught in relevant institutions with an estimated 50–75% of nurses receiving pre-service training.		4.0	
Digital health taught in relevant institutions with >75% of nurses receiving pre-service training.		5.0	
16	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?	1.0	Global Digital Health Index
There is no digital health curriculum for health professionals as part of pre-service training requirements for community health workers.		1.0	
Digital health curriculum proposed and under review as part of pre-service training requirements for community health workers.		2.0	
Digital health curriculum implementation underway covering an estimated 0–25% of community health workers in pre-service training.		3.0	
Digital health taught in relevant institutions with an estimated 50–75% of community health workers receiving pre-service training.		4.0	
Digital health taught in relevant institutions with >75% of community health workers receiving pre-service training.		5.0	
17	MATURITY OF PUBLIC SECTOR DIGITAL HEALTH PROFESSIONAL CAREERS	1.0	Global Digital Health Index
Are there public sector professional titles and career paths in digital health?			
No workforce strategy, policy, or guide that recognizes digital health is in place. Distribution of digital health workforce is ad hoc.		1.0	
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.		2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

DIGITAL HEALTH ENVIRONMENT INDICATORS		SCORE	SOURCE
MATURITY OF PUBLIC SECTOR DIGITAL HEALTH PROFESSIONAL CAREERS (continued)			
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.		3.0	
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.		4.0	
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.		5.0	
STANDARDS AND INTEROPERABILITY			
INFRASTRUCTURE		2.5	
18 NETWORK READINESS		1.0	Global Digital Health Index
Extract the WEF network readiness index score			
1.0–3.3		1.0	
>3.3–4.0		2.0	
>4.0–5.0		3.0	
>5.0–5.4		4.0	
>5.4–7.0		5.0	
19 HOW MUCH INTERNET COVERAGE DOES THE COUNTRY HAVE?		5.0	World Bank
0–20%		1.0	
20–40%		2.0	
40–60%		3.0	
60–80%		4.0	
80–100%		5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

DIGITAL HEALTH ENVIRONMENT INDICATORS		SCORE	SOURCE
20	WHAT TYPE OF MOBILE BROADBAND HAS THE COUNTRY?	4.0	World Bank
	None	1.0	
	2G	2.0	
	3G	3.0	
	4G	4.0	
	5G	5.0	
21	SERVICES AND APPLICATIONS	2.0	Global Digital Health Index
	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. (Use separate worksheet to determine the country's specified priority areas, whether digital systems are in place, and whether those systems are national.) [e.g., Country X chooses 4 priority areas, uses digital systems to address 2 of the 4, with only 1 being at national scale, receives a score of 25%.]	2.0	
	National priority areas are not supported by digital health at any scale.	1.0	
	Few national priority areas are supported by digital health, and implementation initiated (< 25% priority areas).	2.0	
	Some national priority areas supported by scaled digital health systems (25–50% of priority areas).	3.0	
	The majority, but not all national priority areas (50–75% of priority areas) supported by scaled digital health systems.	4.0	
	All nationally prioritized areas supported by national-scale digital health systems (>75%) with monitoring and evaluation systems and results.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)**B. ARCHITECTURE AND DATA**

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
ARCHITECTURE AND DATA (TOTAL SCORE)		1.96	
The following indicators refer to topics such as interoperability, data governance, health information system infrastructure, knowledge in health information systems.			
LEADERSHIP AND GOVERNANCE		0.7	
22 GOVERNANCE STRUCTURE FOR HIS	Definition: The exercise of technical, political, and administrative authority to manage national HIS affairs at all levels of a country's health system	1.0	HIS Framework
	Evolving governing body for health information systems (HIS) is constituted on a case-by-case basis OR no governing body exists	1.0	
	An HIS governing body is formally constituted. The governing body has a scope of work that includes the people responsible for data governance oversight. The governing body oversees interoperability directly or through a separate technical working group (TWG)	2.0	
	The HIS governing body conducts regular meetings with stakeholder participation.	3.0	
	The HIS governing body uses a work plan (or another tool) to monitor the implementation of HIS interoperability. The HIS governing body is government-led HIS governing body mobilizes resources (financial, human resources, and political) to accomplish its goals.	4.0	
	HIS governing body is legally protected from interference or organizational changes. The HIS governing body and its TWGs are nationally recognized as the lead for HIS interoperability. The governing body works in liaison with other similar working groups regionally and/or around the world.	5.0	
23 ARE THE POLICIES IN PLACE AROUND GOVERNANCE OF BIG DATA IN HEALTHCARE?		1.0	World Bank
	Big Data is not included in the national health strategy. It is being implemented in an ad hoc fashion in health programs.	1.0	
	There is some discussion of inclusion of big data in national health or other relevant national strategies or plans.	2.0	
	Big Data is included in national health or relevant national strategies and/or plans.	3.0	
	Big Data is being implemented as part of national health or other relevant national strategies and/or plans.	4.0	
	Big Data is implemented and periodically evaluated and optimized in national health or other relevant national strategies and/or plans.	5.0	
STRATEGY AND INVESTMENT			
24 LEGISLATION AND POLICY	Are policies in place around who can use data, how they can use data, which parts can they use, and for what purposes?	2.0	University of Chicago
	No policies exist around use, transfer, and sharing of data	1.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
LEGISLATION AND POLICY (continued)			
The government/Ministry of Health/health organization has policies in place for the use, transfer, and sharing of data but it does not cover all data that exists within the organization		2.0	
The government/Ministry of Health/health organization has policies in place for the use, transfer, and sharing of data internally		4.0	
The government/Ministry of Health/health organization has policies in place for the use, transfer, and sharing of data internally and externally		5.0	
25	PRIVACY AND DATA SECURITY Digital health projects may deal with sensitive medical information and clients have a right to have their information managed responsibly. Fear of loss of privacy may be a barrier to use of a system or accessing services. Security breaches can be damaging for governments and negatively impact the public's confidence. Describe how privacy and data security will be addressed	2.0	Digital Health Investment Review Tool
	No mention of privacy or security of data.	1.0	
	Partially or generically discusses privacy and security approaches to be used.	2.0	
	Mentions nationally and internationally relevant security policies and partially or generically discusses how security will be implemented.	3.0	
	Fully describes relevant policies as well as front-end security, back-end security, encryption, and physical security	4.0	
	Fully describes relevant policies as well as front-end security, back-end security, encryption, and physical security. Includes plan to audit security as routine maintenance function.	5.0	
26	ARE THERE POLICIES ON DATA MANAGEMENT, QUALITY OF DATA ASSESSMENT, CURATION, VALIDATION, SYNTHETIC DATA? Data management includes procedures on how data are captured, stored, analyzed, transmitted, and packaged for use across the data supply chain.	3.0	HIS
	No national document for data management procedures exists for the national HIS.	1.0	
	Electronic data management procedures or the HIS are clearly developed and documented in a nationally recognized document.	2.0	
	A roadmap is in place to migrate data collection and reporting from a paper system to an electronic system, complete with necessary data security safeguards. A documented mechanism is in place for maintaining data quality throughout the data supply chain.	3.0	
	National electronic data management processes are published and disseminated for the HIS. A standard operating procedure and/or data use plan is in place to facilitate data use by the country and its stakeholders. A data warehouse, integrating data from all HIS subsystems and allowing for data triangulation and quality control, is fully functional and in use.	4.0	
	Data access and use are constantly monitored, and data management systems are updated accordingly. Electronic data transmission is the default method to move data among information systems. Dashboards displaying information from multiple sources are available to decision makers.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
27 DATA ETHICS			
The country has a recognized mechanism (e.g., committee or working group) for reviewing data ethics issues in the national HIS, and for updating policies, procedures, and laws, as needed. This mechanism reflects industry best practices.		1.0	HIS
The country has no healthcare-specific data laws, regulatory frameworks, or ethics provisions to guide data ethics issues, including data security, privacy, and confidentiality		1.0	
The country has drafted laws, policies, or a regulatory framework for data security and privacy that address issues related to health data.		2.0	
The country has an approved health data regulatory framework.		3.0	
The health data security and privacy laws have been implemented, and there are guidelines on how to operationalize the laws in the context of HIS. HIS users have been sensitized on the data security and privacy laws. The government and HIS stakeholders consistently enforce the data security and privacy laws.		4.0	
The country has a recognized mechanism (e.g., a committee or working group) in place for reviewing data ethics issues within the national HIS, and for updating policies, procedures, and laws, as needed.		5.0	
WORKFORCE		2.0	
28 TRAINING OF DIGITAL HEALTH WORKFORCE			
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?		2.0	Global Digital Health Index
There is no training available for digital health workforce available in the country.		1.0	
Digital health workforce needs assessed, gaps identified and training options under development.		2.0	
Professional training is available, but graduates are not yet deployed.		3.0	
Trained digital health professionals available and deployed, but essential personnel gaps remain.		4.0	
Enough trained digital health professionals available to support national digital health needs.		5.0	
29 TRAINING OF DIGITAL HEALTH WORKFORCE			
Specifically, is training in health and/or biomedical informatics (in either public or private institutions) producing trained informaticists or health information systems specialists?		2.0	Global Digital Health Index
There is no training available in informatics or health information systems available in the country.		1.0	
Health informatics workforce needs assessed, gaps identified and training options under development.		2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
TRAINING OF DIGITAL HEALTH WORKFORCE (continued)			
Professional training in health informatics is available, but graduates are not yet deployed.		3.0	
Trained informatics professionals available and deployed, but essential personnel gaps remain.		4.0	
Enough trained health informatics professionals available to support national health information system needs.		5.0	
STANDARDS AND INTEROPERABILITY		1.5	
30 NATIONAL DIGITAL HEALTH ARCHITECTURE AND/OR HEALTH INFORMATION EXCHANGE		2	Global Digital Health Index
Is there a national digital health (eHealth) architectural framework and/or health information exchange (HIE) established?			
There is no national digital health (eHealth) architectural framework and/or health information exchange (HIE) established.		1	
A national digital health architecture and/or health information exchange (HIE) has been proposed, but not approved including semantic, syntactic, and organizational layers.		2	
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.		3	
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.		4	
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.		5	
31 HEALTH INFORMATION STANDARDS		1	Global Digital Health Index
Are there digital health / health information standards for data exchange, transmission, messaging, security, privacy, and hardware?			
There are no digital health / health information standards for data exchange, transmission, messaging, security, privacy, and hardware.		1	
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.		2	
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.		3	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
HEALTH INFORMATION STANDARDS (continued)			
Digital health / health information industry-based technical standards for data exchange, transmission, messaging, security, privacy, and hardware are in use in most applications and systems to ensure the availability of high-quality data. Conformance testing is routinely carried out to certify implementers.		4.0	
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.		5.0	
INFRASTRUCTURE		1.6	
32 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?		1.0	Global Digital Health Index
There is no articulated plan for supporting digital health infrastructure (including equipment- computers/ tablets/ phones, supplies, software, devices, etc.) provision and maintenance.		1.0	
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.		2.0	
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.		3.0	
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.		4.0	
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.		5.0	
33 DO YOU HAVE HEALTH INFORMATION SYSTEMS MONITORING AND EVALUATION IN PLAN?		1.0	HIS
No tracking, or ad hoc tracking, is done of HIS interoperability activities related to plans, resources, and budgets for the national HIS.		1.0	
The methods and tools to report on HIS interoperability implementation are defined and documented.		2.0	
Implementation of HIS interoperability activities is regularly monitored and reviewed. Regular reports on HIS interoperability performance are generated and disseminated to stakeholders		3.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
DO YOU HAVE HEALTH INFORMATION SYSTEMS MONITORING AND EVALUATION IN PLAN? (continued)			
Mechanisms to track and measure performance of HIS interoperability are government-approved and government-led.		4.0	
The regular monitoring of HIS interoperability influences decisions about leadership, governance, resources, and technology.		5.0	
34 ARE THERE PLANS RELATED WITH BUSINESS CONTINUITY IF A DISRUPTIVE INCIDENT HAPPENS?		1.0	HIS
There is no government-approved business continuity plan (BCP) in place for the national or subnational levels of the HIS.		1.0	
The HIS has developed a BCP that outlines the processes needed to ensure continuity of critical business processes.		2.0	
The BCP implementation has been audited. Audit results show that at least 50% of the BCP has been implemented.		3.0	
Audit results show that at least 75% of the BCP has been implemented.		4.0	
Audit results show that all or most of the BCP has been implemented.		5.0	
35 HOW ACCESSIBLE IS THE DATA THAT'S REQUIRED?		1.0	University of Chicago (Adapted)
Only accessible within the application where it is collected		1.0	
Can be accessible outside the application but proprietary format, requiring specialized analysis software		2.0	
All machine readable in standard open format (CSV, JSON, XML, database)		4.0	
All machine readable in standard open format and available through an API		5.0	
36 HOW IS THE DATA STORED?		5.0	University of Chicago
Paper		1.0	
PDFs or Images		2.0	
Text Files		4.0	
Databases		5.0	
37 HOW INTEGRATED ARE THE DIFFERENT DATA SOURCES?		1.0	University of Chicago
Data sits in the source systems		1.0	
Data is exported occasionally and integrated in ad hoc manner		2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
HOW INTEGRATED ARE THE DIFFERENT DATA SOURCES? (continued)			
	Central data warehouse - real-time aggregation and linking (Automatic)	4.0	
	External data also integrated	5.0	
38	HOW MUCH HISTORY IS STORED AND HOW ARE UPDATES HANDLED?	2.0	University of Chicago
	No History Kept - old data is deleted	1.0	
	Historical data is stored but updates overwrite existing data	2.0	
	Historical data is stored, and new data gets appended with timestamp, preserving old values	4.0	
	All history is kept, and new data schema gets mapped to old schema so older data can be used	5.0	
39	HOW MUCH IS DATA FRAGMENTED IN SILOS?	2.0	World Bank
	All healthcare information is fragmented in different silos, and it is not interoperable	1.0	
	Some healthcare information is still fragmented and not interoperable, some databases are interoperable	2.0	
	Few healthcare information is still fragmented and not interoperable, most databases are interoperable	3.0	
	All databases related to healthcare are interoperable, but are still saved in silos	4.0	
	There is one big database containing all the healthcare related information	5.0	
40	WOULD YOU DEFINE THE CURRENT SYSTEMS IN THE COUNTRY AS "LEGACY SYSTEMS" (In computing, a legacy system is an old method, technology, computer system, or application program, "of, relating to, or being a previous or outdated computer system," yet still in use. Often referencing a system as "legacy" means that it paved the way for the standards that would follow it. Wikipedia)	2.0	World Bank
	All systems are defined as Legacy and are currently outdated	1.0	
	75% of systems are defined as Legacy	2.0	
	50% of systems are defined as Legacy	3.0	
	25% of systems are defined as Legacy	4.0	
	All systems have been updated.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
41	INCIDENT RESPONSE: IDENTIFICATION OF INCIDENTS	1.0	University of Oxford - Cyber Maturity Model
	No catalogue of national level incidents exists or is in development.	1.0	
	Certain cybersecurity incidents have been categorized and recorded as national-level threats.	2.0	
	A central registry of national-level cybersecurity incidents is operational.	3.0	
	Regular, systematic updates to the national-level incident registry are made. Resources are allocated for analyzing incidents in order to prioritize which incidents are most urgent.	4.0	
	Focus on incident identification and analysis is adapted in response to environmental changes.	5.0	
42	INCIDENT RESPONSE: MODE OF OPERATION	1.0	University of Oxford - Cyber Maturity Model
	Key incident response processes (detection, resolution, prevention, etc.) and (digital) tools to support them have not been well defined or documented. There is limited or no sufficient training or understanding of the key concepts of cybersecurity incident response.	1.0	
	Key incident response processes have been identified, but not officially documented or operationalized. Members of CSIRTs receive training in an ad-hoc manner. Incident response is reactive and ad-hoc.	2.0	
	Key incident response processes and tools are defined, documented and functional. Members of CSIRTs receive training regularly to understand key concepts of cybersecurity incident response. National-level incident response is limited in scope and still reactive.	3.0	
	Incident response teams have established a training policy for their members; members are being trained in specialized subjects and accredited by internationally recognized bodies on a regular basis. Team members can carry out a sophisticated incident analysis investigation quickly and efficiently. Key processes (detection, resolution, prevention, etc.) are being monitored and reviewed in regular basis and tested with different case scenarios. Forensics services are offered. National incident response teams coordinate with international counterparts.	4.0	
	The results of testing key processes through case scenarios are being analyzed and are incorporated into the updating of processes. The benefits of training and accreditation are being evaluated and inform the future training planning. Tools for early detection, identification, prevention, response and mitigation of zero-day vulnerabilities are embedded in incident response organization(s). Mechanisms for regional cooperation in incident response have been established.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
43	CRITICAL INFRASTRUCTURE PROTECTION: RISK MANAGEMENT AND RESPONSE	1.0	University of Oxford - Cyber Maturity Model
	Risk management skills and understanding may be incorporated into business practices, but cybersecurity, if recognized, is subsumed into IT and data protection risk and is not recognized as a priority. Response planning and threat awareness may have been broadly discussed, but no formal plan exists.	1.0	
	Physical and virtual access control is implemented. CI has basic capacity to detect, identify, respond to and recover from cyber threats, but such capabilities are uncoordinated and vary in quality. Protection of CI assets includes basic level cybersecurity awareness and data security policies, but no protection processes have been agreed.	2.0	
	Best practices in security measures, guidelines, and standards for CI cybersecurity have been established and adopted. Cybersecurity risk management processes have been established, supported by adequate technical security solutions, communication links, and harm mitigation measures. CI risk management procedures are used to create a national response plan including the participation of all vital entities.	3.0	
	Cybersecurity is firmly embedded into general risk management practice. Assessment of the breadth and severity of harm incurred by CI assets is regularly conducted and response planning is tailored to that assessment to ensure business continuity. Resources are allocated in proportion to the assessed impact of an incident to ensure rapid and effective incident response. Insider threat detection is accounted for.	4.0	
	Audit practices to assess network and system dependencies and vulnerabilities (e.g., unmitigated dependencies) are implemented on a regular basis and inform continuous reassessment of CI risk portfolio, technologies, policies, and processes. The impact of cybersecurity risk on the business operations of CI, including direct and opportunity costs, impact on revenue, and hindrance to innovation, are understood and incorporated into future planning and executive decision making.	5.0	
SERVICES AND APPLICATIONS		3.2	
44	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?	2.0	Global Digital Health Index
	No secure registry or master patient index exists.	1.0	
	A secure registry exists, but is incomplete / partially available, used, and irregularly maintained.	2.0	
	A secure registry exists, is available and in active use and includes <25% of the relevant population.	3.0	
	A secure registry exists, is available and in active use and includes 25–50% of the relevant population.	4.0	
	A secure registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
45	DIGITAL IDENTITY MANAGEMENT OF INDIVIDUALS FOR HEALTH: SPECIFICALLY, IS THERE A SECURE MASTER PATIENT INDEX of uniquely identifiable individuals available, accessible, and current that is used for health-related purposes?	2.0	Global Digital Health Index
	No secure master patient index exists.	1.0	
	A master patient index exists, but is incomplete / partially available, used, and irregularly maintained.	2.0	
	A master patient index exists, is available and in active use and includes <25% of the relevant population.	3.0	
	A master patient index exists, is available and in active use and includes 25–50% of the relevant population.	4.0	
	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.	5.0	
46	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?	5.0	Global Digital Health Index
	No secure birth registry exists.	1.0	
	A secure birth registry exists, but is incomplete / partially available, used, and irregularly maintained.	2.0	
	A secure birth registry exists, is available and in active use and includes <25% of the relevant population.	3.0	
	A secure birth registry exists, is available and in active use and includes 25–50% of the relevant population.	4.0	
	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.	5.0	
47	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?	5.0	Global Digital Health Index
	No secure death registry exists.	1.0	
	A secure death registry exists, but is incomplete / partially available, used, and irregularly maintained.	2.0	
	A secure death registry exists, is available and in active use and includes <25% of the relevant population.	3.0	
	A secure death registry exists, is available and in active use and includes 25–50% of the relevant population.	4.0	
	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.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ARCHITECTURE AND DATA INDICATORS		SCORE	SOURCE
48	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?	2.0	Global Digital Health Index
	No secure immunization registry exists.	1.0	
	A secure immunization registry exists, but is incomplete / partially available, used, and irregularly maintained.	2.0	
	A secure immunization registry exists, is available and in active use and includes <25% of the relevant population.	3.0	
	A secure immunization registry exists, is available and in active use and includes 25–50% of the relevant population.	4.0	
	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.	5.0	
49	ARE THERE ANY HEALTHCARE SERVICES USING CLOUD COMPUTING?	3.0	World Bank
	No cloud services are used	1.0	
	There are discussions to transfer services to cloud services	2.0	
	Some services are cloud-based	3.0	
	Most services are cloud-based	4.0	
	All online services used cloud servers	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

C. APPLICATIONS INDICATORS		SCORE	SOURCE
APPLICATIONS (TOTAL SCORE)		1.09	
The following indicators refer to topics related with digital health applications to deliver quality care to patients			
LEADERSHIP AND GOVERNANCE			
STRATEGY AND INVESTMENT		2.0	
50 STRUCTURED PILOTISM TO COUNTER FRAGMENTATION:			Broadband Commission - AI (Adapted)
The umbrella structure for coordinated piloting is integrated into the larger ecosystem of scaled and operational AI in health solutions as well as into cross-sectoral working groups. Funding opportunities can be managed through a centralized platform designed for funders and donors		2.0	
No pilots going in the country		1.0	
Pilotism is supported by a broad remit of actors ranging from IOs, INGOs, and governments; however, there is little or no coordination between disparate pilot projects		2.0	
The value of innovative pilotism is widely recognized by public-private actors and is brought under an organizational umbrella to maximize value generation while minimizing duplication and a lack of coordination		4.0	
The umbrella structure for coordinated piloting is integrated into the larger ecosystem of scaled and operational AI in health solutions as well as into cross-sectoral working groups. Funding opportunities can be managed through a centralized platform designed for funders and donors		5.0	
LEGISLATION AND POLICY		1.0	Global Digital Health Index
51 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?		1.0	
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.		1.0	
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.		2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

APPLICATIONS INDICATORS		SCORE	SOURCE
PROTOCOL FOR REGULATING OR CERTIFYING DEVICES AND/OR DIGITAL HEALTH SERVICES (continued)			
	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.	3.0	
	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.	4.0	
	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.	5.0	
52	DOES THE GOVERNMENT HAVE A POLICY ON UTILIZATION OF SOCIAL MEDIA FOR HEALTHCARE COMMUNICATION, PREVENTION, INFORMATION?	1.0	Global Observatory of eHealth
	There is no utilization of social media for healthcare purposes	1.0	
	There is a strategy to use social media	2.0	
	The government has an extensive use of social media to inform	3.0	
	The government has an extensive use of social media to inform, prevent, share	4.0	
	The government has an extensive use of social media to inform, prevent, share and also analyze social media to track and find patterns	5.0	
	WORKFORCE	1.0	
53	DIGITAL HEALTH INTEGRATED IN HEALTH AND RELATED PROFESSIONAL IN-SERVICE TRAINING (AFTER 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]	1.0	Global Digital Health Index
	There is no digital health curriculum as part of in-service (continuing education) training for health professionals in the workforce.	1.0	
	Digital health curriculum proposed and under review as part of in-service (continuing education) training for health professionals in the workforce.	2.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 0–25% health professionals in the workforce.	3.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 50–75% health professionals in the workforce.	4.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% health professionals in the workforce.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

APPLICATIONS INDICATORS		SCORE	SOURCE
54	DIGITAL HEALTH INTEGRATED IN HEALTH AND RELATED PROFESSIONAL IN-SERVICE TRAINING (AFTER DEPLOYMENT) SPECIFICALLY, IS DIGITAL HEALTH PART OF CURRICULUM FOR DOCTORS/PHYSICIANS IN THE WORKFORCE?	10	Global Digital Health Index
	There is no digital health curriculum as part of in-service (continuing education) training for doctors/physicians in the workforce.	1.0.	
	Digital health curriculum proposed and under review as part of in-service (continuing education) training for doctors/physicians in the workforce.	20.	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 0–25% of doctors/physicians in the workforce.	3.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 50–75% of doctors/physicians in the workforce.	4.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% of doctors/physicians in the workforce.	5.0.	
55	DIGITAL HEALTH INTEGRATED IN HEALTH AND RELATED PROFESSIONAL IN-SERVICE TRAINING (AFTER DEPLOYMENT) SPECIFICALLY, IS DIGITAL HEALTH PART OF CURRICULUM FOR NURSES IN THE WORKFORCE?	1.0	Global Digital Health Index
	There is no digital health curriculum as part of in-service (continuing education) training for nurses in the workforce.	1.0	
	Digital health curriculum proposed and under review as part of in-service (continuing education) training for nurses in the workforce.	2.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 0–25% of nurses in the workforce.	3.0.	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 50–75% of nurses in the workforce.	4.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% of nurses in the workforce.	5.0	
56	DIGITAL HEALTH INTEGRATED IN HEALTH AND RELATED PROFESSIONAL IN-SERVICE TRAINING (AFTER DEPLOYMENT) SPECIFICALLY, IS DIGITAL HEALTH PART OF CURRICULUM FOR COMMUNITY HEALTH WORKERS IN THE WORKFORCE?	1.0	Global Digital Health Index
	There is no digital health curriculum as part of in-service (continuing education) training for community health workers in the workforce.	1.0.	
	Digital health curriculum proposed and under review as part of in-service (continuing education) training for community health workers in the workforce.	2.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 0–25% of community health workers in the workforce.	3.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for 50–75% of community health workers in the workforce.	4.0	
	Digital health curriculum is implemented as part of in-service (continuing education) training for >75% of community health workers in the workforce.	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

APPLICATIONS INDICATORS		SCORE	SOURCE
STANDARDS AND INTEROPERABILITY		1.0	Global Digital Health Index
57 HEALTH SYSTEM AND WORKFLOW INTEGRATION	AI solutions are an essential and integrated component of the health system, with outcome reviews built into regular cost-benefit analyses. Integration into the health system is streamlined and follows clearly outlined processes, and can be completed with relative ease thanks to robust guidelines, agile health organizations, and predefined workflows	1.0	Broadband Commission - AI
	Valuable AI technologies are not systematically integrated into the existing health system, but require individual adoption processes and protocols for the government/Ministry of Health/health organization implementing them	1.0	
	Government agencies and health system managers start to work together to give guidance on AI health system integration	2.0	
	National guidelines on integrating AI-driven health solutions have been co-created by relevant government agencies and health players	3.0	
	The integration of AI solutions into clinical workflows is enabled through stepwise protocols and targeted guidelines and rules on clinical processes, equipment requirements, and information generation/consumption. Clinical workflows have been updated or are easily updatable due to the advances of digital and AI technologies	4.0	
	AI solutions are an essential and integrated component of the health system, with outcome reviews built into regular cost-benefit analyses. Integration into the health system is streamlined and follows clearly outlined processes and can be completed with relative ease thanks to robust guidelines, agile health organizations, and predefined workflows. In addition to robust guidelines, a working group for the continuous improvement of AI health system integration has been set up and provides frequent updated guidance. Clinical workflows and AI solutions are fully integrated processes and an important dimension of the health system ecosystem. All relevant medical equipment is a connected device. Guidelines are regularly updated and adapted to new technological specifications. The benefits and health outcomes of AI solutions are continuously measured and directly influence decision-making processes and BI	5.0	
INFRASTRUCTURE			
SERVICES AND APPLICATIONS			
58 ARE THERE ANY DECISION SUPPORT SYSTEMS IMPLEMENTED IN ANY HEALTHCARE WORKFLOW?		1.0	World Bank
	No	1.0	
	Yes	5.0	
59 NUMBER OF SERVICES THAT CAN BE PROVIDED DIGITALLY		1.0	World Bank
	0–20%	1.0	
	20–40%	2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

APPLICATIONS INDICATORS		SCORE	SOURCE
NUMBER OF SERVICES THAT CAN BE PROVIDED DIGITALLY (continued)			
40–60%		3.0	
60–80%		4.0	
80–100%		5.0	
60	DIGITAL IDENTITY MANAGEMENT OF SERVICE PROVIDERS, ADMINISTRATORS, AND FACILITIES FOR DIGITAL HEALTH, INCLUDING LOCATION DATA FOR GIS MAPPING	1.0	Global Digital Health Index
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?			
Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are not available, accessible, and current.		1.0	
Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are being developed but are not available for use.		2.0	
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.		3.0	
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.		4.0	
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.		5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

D. ANALYTICS INDICATORS		SCORE	SOURCE
ANALYTICS (TOTAL SCORE)		1.6	
The following indicators refer to the maturity of AI, the utilization of data, the knowledge in data science among healthcare workers, AI strategy			
LEADERSHIP AND GOVERNANCE		1.4	
61 LEADERSHIP			
Creating an integrated AI for health ecosystem across the full application spectrum is a top priority at the highest levels of government and for industry leaders		1.0	Broadband Commission
The government supports the implementation of AI for health on an ad hoc basis, and top-level support is often missing		1.0	
The government systematically supports the incorporation of AI into healthcare at a leadership level		2.0	
National agencies for key governance and regulatory AI dimensions are established and supported by political leadership		3.0	
Creating an integrated AI for health ecosystem across the full application spectrum is a top priority at the highest levels of government and for industry leaders		4.0	
A digital/AI unit is formally established within the Ministry of Health/ICT. Support stretches across key ministries and executive offices		5.0	
62 AI GOVERNANCE AND STEWARDSHIP			
Data, algorithm, model, digital technology, ethical and workforce policies, are sufficiently robust to achieve the strategic national transformation for a data-driven health future.		1.0	Broadband Commission
Health data management accountability is formalized but not centralized. Rules, standards, and guidelines are not defined nationally		1.0	
Data, algorithm, model, digital technology, ethical, and workforce policies inform the governance, acquisition, ingestion, transformation, and use of data in health, according to public health priorities		2.0	
National data stewardship efforts create a public sector platform for creating and managing health data, documenting relevant rules and standards, and managing data quality		3.0	
National data stewardship efforts define guidelines for data controls, rules and uses that are underpinned by policy and champion all data as an asset for public health. There are concerted national efforts to comply with and co-shape international standards and policy frameworks		4.0	
Data stewardship is formalized and ensures that data policies and standards are turned into practice, including regular audits		5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ANALYTICS INDICATORS		SCORE	SOURCE
63	HOW DOES LEADERSHIP VALUE DATA?	2.0.	University of Chicago
	Do they require data to be presented to make decisions?		
	Leaders at this level fundamentally don't know how data can help advance the organization's mission.	1.0	
	Leadership wants to use data but don't have a clear path forward to use data	2.0	
	Leadership has a clear idea of how data can be used to drive business decisions beyond justification of funding	4.0	
	Leadership builds a culture of data within the organization and demands data to justify all programmatic decisions	5.0	
STRATEGY AND INVESTMENT		1.0	
64	STRATEGY & BUDGET: AI STRATEGY FULLY BUDGETED	1.0	Broadband Commission
	Budgets have not been granted or earmarked for digital health, although individual AI in health solutions may be supported opportunistically	1.0	
	National public health priorities and the role of AI are described in an official document	2.0	
	The government has published and is operationalizing its AI strategy or a digital health strategy with specific articles on AI, and has allocated dedicated funding (e.g., a percentage of the overall health budget) for AI pathways that support national health priorities	3.0	
	There is a dedicated national AI in health strategy that directly links national AI strategies from different sectors with the aim of cross-sectoral support and a learning ecosystem. The strategy is fully budgeted and integrated into the overall health roadmap for multiple years	4.0	
	Dedicated agencies and good governance stewards oversee implementation, outcome measurement, and continuous support. Open innovation is systematically integrated into national strategies and an essential part of the larger innovation ecosystem that is creating new value chains	5.0	
65	BUSINESS MODELS		Broadband Commission
	Health system players are scaling product and business models to target large NGO, commercial, or government adoption of AI solutions	1.0	
	Sustainable business models have been introduced with limited scope and no national guidance exists	1.0	
	National funding for AI in health is not led by dedicated budgets but builds on existing budgets	2.0	
	Health system players are testing and piloting sustainable business models, while still largely relying on external funding	3.0	
	AI in health has a nationally dedicated budget and forecasts for long-term sustainability	4.0	
	Health system players are scaling product and business models to target large NGO, commercial, or government adoption of AI solutions	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ANALYTICS INDICATORS		SCORE	SOURCE
LEGISLATION AND POLICY		1.5	
66	ARE THERE POLICIES IN PLACE AROUND THE NEED FOR EXPLAINABILITY/FAIRNESS/TRANSPARENCY IN AI MODELS?	1.0	Broadband Commission
	AI explainability requirements have not been established, but national efforts exist to provide technical explainability guidelines (e.g., guidance on making AI systems understandable and traceable to humans). While there is no consensus around algorithm and model transparency and bias, the government is establishing a working group to propose recommendations	1.0	
	AI explainability requirements have not been established	2.0	
	AI explainability requirements are formalized for applications requiring regulatory approvals and strong guidelines are in place for others	3.0	
	Beyond technical explainability, this includes interpretability requirements enabling physicians to transparently explain to patients proposed decisions for informed patient consent	4.0	
	AI explainability is closely regulated and government support extends beyond explainability and interpretability to foster transparent, re-enactive, comprehensible, retraceable, and reproducible models or self-explaining agents	5.0	
67	THERE IS A WRITTEN SET OF PROCEDURES FOR DATA ANALYSIS?	2.0	IS4H Maturity Assessment tool
	No procedures	1.0	
	Some procedures	2.0	
	Procedures and policies documented but not fully implemented	3.0	
	Procedures and policies documented and implemented at the region and national levels	4.0	
	Procedures and policies documented and implemented at the facility, region and national levels	5.0	
WORKFORCE		1.3	
68	HOW BOUGHT IN ARE STAFF THROUGHOUT THE GOVERNMENT/MINISTRY OF HEALTH/HEALTH ORGANIZATION? WHAT PERCENTAGE OF THE STAFF ARE INVOLVED IN DATA COLLECTION? DATA ANALYSIS?	2.0	University of Chicago
	Staff at the government/Ministry of Health/health organization have some idea that data exists but doesn't understand it is important	1.0.	
	There are a few individuals who deeply understand the data available and what can be done with it	2.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ANALYTICS INDICATORS		SCORE	SOURCE
HOW BOUGHT IN ARE STAFF THROUGHOUT THE GOVERNMENT/MINISTRY OF HEALTH/HEALTH ORGANIZATION? WHAT PERCENTAGE OF THE STAFF ARE INVOLVED IN DATA COLLECTION? DATA ANALYSIS? (continued)			
The government/Ministry of Health/health organization has a clear idea of how data can be used to drive business decisions beyond justification of funding		4.0	
The government/Ministry of Health/health organization has a culture of data within the organization and demands data to justify all programmatic decisions		5.0	
69	NATIONAL CURRICULA AND EDUCATION INSTITUTIONS (DATA SCIENCE AND AI)	1.0	Broadband Commission
	National curricula for health in tertiary education do not include Data Sciences and AI (DSAI)	1.0	
	Government actions are focused on drafting policies for DSAI to become part of formal health education	2.0	
	Selected health driven DSAI courses are compulsory for higher education programs in health	3.0	
	Public health priorities and the role of DSAI are taught at the basic level in secondary education. Government is prioritizing university research on DSAI in health through funding and incentives (tax benefits, Centers of Excellence, etc.)	4.0	
	Secondary school curricula introduce basic DSAI concepts. DSAI skills are mandatory for medical and health-related degrees. Higher education institutions not only prioritize teaching and research in DSAI for health, but they also incubate national cross-sectoral collaborations	5.0	
70	PROFESSIONAL AND ON-THE-JOB TRAINING (DATA SCIENCE & AI)	1.0	Broadband Commission
	Professional DSAI trainings in health are not compulsory for specialized health workers and course offerings are restricted to basic courses. Development of technology skills is rarely part of continuous learning opportunities for health staff. No continuous education curricula for in-service training of health staff have been drafted	1.0	
	Social learning is supported by key actors but lacks systematic support	2.0	
	Training programs on DSAI in health are closely aligned with public health priorities. Health systems are actively prioritizing the extension of trainings from specialized medical workers to general health workers.	3.0	
	Continuous and social learning on AI in health is an integrated part of on-the-job training goals	4.0	
	Certified trainings in DSAI in health are mandatory on a national level for all relevant health professionals and are fully aligned with public health priorities. National actors work towards international recognition of training certifications and public-private sector trainings are initiated for upskilling and knowledge exchange. Continuous learning on AI in health is compulsory for most medical and health workers	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ANALYTICS INDICATORS		SCORE	SOURCE
71 TALENT ACQUISITION (DATA SCIENCE & AI)		1.0	Broadband Commission
	There is no national strategy to attract and retain DSAI talents, yet the government is defining its first strategies to attract talent, e.g., through innovation parks, research hubs, strong workers' rights and benefits, and streamlined processes for integrating innovation into public sectors	1.0	
	Attracting and retaining AI and talent with both expertise in health and DSAI is anchored in policy initiatives and supported through financial or tax incentives	4.0	
	Existing efforts to retain key talent are supplemented by the establishment of prestigious grants, grand challenges, and adjunct research positions for thought-leaders from both private and public sectors	5.0	
STANDARDS AND INTEROPERABILITY			
INFRASTRUCTURE		3.0	
72 ONLINE TOOLS AND PLATFORMS FOR DATA DISSEMINATION AND ANALYSIS ARE AVAILABLE		3.0	IS4H Maturity Assessment tool
	Not available	1.0	
	For private use of technical team	2.0	
	For decisions makers	3.0	
	For stakeholders	4.0	
	For public	5.0	
SERVICES AND APPLICATIONS		2.4	
73 DOES THE HEALTHCARE SECTOR USE DATA CONSUMPTION AND BUSINESS INTELLIGENCE SERVICES?		2.0	Broadband Commission
	No business intelligence is integrated	1.0	
	Basic data consumption and business intelligence metrics are integrated into essential operating processes, e.g., dashboards and interfaces to steer decision-making on how the government/Ministry of Health/health organization is deriving value from data, what data is used, how it is accessed, which decisions are data-driven, etc.	3.0	
	Advanced data consumption and business intelligence metrics, including advanced real-time analytics on outcomes and value generation as well as live feeds on workflow integration, create an ecosystem of data-driven decision making across the health system and the government/Ministry of Health/health organization's business processes	5.0	

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Appendix table C.1 Indicators of Digital Maturity in Lesotho (continued)

ANALYTICS INDICATORS		SCORE	SOURCE
74	ADVANCED ANALYTICAL TECHNIQUES (E.G., AI, PREDICTIVE ANALYSIS, NATURAL LANGUAGE PROCESSING, ETC.) ARE APPLIED TO SUPPORT REAL-TIME AND ROUTINE CLINICAL, MANAGEMENT AND POLICY DECISION-MAKING.	1.0	IS4H Maturity Assessment tool
	No	1.0	
	Not on a regular basis	2.0	
	Ad hoc	3.0	
	On demand	4.0	
	Routinely	5.0	
75	TOOLS USED TO SUPPORT HEALTH ANALYSIS	4.0	IS4H Maturity Assessment tool
	No tools	1.0	
	Spreadsheets (Excel)	2.0	
	Graphing tools and statistical packages (R, SPSS, SAS).	3.0	
	Business intelligence tools and dashboards.	4.0	
	GPS data sets, data warehouses, visualization tools and analytical presentation tools available through websites	5.0	

APPENDIX D PROFILE OF DIGITAL HEALTH LANDSCAPE

Appendix table D.1 Socio-demographics and healthcare system basic information

	LESOTHO	BOTSWANA	ESWATINI	NAMIBIA	SOUTH AFRICA	YEAR	SOURCE
Population, total (millions)	2.14	2.35	1.16	2.54	59.31	2020	World Bank
Population growth (annual %)	0.8%	2.1%	1.0%	1.8%	1.3%	2020	World Bank
Population density (people per sq. km of land area)	69	4	66	3	48	2020	World Bank
Rural population (% of total)	71%	29%	76%	48%	33%	2020	World Bank
Life expectancy at birth, total (years)	54	70	60	64	64	2019	World Bank
GDP per capita, PPP (constant 2017 international \$)	2,280	16,040	8,393	8,894	11,466	2019	World Bank
GDP per capita growth (annual %)	-11.8%	-9.8%	-2.7%	-9.7%	-8.1%	2020	World Bank
Income level	LMI	UMI	LMI	UMI	UMI	–	World Bank
Hospital beds (per 1,000 people)	1.3	1.8	2.1	2.7	2.3	Various	World Bank
Physicians (per 1,000 people)	0.1	0.5	0.3	0.4	0.9	Various	World Bank
Nurses and midwives (per 1,000 people)	3.3	5.4	4.1	2.0	1.3	Various	World Bank
Health expenditure as % of GDP	9.28%	5.85%	6.54%	7.95%	8.25%	2018	World Bank
Out-of-pocket expenditure (% of current health expenditure)	16.04%	3.32%	11.26%	8.43%	7.72%	2018	World Bank

Appendix table D.2 Digital Environment and Infrastructure

	LESOTHO	BOTSWANA	ESWATINI	NAMIBIA	SOUTH AFRICA	YEAR	SOURCE
E-Government development index (out of 193)	135	115	128	104	78	2020	UN
ICT development index (out of 176)	133	105	–	118	92	2017	ITU
Access to electricity (% of population)	47	70	77	55	85	2019	World Bank
Mobile-cellular subscriptions (per 100 inhabitants)	74	163	94	113	166	2019	World Bank
Fixed-telephone subscriptions (per 100 inhabitants)	1	6	4	6	3	2019	World Bank

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Appendix table D.2 Digital Environment and Infrastructure (continued)

	LESOTHO	BOTSWANA	ESWATINI	NAMIBIA	SOUTH AFRICA	YEAR	SOURCE
Mobile-cellular basket low usage (70 min + 20 SMS) (%GNI pc)	6.85	1.05	1.62	1.95	1.55	2019	ITU
Individuals using internet (% of population)	29	47	47	51	56	2019	ITU
Percentage of households with computers	8.86	27.80	21.40	21.19	21.85	2019	ITU
Percentage of households with internet access	30.42	63.45	27.00	34.57	61.83	2019	ITU
TYPE OF COVERAGE AND % OF POPULATION							
2G	90%	–	–	–	–	–	GSMA
3G	90%	–	–	–	–	–	GSMA
4G	45%	–	–	–	–	–	GSMA
Mobile coverage gap	15%	–	–	–	–	–	GSMA
Mobile utilization gap	55%	–	–	–	–	–	GSMA

Appendix table D.3 Digital Health Applications and Interventions

	INDICATOR	YEAR	SOURCE
No. or percentage of population registered in the national EMR	Only HIV/TB patients		
No. of health facilities using EHR	182	2021	
No. of health facilities using national EMR	182	2021	
Percentage of health facilities connected to the internet	at least 182	2021	
IS THE NATIONAL EMR INTEGRATED WITH:			
Laboratory info	No	2020	
Radiology/PACS	No	2020	
Pharmacy info	Work in progress	2021	

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Appendix table D.3 Digital Health Applications and Interventions (continued)

	INDICATOR	YEAR	SOURCE
IS THE NATIONAL EMR INTEGRATED WITH (continued):			
Drug procurement	No	2020	
Electronomical medical billing	No	2020	
HR	No	2020	
WHAT KIND OF DIGITAL HEALTH INTERVENTIONS EXISTS IN THE COUNTRY?			
Appointment reminders	No	2020	ICAP
Mobile telehealth	No	2020	
Management of disasters and emergencies	No	2020	
Treatment adherence	Yes (only HIV/TB)	2020	
Community mobilization	No	2020	
Access to information, databases, and tools	No	2020	
Patient records	Yes (only HIV/TB)	2020	
eLearning	No	2020	
Decision support systems	No	2020	
Patient monitoring	No	2020	
Disease surveillance	Yes	2020	
Other (name)	Reporting	2020	

APPENDIX E KEY ACHIEVEMENTS OF THE EHEALTH STRATEGY (2019–2023) BY STRATEGIC AREA

Focus Area - ICT Services and Applications:

- **Identified the HIE platform**
 - Selected the HIE architecture
 - Acquired the hardware
 - Configured and tested the software
- **Assessed all facilities with or without VoIP**
 - Procured VoIP infrastructure
 - Installed and configured VoIP infrastructure
 - Trained personnel/users on use of VoIP
 - Provided support and maintenance
 - Identified plausible systems supporting voice and video
 - Identified hardware supporting systems
 - Acquired software compatible with the hardware chosen
 - Installed, configured, and tested the solution
- **Assessed OpenLMIS**
 - Identified modules to be customized
 - Customized (prototyping) the modules according to specifications
 - Trained users and piloted the system
 - Rolled out the system to all facilities
- **Assessed the IHRIS**
 - Identified modules to be customized
- **Conducted a readiness assessment of all health centers beyond the current 45 e-Register implementing sites**
 - Procured infrastructure for sites without e-Register
 - Installed and configured infrastructure
- Added modules to the e-Register to accommodate all programs
- Assessed available Open-Source Shared Health Record Applications

Focus Area - Leadership and Governance: Minimal

Focus Area - Strategy and Investment:

- **Finalized the development of the National eHealth Strategy 2019–2023**
 - Incorporated comments from the validation workshop and finalized the eHealth strategy
 - Submitted the final version of the eHealth Strategy for political endorsement
- **Promoted the eHealth strategy for buy-in across all MoH departments and GoL sectors and stakeholders**
 - Identified key departments and stakeholders to promote eHealth
 - Sourced funding from stakeholders and development partners
- **Identified potential sources of funding**

Focus Area - Infrastructure

- **Upgraded the government network**
 - Assessed and identified the end-of-life devices to be upgraded
- **Improved cybersecurity for the MoH**
 - Acquire SSL certificates
- **Expanded the network to all health facilities**
 - Assessed status of network coverage at health facilities
- **Upgraded MoH server capacity to boost the speed of the eHealth system**
 - Procured adequate equipment
 - Installed equipment
 - Improved security of the data center server
 - Secured the data center premises

Focus Area - Standards and Interoperability: Minimal

Focus Area - Workforce:

- **Mobilized institutions of higher learning to provide eHealth training programs**
 - Established partnerships with local Institutions of higher learning

APPENDIX F PRINCIPLES OF PARTICIPATORY DESIGN

Participatory design and implementation of digital health care and health care digitization refer to the adoption, integration, and sustainability of new systems. It is a collaborative method that requires creative partnerships between developers and end-users, specifically in the context of technology, to enable users to design their experiences with modern technology in a formative design stage, to collectively propose solutions to improve use in practice.

Failure to incorporate participatory design and implementation may lead to wasted resources and create new challenges on the ground and to end-users. Participatory design requires repeated engagement with all stakeholders and their perspectives as well as use of digital technology, integration with existing information systems, and standardized delivery at scale.

Co-design with all intended users is necessary, including consideration of patients' experiences to note differences in how users view digital interventions compared to health care workers and providers, which can impact engagement throughout the health system. It is recommended that the principles of participatory design and implementation guide the development of every component of strategies and actions to support the uptake and integration of digital health and health digitalization.

Participatory design and implementation processes typically involve using visual or narrative methods understand better the needs and circumstances of end-users, as well as rapid prototyping to critique assumptions and proposed solutions to complex health care problems. Key actionable means to be considered in participatory design and implementation include the following:

- Empathy mapping during data collection to gain insight and determine end-users' pain points and challenges
- Conceptual design and data analyses using the living lab approach, following a predetermined set of end-users of different perspectives and profiles in real-world environments
- Focus group prototyping with end-users to predict reactions prior to completion, which differs from usability testing, which only engages end-users with the completed version of prototypes

These structured methods promote consideration of the motivations and concerns of real-world users across the design process, limiting time and resource wastage on creating tools that are not relevant or acceptable to the target population.

APPENDIX G SUMMARY OF RECOMMENDATIONS

	#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
	DIGITAL ENVIRONMENT					
	R1	Need for leadership and ownership of digital health strategy	Restructure the IT department within MOH and expand their role beyond ICT maintenance to promote inclusive digital health policies and strategies across internal and external stakeholders. Assign a dedicated budget for digital health with defined objectives and priorities; align and funnel investments to the right interventions; provide adequate skill mixes; and evaluate interventions.	Positioning of the MoH as the guidance, coordination, and regulatory body on digital health	Start Now 	- IT Department - Ministry of Health - Ministry of Finance
	R2	Extensive use of mobile, however mobile coverage and internet connectivity is not equally distributed, unstable electricity supply	Enrich the Lesotho ICT policy 2021 by conducting a health sector infrastructure assessment. Conduct a sectoral assessment of infrastructure and connectivity to implement some of the recommendations made by the Lesotho ICT policy 2021 (currently in draft form).	Improvement of connectivity and electricity supply to ensure the functioning of systems and the implementation of digital health interventions	Start Now 	- Ministry of Health - Ministry of Communications, Science, and Technology
	R3	Few courses that can provide digital health skills at levels of pre/in-training	Collaborate with the Ministry of Education and Training to implement pre-service education of health professionals and health workers on digital health, as well in service health professionals. The curriculum should include topics in health informatics, data science for health care, development and implementation of digital health interventions, and entrepreneurship to create a pre-trained cadre to assist the work of the MoH. Leverage regional knowledge by coordinating with other digital health capacity-building initiatives.	Creation of a pre-trained cadre to assist the work of the MoH. Potential to leverage regional knowledge by coordinating with other digital health capacity-building initiatives or through the digital health hub (R4).	Start Next 	- Ministry of Health - Ministry of Education and Training

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SUMMARY OF RECOMMENDATIONS (continued)

#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
DIGITAL ENVIRONMENT (continued)					
R4	Lack of interoperability with other sectors that are connected to health (i.e., education, housing, transportation), limiting a holistic perspective of patients	Promote digital health within the broader e-government context to enhance the digital economy, including promoting digital ID. The African Union's Agenda 2063, ratified by all African countries, aims to ensure that "99.9% of people in Africa have a digital legal identity as part of a civil registration process by 2030." The MoH must coordinate with other governmental bodies to implement digital ID to empower patients by linking patient information across facilities.	Develop policies and guidelines for facilitating the dialogue and policy making around potential investments, research centers, and coordination with universities for local development of digital health to enhance the digital economy	Start Next 	All government
R5	Limited human resources as people move to neighboring countries to study and work	Formalize digital health collaboration with countries within the SADC region to form a regional digital health hub, like Digital REACH Initiative proposed by USAID for the East Africa Community. Lesotho could coordinate efforts and collaborate with neighboring countries through a regional digital health hub, that will facilitate sharing of human resources, skills, knowledge, and better practices to improve preparedness and resilience for future health events such as pandemics.	Economies of scale and human resources, skills, knowledge, and better practices to improve readiness to manage future events, because Lesotho is fully dependent on South Africa	Start Later 	- Ministry of Health - AU specific Regional Economic Communities - AU
ARCHITECTURE AND DATA					
R6	Nascent development safeguards and preparedness for digitalization	Conduct a cybersecurity assessment to improve cybersecurity and data privacy. Provide technical assistance to develop policies and guidelines for data privacy, cybersecurity, and data transfer to reduce vulnerability to cyber-attacks that could disrupt the provision of care or jeopardize the privacy of patients' data.	Creation of the necessary safeguards to protect the privacy and security of data and systems and avoid the disruption of health care delivery	Start Now 	- Ministry of Health - Ministry of Communications, Science, and Technology Ministry of Justice
R7	Limited Standard and operating procedures. Lack of standards for data governance	Develop health data governance legislation. Develop data governance legislation and standards and define data ownership, data transparency, data governance, and data management sharing information rules within the health information exchange architecture.	Improved interoperability between the MoH and partners and information transfer from facilities and partner's programs into the MoH	Start Next 	- Ministry of Health - Ministry of Justice, Human Rights & Correctional Services

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SUMMARY OF RECOMMENDATIONS (continued)

#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
ARCHITECTURE AND DATA (continued)					
R8	Limited interoperability between health facilities and between MoH and partners	Expand the health information exchange architecture to build a digital health platform (infostructure). Apply the recent WHO guideline “Building a Digital Information Infrastructure (Infostructure) for Health” to build a digital health platform using accepted standards and connect with other MoH applications, such as pharmacy systems, DHIS-2, and future human resources and logistics management applications.	Facilitation of continuity of care by sharing data among users, health care providers, health systems managers, and health data services	Start Next 	- Ministry of Health - Partners
ANALYTICS					
R9	Inefficient use of data systems to monitor, evaluate, analyze, and improve health care	Design and implement a health facility report card based on selected indicators for quality improvement. Indicators could include service delivery, patient satisfaction, resources, and wait times to provide insight and transparency regarding the quality of care at each health facility.	Creation of evidence-based inputs to support decision-making and resource allocation	Start Now 	Ministry of Health
R10	Lack of targeted digital health interventions	Commission an assessment of primary health care challenges to identify areas that can be improved with digital health mechanisms. To be effective and impactful, digital health interventions or applications should respond directly to primary care challenges that can be identified through assessments like the World Bank’s vital signs profile for primary health care performance improvement (PHCPI).	Matching of digital health interventions to primary care challenges and generation of impactful outcomes	Start Now 	Ministry of Health
R11	Data is being collected however, quality is low and not always reliable	Commission a data quality assessment. As part of the effort to strengthen surveillance and data collection, the World Bank is currently conducting a process mining analysis from data collection to data reporting and analysis. This can contribute to a more extensive data quality assessment quality across the health care sector.	Improved decision making using timely and complete data and information	Start Now 	Ministry of Health

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SUMMARY OF RECOMMENDATIONS (continued)

#	CURRENT SITUATION	RECOMMENDATION	IMPACT	PHASING	RESPONSIBLE
APPLICATIONS					
R12	Lack of a costed implementation plan of digital health interventions/applications	Design a prioritized and costed plan for digital health applications. This plan should determine which interventions are relevant, provide an estimate of costs and benefits, assign responsible parties, and provide a clear monitoring and evaluation plan. The WHO Digital implementation investment guide (DIIG) could be a valuable resource to guide this work.	Completion of a costed implementation plan	Start Now >	- Ministry of Health - Partners
R13	Fragmentation and dependency on partners for digital health development Lack of private investment and entrepreneurship	Commission technical assistance to support public-private partnerships (PPP) and service level agreements (SLA) for digital health interventions. SLAs could address the lack of digital health skills and skilled resources in the short term. These should be accompanied by a mid-term strategy to create skilled, in-house resources. Coordination with WHO and IFC could support this activity.	Lesotho currently enjoys significant public investment. The current global discussions about PPPs could generate enough incentive to attract private sector investment in the country.	Start Now >	Ministry of Health
R14	Limited number of digital health interventions at community level Limited programs within e-Register	Design a plan to scale up e-Register gradually over the next three years to transform all existing health programs and into a comprehensive EMR. Expand the e-Register to include aspects such as family planning, chronic diseases, children's health, among others to assure comprehensive care for all.	Provision of comprehensive care for all	Start Next >	Ministry of Health
R15	Lack of impact evaluation of digital health investments	Establish an innovation testing environment for the various interventions and evaluate impact and feasibility. Testing environments, such as an innovation and regulatory sandbox or living lab, can provide a framework to test solutions in a responsible, monitored, and real-world environment.	Generation of evidence, measurement of social response, elimination of failed interventions, and reduction of future implementation costs.	Start Next >	- Ministry of Health - Private sector - Universities
R16	Lack of evidence on the cost and effectiveness of digital health interventions	Commission feasibility and economic evaluation studies of priority digital health interventions. Build evidence on the cost-effectiveness and cost benefit of digital health interventions such as eRegister, DHIS-2, ECHO to prioritize future investment.	Creation of evidence to guide the MoH on future investments	Start Later >>	- Ministry of Health - Partners

APPENDIX H SUMMARY OF PRIORITY DIGITAL HEALTH INTERVENTIONS BY HEALTH SYSTEM CHALLENGE

Interventions are grouped according to the WHO Classification of Digital Health Interventions, based on system challenges, clients, digital health interventions and system category. Table H1 summarizes each digital health application in relation to the health system challenge it aims to resolve. Table H.2 offers examples of the applications used for each health system challenge identified.

Appendix table H.1 Priority Digital Health Interventions (applications) by Health System Challenge

WHO CLASSIFICATION: HEALTH SYSTEM CHALLENGES	HEALTH SYSTEM CHALLENGE	DIGITAL HEALTH APPLICATIONS/ INTERVENTIONS	WHO CLASSIFICATION: PRIMARY USER	WHO CLASSIFICATION: DIGITAL HEALTH INTERVENTION	WHO CLASSIFICATION: SYSTEM CATEGORY
INFORMATION	1.2 Delayed reporting of events	Surveillance and public health data collection, processing, and quality check are time consuming, affecting timely decision making. Due to the high prevalence of communicable diseases, early detection of cases is fundamental.	Data services	4.1.4 Automated analysis of data to generate new information or develop future projections	I Emergency response system
	1.3 Lack of quality/reliable data	Manual data processing is vulnerable to errors and currently, there are discrepancies among data points (e.g., a woman-specific disease should not be registered for a man)	Data services	4.1.2 Data storage and aggregation	X Shared health records and health information repositories
	1.5 Lack of access to information or data	Results notification	Clients	1.1.4 Transmit diagnostic results, or communicate the availability of results, to client(s)	D Client communication system
		Expansion of e-Register	Health system providers	2.2.1 Longitudinal tracking of clients' health status and services	H Electronic Medical Record
		Implementation of intelligent dashboards	Data services	4.1.3 Data synthesis and visualization	Various GIS, HMIS surveillance system

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Appendix table H.1 Priority Digital Health Interventions (applications) by Health System Challenge (continued)

WHO CLASSIFICATION: HEALTH SYSTEM CHALLENGES		HEALTH SYSTEM CHALLENGE	DIGITAL HEALTH APPLICATIONS/ INTERVENTIONS	WHO CLASSIFICATION: PRIMARY USER	WHO CLASSIFICATION: DIGITAL HEALTH INTERVENTION		WHO CLASSIFICATION: SYSTEM CATEGORY	
AVAILABILITY	2.1	Insufficient supply of commodities	The fragile financial situation of Lesotho affects the resources provided to the health care sector. This also affects the supply of equipment and qualified health care workers, the ability to provide the same quality of health services consistently to every citizen and region. The capacity for testing, laboratory diagnostics, medical consultation, infection control, and critical care is weak.	Telemedicine for follow up with TB and HIV patients, telecare for initial triage and mild cases	Health system providers	Telemedicine	2.4.1 Consultations between remote clients and health care providers	Y Telemedicine
	2.2	Insufficient supply of services					2.4.2 Remote monitoring of client health or diagnostic data by the health care provider	Y Telemedicine
	2.3	Insufficient supply of equipment					2.4.3 Transmission of medical data to the health care provider	Y Telemedicine
	2.4	Insufficient supply of qualified health workers					2.4.4 Consultations for case management between health care providers	Y Telemedicine
QUALITY	3.1	Poor patient experience	Patients in Lesotho cannot schedule appointments online, and at health facilities, appointments are managed manually using a registration book. This affects the experience of the patient, who must, therefore, remember appointments. Moreover, at the facility level, the patients with appointments may not be prioritized over walk-in patients	Appointment scheduling through SMS	Clients	On-demand information services to clients	1.6.1 Client search for health information	D Client communication system
				Module for tracking no-shows in e-Register	Health system providers	Health worker activity planning and scheduling	2.7.2 Scheduling of the health care provider's activities	K Facility management information systems

Table continued on page 84

Appendix table H.1 Priority Digital Health Interventions (applications) by Health System Challenge (continued)

WHO CLASSIFICATION: HEALTH SYSTEM CHALLENGES	HEALTH SYSTEM CHALLENGE	DIGITAL HEALTH APPLICATIONS/ INTERVENTIONS	WHO CLASSIFICATION: PRIMARY USER	WHO CLASSIFICATION: DIGITAL HEALTH INTERVENTION		WHO CLASSIFICATION: SYSTEM CATEGORY	
QUALITY (continued)	3.2 Insufficient health worker competence	Expansion of telementoring support	Health system providers	Telemedicine	2.4.4 Consultations for case management between health care providers	Y	Telemedicine
		Expansion of telementoring support	Health system providers	Health care provider training	2.8.1 Provision of training to health care providers	S	Learning and training system
		Expansion of telementoring support	Health system providers	Health care provider training	2.8.2 Assessing the capacity of health care provider(s)	S	Learning and training system
	3.5 Insufficient continuity of care	Telemedicine	Clients	–	–	Y	Telemedicine
		Module for tracking no-shows in e-Register	Health system providers	Health worker activity planning and scheduling	2.7.2 Scheduling of the health care provider's activities	K	Facility management information systems
		Expansion of e-Register	Health system providers	Client health records	2.2.2 Management of client's clinical records	H	Electronic Medical Record
				Client health records	2.2.4 Routine health indicator data collection and management	H	Electronic Medical Record
		Implementation of digital referral system	Health system providers	Referral coordination	2.6.1 Coordination of emergency response and transport	G	Data interchange interoperability and accessibility

Table continued on page 85

Appendix table H.1 Priority Digital Health Interventions (applications) by Health System Challenge (continued)

WHO CLASSIFICATION: HEALTH SYSTEM CHALLENGES		HEALTH SYSTEM CHALLENGE	DIGITAL HEALTH APPLICATIONS/ INTERVENTIONS	WHO CLASSIFICATION: PRIMARY USER	WHO CLASSIFICATION: DIGITAL HEALTH INTERVENTION		WHO CLASSIFICATION: SYSTEM CATEGORY	
UTILIZATION	5.1	Low demand for services	Due to the distance between health facilities and homes (especially rural areas), health care personnel often intervene once cases are critical instead of using preventive health measures to limit the severity of cases	Appointment scheduling through SMS	Clients	On-demand information services to clients	1.6.1 Client search for health information	D Client communication system
				Health promotion messaging	Clients	Untargeted client communication	1.2.1 Transmission of untargeted health information to an undefined population	C Client applications
	5.2	Geographic inaccessibility	The mountainous geography of the country hampers certain populations' ability to reach health facilities	Telemedicine	Clients	–	–	Y Telemedicine
	5.3	Minimal adherence to treatment plans	Adherence to treatment plans is fundamental to reduce the severity of communicable diseases such as HIV and TB. The lack of health literacy and the distance to health facilities impede follow-up of treatments and monitoring of adherence.	Appointment reminders	Clients	Targeted client communication	1.1.3 Transmission of targeted alerts and reminders to client(s)	D Client communication system
				Medication management	Clients	Personal health tracking	1.4.1 Access by the client to own medical records	D Client communication system
				Health promotion messaging	Clients	Untargeted client communication	1.2.1 Transmission of untargeted health information to an undefined population	C Client applications
				Nudge and gaming applications for behavioral change	Clients	Personal health tracking	1.4.2Self-monitoring of health or diagnostic data by client	C Client applications

Table continued on page 86

Appendix table H.1 Priority Digital Health Interventions (applications) by Health System Challenge (continued)

WHO CLASSIFICATION: HEALTH SYSTEM CHALLENGES			HEALTH SYSTEM CHALLENGE	DIGITAL HEALTH APPLICATIONS/ INTERVENTIONS	WHO CLASSIFICATION: PRIMARY USER	WHO CLASSIFICATION: DIGITAL HEALTH INTERVENTION		WHO CLASSIFICATION: SYSTEM CATEGORY
UTILIZATION (continued)	5.4	Loss to follow up	Adherence to treatment plans is fundamental to reduce the severity of communicable diseases such as HIV and TB. The lack of health literacy and the distance to health facilities impede follow-up of treatments and monitoring of adherence.	Appointment reminders	Clients	Targeted client communication	1.1.3 Transmission of targeted alerts and reminders to client(s)	D Client communication system
				Module for tracking no-shows in e-Register	Health system providers	Health worker activity planning and scheduling	2.7.2 Scheduling of the health care provider's activities	K Facility management information systems
EFFICIENCY	6.1	Inadequate workflow management	There are limited standard operation procedures at health facilities. Most of the registries are paper based and, in many cases, folders and patient records are lost.	Implementation of digital referral system	Health system providers	Referral coordination	2.6.2 Management of referrals between points of service within the health sector	G Data interchange interoperability and accessibility
	6.2	Lack of or inappropriate referrals	Referrals are registered in the BOKANA, a paper booklet maintained by each patient.	Implementation of digital referral system	Health system providers	Referral coordination	2.6.3 Management of referrals between health and other sectors	G Data interchange interoperability and accessibility
	6.3	Poor planning and coordination	The lack of timely information affects the planning and coordination of resources. Lesotho's capacity for pandemic preparedness is limited.	Disease outbreak notifications, early warning applications	Health System Managers	Public health event notifications	3.3.1 Notification of public health events from point of diagnosis	D Client communication system
	6.4	Delayed provision of care	The lack of timely information and interoperability does not permit effective tracking of cases, which delays the provision of care and increases the severity of cases that can be managed.	Implementation of digital referral system	Health system providers	Referral coordination	2.6.3 Management of referrals between health and other sectors	G Data interchange interoperability and accessibility
				Disease outbreak notifications, early warning applications	Health System Managers	Public health event notifications	3.3.1 Notification of public health events from point of diagnosis	D Client communication system

Table continued on page 87

Appendix table H.1 Priority Digital Health Interventions (applications) by Health System Challenge (continued)

WHO CLASSIFICATION: HEALTH SYSTEM CHALLENGES		HEALTH SYSTEM CHALLENGE	DIGITAL HEALTH APPLICATIONS/ INTERVENTIONS	WHO CLASSIFICATION: PRIMARY USER	WHO CLASSIFICATION: DIGITAL HEALTH INTERVENTION		WHO CLASSIFICATION: SYSTEM CATEGORY	
COST	7.1	High cost of manual processes	Lesotho has many manual processes (from patient registration and data collection to data quality verification and administrative processes).	Module for tracking no-shows in e-Register	Health system providers	Health worker activity planning and scheduling	2.7.2 Scheduling of the health care provider's activities	K Facility management information systems
				Implementation of digital referral system	Health system providers	Referral coordination	2.6.3 Management of referrals between health and other sectors	G Data interchange interoperability and accessibility
	7.2	Lack of effective resource allocation	As referrals, appointments, registries, and supplies are not completely digitalized, the government cannot effectively allocate resources, which affects the supply at health facilities and the quality of care.	Module for tracking no-shows in e-Register	Health system providers	Health worker activity planning and scheduling	2.7.2 Scheduling of the health care provider's activities	K Facility management information systems
				Automatic medical triage applications based on comparable cases	Health system providers	Health care provider decision support	2.3.3 Screening of clients by risk or other health status	K Facility management information systems
ACCOUNTABILITY	8.1	Insufficient patient engagement	The high prevalence of communicable and non-communicable diseases and significant malnutrition can be controlled if patients are engaged and there is strong communication between the policy maker and the end-user.	Health promotion messaging	Clients	Untargeted client communication	1.2.1 Transmission of untargeted health information to an undefined population	C Client applications

Appendix table H.2 Examples of Digital Health Applications

SELECT INTERVENTIONS FOR LESOTHO
ACCORDING TO THE WHO CLASSIFICATION OF
DIGITAL HEALTH INTERVENTIONS

EXAMPLES

(EXTRACTED FROM THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS)

TARGETED CLIENT COMMUNICATION

- | | |
|---|--|
| 1.1.3 Transmission of targeted alerts and reminders to client(s) | <ul style="list-style-type: none"> ▪ EngageTB: “Once a client has been confirmed as TB positive, the Lab Technicians will register the client back into the application and enable the client to receive reminders about Directly Observed Therapy (DOT).” ▪ mTIKA: “...sends SMS reminders to families when their children are due for immunization services.” ▪ Moby App: “sends automated SMS reminders to clients, reminding them of upcoming appointments, missed appointments, and approaching delivery dates so women can prepare to deliver in a health facility.” ▪ Wired Mothers: “Women receive appointment reminders and educational messaging and can call their primary care providers to discuss non-acute issues.” |
| 1.1.4 Transmit diagnostic results, or communicate the availability of results, to client(s) | <ul style="list-style-type: none"> ▪ txtAlert: “This version of txtAlert delivers CD4 count results to patients who have been tested for HIV but who may not return to the clinic to collect their CD4 count results” |

UNTARGETED CLIENT COMMUNICATION

- | | |
|--|---|
| 1.2.1 Transmission of untargeted health information to an undefined population | <ul style="list-style-type: none"> ▪ WAHA Maternal Health mHealth Program: “Two SMS campaigns were launched, targeting the inhabitants of the Tambacounda district... The second campaign targets all people, so that they are regularly informed of available medical services within the district.” |
|--|---|

PERSONAL HEALTH TRACKING

- | | |
|--|--|
| 1.4.1 Access by the client to own medical records | <ul style="list-style-type: none"> ▪ Digital Weighing Card: “This project is therefore seeking to provide a digital copy of every child weighing card, such that it can be accessed via mobile phone whenever needed and updated by community health workers at any time.” |
| 1.4.2 Self-monitoring of health or diagnostic data by client | <ul style="list-style-type: none"> ▪ Wearables and fitness trackers: “track every part of your day—including activity, exercise, food, weight, and sleep.” ▪ Medopad Patient Monitoring: “monitor vital signs, log symptoms, share information with your care providers and more.” |

ON-DEMAND INFORMATION SERVICES TO CLIENTS

- | | |
|--|---|
| 1.6.1 Client search for health information | <ul style="list-style-type: none"> ▪ Hesperian Health Wiki: “An online source of clear, actionable, and thorough health information accessible via computer or mobile device.” ▪ EngageTB: “The software enables clients to do TB self-screening and access basic health information related to TB via short messages (SMS) through their phones. Clients send the code “TB” to a network neutral toll-free short code and a list of health facilities that can conduct laboratory tests to confirm TB status.” ▪ m4RH: “A set of text messages on family planning methods that users in can access via their mobile phones.” |
|--|---|

Table continued on page 89

Appendix table H.2 Examples of Digital Health Applications (continued)

**SELECT INTERVENTIONS FOR LESOTHO ACCORDING
TO THE WHO CLASSIFICATION OF DIGITAL HEALTH
INTERVENTIONS**

**EXAMPLES
(EXTRACTED FROM THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS)**

CLIENT HEALTH RECORDS

2.2.1 Longitudinal tracking of clients' health status and services	▪ MomConnect: "Register each pregnancy at a government health facility" ▪ iCMM: "The first component of the iCMM application captures all elements of the village register used by the HSA. The application has built-in functionalities that enable HSAs to register children between the ages of 2 and 59 months only and adhere to standard protocols."
2.2.2 Management of client's clinical records	▪ OpenMedical Record System (OpenMRS): "a software platform and reference application to design a customized medical records system." ▪ Epic Systems: "provide a full picture of health and membership information for your members and a secure web portal for providers to interact with and view managed care information."
2.2.4 Routine health indicator data collection and management	▪ Catholic Relief Services (CRS) Senegal [CommCare] mHealth Pilot: "The app was developed to collect data on childhood illnesses and manage child diarrhea cases; it is accessible via a central database." ▪ SEDA Automated Health Data Exchange System (SEDA): "Data [facility-level indicators] are aggregated in a centralized, web-based system to visualize and manage decision support. Aggregate-level data reported to the mobile system from health facilities are automatically uploaded into DHIS-2 once validated." ▪ DHIS-2: "used as a national health information system for data management and analysis and health program monitoring and evaluation."

HEALTH CARE PROVIDER DECISION SUPPORT

2.3.3 Screening of clients by risk or other health status	▪ OpenSRP: "contains electronic forms with embedded logic and decision support, including checklists and algorithms for risk assessment." ▪ Emergency Triage Assessment and Treatment (ETAT): "Using the app with the ETAT protocol, health workers scan the queues at the health centers, assessing each child for the appropriate level of acuity and identifying children who need immediate assessment." ▪ ePartogram: "syncs data within a facility and automatically prioritizes laboring clients based on clinical algorithms, helping supervisors allocate staffing appropriately." ▪ CommCare Mobile Job Aid for Sahiyas: "It is built on a complex decision- and logic-processing platform that can help these CHWs deliver timely services."
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Table continued on page 90

Appendix table H.2 Examples of Digital Health Applications (continued)

SELECT INTERVENTIONS FOR LESOTHO ACCORDING TO THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS

EXAMPLES
(EXTRACTED FROM THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS)

TELEMEDICINE

2.4.1 Consultations between remote clients and health care providers	▪ VillageReach Chipatala cha pa Foni (CCPF): “A toll-free health hotline that is staffed by trained health workers who provide information, advice, and referrals over the phone.” ▪ Ligne Verte: “By dialing a toll-free number, callers can speak to a trained educator and get accurate information about birth spacing, the correct use of family planning methods, how to avoid unwanted pregnancies, and how to locate the nearest partner clinic.”
2.4.2 Remote monitoring of client health or diagnostic data by health care provider	▪ Body Sensor Networks for Mobile Health Monitoring: “patients’ biosignals are measured with body-worn sensors that communicate wirelessly with a handheld device. Alarms and biosignals can be transmitted over wireless communication links to a remote location, and a remote health professional can view the biosignals via a web application.”
2.4.3 Transmission of medical data to the health care provider	▪ Africa Tele dermatology Project: “The Africa Tele dermatology Project operates in six African countries, using cameras and laptop PCs to capture and send images of patients to specialists in other African countries, Austria, and the United States, providing diagnostic and treatment support to local physicians, dermatologists, and health care workers in hospitals and clinics in underserved regions.”
2.4.4 Consultations for case management between health care providers	▪ Mobile-based Early Detection and Prevention of Oral Cancer (mEPOC): “Information collected on the mobile phones is uploaded to OpenMRS. A specialist in a remote location sends the recommendation through SMS.” ▪ Peek Vision: “A health worker with minimal training can use Peek to gather detailed clinical information. Images are graded and patients diagnosed, either through an automated process or via cascading of digital images to a network of experts around the world.”

REFERRAL COORDINATION

2.6.1 Coordination of emergency response and transport	▪ mHealth for Safer Deliveries: “use text or voice communication to notify a health facility that a woman is in transit to ensure the facility is prepared.”
2.6.2 Management of referrals between points of service within the health sector	▪ Mobile-based Early Detection and Prevention of Oral Cancer (mEPOC): “CHWs can communicate with the specialists through open Medical Record System (OpenMRS) and refer patients for treatment in a timely manner.” ▪ ePartogram: “It also strengthens the referral pathway between peripheral and referral facilities by enabling electronic transmission of data between facilities”

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Appendix table H.2 Examples of Digital Health Applications (continued)

SELECT INTERVENTIONS FOR LESOTHO ACCORDING TO THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS

EXAMPLES (EXTRACTED FROM THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS)

REFERRAL COORDINATION (continued)

2.6.3 Management of referrals between health and other sectors

- **Unnamed project:** Referrals do not only take place within the health sector, but also between the health sector and other non-health services. For example, in cases of gender-based violence, referrals may be provided by social services, police, justice services and health services. In the case of traffic accidents, referrals are needed from police, emergency services, and health services. In cases of malnutrition, referrals may be needed from health and food support services. Where health and poverty and closely inter-related, referrals may be needed to provide economic strengthening, social services, and health services. Digital systems may offer features to support and track these referrals.

HEALTH WORKER ACTIVITY PLANNING AND SCHEDULING

2.7.2 Scheduling of the health care provider's activities

- **mCARE:** "integrated mobile phone and server-based software system for CHWs that helps them digitally manage their daily workflow."
- **CommCare for home-based care:** "provides CHWs a checklist of activities which are expected to be performed during each home visit, as well as reminders of appointments."

HEALTH CARE PROVIDER TRAINING

2.8.1 Provision of training to health care providers

- **Projecting Health:** "Frontline health care workers are equipped with educational videos to conduct video screening and lead group discussions on issues raised in the videos."
- **iDEA: Interactive Distance Education Application:** "Providing health workers with mobile-based video instruction and reference materials"
- **Safe Delivery App:** "The app contains three animated clinical instruction films...can also be used as a reference tool during clinical work"
- **OppiaMobile:** "mobile learning platform for delivering learning content, videos, and quizzes."
Mobile Academy: "an interactive voice response (IVR) training course designed to refresh CHWs' knowledge of simple steps families can take to improve the health of mothers and babies and to improve their ability to clearly communicate them."

2.8.2 Assessing the capacity of health care provider(s)

- **Safe Delivery App:** "The app features push messages with quizzes prompting the health worker to use the application to update their knowledge."

PUBLIC HEALTH EVENT NOTIFICATION

3.3.1 Notification of public health events from point of diagnosis

- **mSOS Ebola (KEMRI Laboratory module):** "Results of laboratory confirmation of the patient serum samples were updated using the mSOS Ebola web portal, and text messages were automatically delivered to senior management and policy makers at the MoH."
GXAlert: "Automatically send SMS texts or email alerts to MoH officials when a new MDR-positive or RIF-positive case is detected."

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Appendix table H.2 Examples of Digital Health Applications (continued)

SELECT INTERVENTIONS FOR LESOTHO ACCORDING TO THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS		EXAMPLES (EXTRACTED FROM THE WHO CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS)
DATA COLLECTION, MANAGEMENT AND USE		
4.1.2Data storage and aggregation		▪ Anesthesiological Data Warehouse Project: “A web interface that will allow users to input and access pre-, peri- and post-operative anesthesiology data.”
4.1.3Data synthesis and visualization		▪ cStock: “District- and central-level managers could monitor supply chain performance using over 10 indicators displayed on a web-based dashboard.” ▪ DHIS-2: “Get the complete overview through the pivot table feature, spot trends in your data with charting, and visualize your geographical data using the GIS function.”
4.1.4Automated analysis of data to generate new information or develop future projections		▪ Simplified, Effective, Labour Monitoring-to-Action (SELMA) tool: “Prediction models will be developed to identify women at risk of intrapartum-related perinatal death or morbidity (primary outcomes) throughout the course of labor.”

