The role of telehealth in strengthening health systems

Background paper

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Executive summary

COVID-19 has put global health inequities and inequalities into stark relief, and made clear the challenges in delivering universal health coverage. However, the pandemic has also catalysed digital transformation around the world. Countries with existing digital foundations responded quickly to COVID-19 – whilst others have prioritised digital transformation to drive response and recovery. This builds on the rapid and longer-term advancement and accessibility of digital technologies

The role of digital has extended to the health sector, where digital tools and technologies are supporting disease monitoring, public health, and preventative and diagnostic efforts. Telehealth – digital solutions that enhance or enable self-management of healthcare, facilitate remote support from healthcare providers, and support any components and activities in the health system in the provision of care – is a crucial component of this digital approach.

In recent years telehealth has emerged as a critical basket of solutions that has transformed health systems in many countries, by enhancing health system efficiencies and resilience. Telehealth has been successful in promoting the availability, affordability, accessibility, quality and efficiency of essential health services - particularly among marginalised and vulnerable populations. It achieves this by providing solutions that address physical, economic or socio-cultural barriers to health. Telehealth has wide relevance –from supporting the chronic management of diseases, to driving public health messaging, and strengthening the health system response to COVID-19.

However, the COVID-19 pandemic has also highlighted the complexity of delivering successful telehealth solutions. There now exist a wide-range of initiatives from the private and public sectors, and civil society. This fragmentation has complicated the efforts of policymakers, programme managers, and development partners that look to leverage the potential that telehealth can enable. In response, this paper provides a global overview – founded on national country experiences - of how telehealth can promote equitable access to essential health services. The paper aims to support the above stakeholders in defining and implementing their strategic approaches to introducing and scaling up telehealth systems in their countries - and ensuring that no one is left behind.

There are a number of priorities that are crucial in scaling telehealth efforts beyond the pilot stage. Strong political will and government leadership, particularly among those working at the intersection of ICT and health, is needed to consolidate the often-fragmented digital health ecosystem and affect any meaningful and systemic improvements in the health system. These efforts must be aligned with an enabling policy, legal, and regulatory environment. Related to this, digital health implementation strategies and processes need to be founded on a clear understanding of the national digital ecosystem – and the needs and priorities of the health system. This includes developing the technical attributes needed for success: from assessing the digital health maturity of the country, through to shaping standards and guidelines for interoperability, ensuring strong foundational digital infrastructure, and developing a workforce able to maximise the benefits offered by telehealth.

Most importantly, telehealth must meet the needs, expectations, aspirations, and realities of patients and citizens – and adhere to ethical and broader standards. Telehealth has enormous potential in improving health system efficiencies and resilience, and shifting the way we access healthcare. The importance of this has been highlighted by the COVID-19 pandemic. However, its success is by no means guaranteed. It is only through taking a holistic, inclusive, and people-centred approach to delivery – building on existing and emerging learning and best practice – that telehealth will be able to play a key role in achieving universal health coverage.

Glossary

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.[1]
Digitalisation	The use of digital technology to adopt fundamental ways of doing business and the business model.[2]
Digitisation	The use of digital technology for the process of converting physical information into digital formats to achieve efficiency gains. [3]
Health data	Individual and population-level information to drive health outcomes.
Health system	A health system comprises all people, resources, organizations, and actions that share the primary goal to promote, maintain, or restore the health of a population.[4]
Interoperability	The ability of different applications to access, exchange, integrate, and cooperatively use data in a coordinated manner through shared application interfaces and standards, within and across organizational, regional, and national boundaries, to provide the timely and seamless portability of information and optimise health outcomes.[5]
Telehealth	Telehealth is the provision and management of healthcare in which individuals (or their caregivers) manage aspects of their care with remote support from healthcare professionals who are not necessarily clinicians.[6] Telehealth includes the use of technologies such as mHealth (or mobile health), video and audio technologies, digital photography, remote patient monitoring (RPM), and store and frontier technologies.[7]
Telemedicine	The distant delivery of healthcare services by any healthcare professional—usually clinicians—using information and communication technologies to exchange valid information for the diagnosis, treatment, and prevention of diseases and injuries, research and evaluation, in the interests of advancing the health of individuals and

[1] World Health Organization, 'Global Strategy on Digital Health 2020-2025' (Geneva: World Health Organization, 2021).
[2] United Nations Development Programme, 'Future Forward: UNDP Digital Strategy' (New York: United Nations Development Programme, 2019).
[3] Ibid.
[4] World Health Organization, 'Everybody's Business—Strengthening Health Systems to Improve Health Outcomes : WHO's Framework for Action' (Geneva: World Health Organization, 2007).
[5] World Health Organization, 'Global Strategy on Digital Health 2020-2025'.
[6] World Health Organization, 'Everybody's Business—Strengthening Health Systems to Improve Health Outcomes : WHO's Framework for Action'.
[7] NEJM Catalyst, 'What Is Telehealth?', NEJM Catalyst (Massachusetts Medical Society, 1 February 2018), https://catalyst.nejm.org/doi/full/10.1056/CAT.18.0268.

their communities.[8] Telemedicine is a subcategory of telehealth and includes, e.g., teleradiology and teledermatology amongst other specialist services.

1. Introduction

Digital technologies in healthcare have transformed the ways populations access healthcare services and how healthcare providers promote and protect people's health and wellbeing.[9] This transformation has been accelerated during the COVID-19 pandemic—with health systems under strain the importance of digitalisation became more relevant and obvious than before. With many governments imposing lockdowns and restricting social interactions, digital technologies allowed health systems to continue providing services to people and reduce interactions that could put patients and healthcare staff at risk of infections.

Digital technologies can contribute to the advancement of universal health coverage (UHC) and, due to the versatility of applications, they can also strengthen health systems.[10] Through the Secretary-General's Roadmap for Digital Cooperation,[11] the United Nations has acknowledged the potential of digital technologies as a contributor to the promotion of wellbeing and health. Furthermore, through the World Health Assembly Resolution WHA/71 A71 on Digital Health, the World Health Organization (WHO) has recognised the value of digital technologies to achieve the Sustainable Development Goals (SDGs) and strengthen health systems by supporting the promotion of health, preventing diseases, and improving access to and affordability of healthcare services.[12]

The use of digital technologies for healthcare—or *telehealth*—helps to connect patients to healthcare services that were often not only physically distant or inaccessible, but also unaffordable. Through telehealth, members of the community can effectively manage aspects of their health with remote support from healthcare professionals using technology, such as information and communication technologies (ICTs).[13] For low- and middle-income countries (LMICs), the increase in connectivity and mobile phones adoption has enabled the use of telehealth for the provision of primary and specialised healthcare services in remote and inaccessible areas. For example, Sub-Saharan Africa (SSA) has one of the largest burdens of disease and health systems that often lack adequate staff, equipment, and access; digital health innovations are booming in the region, aiming to strengthen health systems.[14] Telehealth also allows patients to access knowledge and health information, which empowers them to actively participate in their own care journey.

[8] 'Telemedicine: Opportunities and Developments in Member States. Report on the Second Global Survey on EHealth' (Geneva, Switzerland: World Health Organization, 2010).
[9] World Health Organization, 'Global Strategy on Digital Health 2020-2025'.
[10] World Health Organization, 'WHO Guideline. Recommendations on Digital Intervention for Health Systems Strengthening.' (Geneva: World Health Organization, 2019), http://www.ncbi.nlm.nih.gov/books/NBK541902/.
[11] United Nations, 'Report of the Secretary-General. Roadmap for Digital Cooperation.' (New York: United Nations, 2020).
[12] World Health Organization, 'Digital Health', Seventy-First World Health Assembly (Geneva: World Health Organization, 2018).
[13] Ann Blandford et al., 'Opportunities and Challenges for Telehealth within, and beyond, a Pandemic', *The Lancet Global Health* 8, no. 11 (November 2020): e1364–65, https://doi.org/10.1016/S2214-109X(20)30362-4.
[14] Ibid.

The COVID-19 pandemic strained health systems globally. Already fragile health systems were further weakened, and even the more resource-rich systems in high-income economies faced unprecedented pressures.[15] With societies around the globe entering lockdowns to reduce the spread of this novel virus, the COVID-19 pandemic evidenced the relationship between health systems, the economy, and governance.[16] Telehealth has played a critical role in the response to the COVID-19 pandemic allowing for the provision of some healthcare services to continue, reducing the number of people requiring face-to-face services and providing tools for healthcare workers to continue monitoring patients remotely.[17] In some regions of the world, the adoption of telehealth was accelerated as a growing range of digital health solutions are rapidly mainstreamed.[18] The relevance of telehealth in strengthening health system efficiency, quality and resilience, and the opportunity that it offers in improving health outcomes, are expected to grow in a post-pandemic environment.

In its 'Prepare, Respond and Recover' framework for supporting countries in responding to the COVID-19 pandemic, UNDP recognises the importance of supporting governments to provide critical healthcare services remotely, a need which can be effectively met by telehealth. However, significant challenges exist in the implementation, adoption, and scaling of telehealth solutions; and there is a limited understanding of their impact on health systems and people's health and wellbeing.[19] For instance, although telehealth has the potential to facilitate access to healthcare for many people in South Asia, the entire sector is fragmented and has failed to create systemic improvements in health service access.[20] Similarly, the implementation of telehealth in some African countries has been hindered by the poor coordination of pilot projects, lacking general awareness of digital health, poor infrastructure (including poor connectivity and unreliable power supply), and lack of interoperability of the numerous digital health systems.[21] It is only recently that governments have started to recognise the importance of policies and regulations to ensure effective implementation and uptake of digital health solutions at a national scale.[22]

The reliance on digital technologies for the provision of healthcare, however, may create greater health disparities as many people lack access to digital technology and internet connectivity, and do not have digital skills to benefit from technologies.[23] The pandemic has made the challenges of the digital divide more evident as many marginalised groups are now further excluded through the

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[15] GSMA, 'Digital Health: A Health System Strengthening Tool for Developing Countries' (London: GSMA, 2020).
[16] Victoria Haldane et al., 'Health Systems Resilience in Managing the COVID-19 Pandemic: Lessons from 28 Countries', *Nature Medicine* 27, no. 6 (June 2021): 964–80, https://doi.org/10.1038/s41591-021-01381-y.
[17] Elham Monaghesh and Alireza Hajizadeh, 'The Role of Telehealth during COVID-19 Outbreak: A Systematic Review Based on Current Evidence', *BMC Public Health* 20, no. 1 (1 August 2020): 1193, https://doi.org/10.1186/s12889-020-09301-4.
[18] Sam Kim and Vrishti Beniwal, 'Pandemic Bolsters Case for Telemedicine Across Asia-Pacific', Bloomberg, accessed 28 July 2021, https://webcache.googleusercontent.com/search?q=cache:RMZgAu7eVwcJ:https://www.bloomberg.com/news/articles/2020-07-23/pandemic-bolsters-case-for-telemedicine-across-asia-pacific+&cd=30&hl=en&ct=clnk&gl=uk.
[19] Alain B. Labrique et al., 'Best Practices in Scaling Digital Health in Low and Middle Income Countries', *Globalization and Health* 14, no. 1 (3 November 2018): 103, https://doi.org/10.1186/s12992-018-0424-z.
[20] Edward Booty and Logan Ansel, 'How Digital Can Transform Healthcare in Asia for Millions of People', World Economic Forum, accessed 28 July 2021, https://www.weforum.org/agenda/2019/10/digital-healthcare-healthtech-asia/.
[21] Olushayo Olu et al., 'How Can Digital Health Technologies Contribute to Sustainable Attainment of Universal Health Coverage in Africa? A Perspective', *Frontiers in Public Health* 7 (15 November 2019): 341, https://doi.org/10.3389/fpubh.2019.00341.
[22] Nachiket Gudi et al., 'Telemedicine Supported Strengthening of Primary Care in WHO South East Asia Region: Lessons from the COVID-19 Pandemic Experiences', *BMJ Innovations* 7, no. 3 (July 2021): 580–85, https://doi.org/10.1136/bmjinnov-2021-000699.
[23] Cynthia J. Sieck et al., 'Digital Inclusion as a Social Determinant of Health', *Npj Digital Medicine* 4, no. 1 (December 2021): 52, https://doi.org/10.1038/s41746-021-00413-8.

digitisation of services, including for health. For this reason, digital literacy and internet connectivity should be considered 'social determinants of health'.

Defining telehealth

Telehealth is the provision and management of healthcare in which individuals (or their caregivers) manage aspects of their care with remote support from healthcare professionals who are not necessarily clinicians.[24] Unlike telemedicine, telehealth goes beyond clinical practice and covers the use of ICT to support all components and activities in the health system for the provision of care. [25] Telehealth implementation include the use mHealth (or mobile health), video and audio technologies, digital photography, remote patient monitoring (RPM), and store and frontier technologies.[26]

Telehealth examples range from mobile phones being used to support maternal health interventions, detect falsified medicines and drugs, or access financing mechanisms for health spending. Other applications include the use of social media for health promotion, the use of drones for transportation and delivery of supplies (blood or medical supplies), the development of internet-of-things (IoT) systems for health, such as sensors and wearables for diagnostics or health tracking.[27]

Figure 1. Common mHealth and ICT applications[28]

The versatility of digital technologies enables multiple applications of technology to support functions within the health system. Labrique et al.[29] identified and categorised several mHealth and ICT applications in healthcare around twelve categories, as shown in Figure 1. A full description can

[24] Blandford et al., 'Opportunities and Challenges for Telehealth within, and beyond, a Pandemic'.
[25] NEJM Catalyst, 'What Is Telehealth?'
[26] Ibid.
[27] Christine Holst et al., 'Sub-Saharan Africa—the New Breeding Ground for Global Digital Health', *The Lancet Digital Health* 2, no. 4 (April 2020): e160–62, https://doi.org/10.1016/S2589-7500(20)30027-3.
[28] Alain B. Labrique et al., 'MHealth Innovations as Health System Strengthening Tools: 12 Common Applications and a Visual Framework', *Global Health, Science and Practice* 1, no. 2 (August 2013): 160–71, https://doi.org/10.9745/GHSP-D-13-00031.
[29] Ibid.

be found in Annex 1. These various digital health applications do not work in isolation, but they usually operate at the intersection of different components of a health system, as discussed in the next section. The telehealth field has been slow to mature; however, new technologies and the increasing internet connectivity and penetration of smartphones in LMICs offer great opportunities to strengthen resilience of health systems through the innovative use of telehealth.

Objectives of the review and methodology

This background paper provides an overview of how telehealth promotes equitable access to essential health services and elucidates key policy, programmatic and strategic drivers for the successful implementation of telehealth programmes in LMICs. The background paper aims to inform policymakers, programme managers and development partners on their strategic approaches to introducing and scaling up telehealth systems in their countries.

Relevant grey and scientific literature on telehealth or digital health implementations in LMICs, including the role of digital health in health systems strengthening, were identified and reviewed, as were key technical reports and strategy documents from intergovernmental and development agencies (including the WHO, UNDP, and the World Economic Forum). Various case studies are presented in this paper to exemplify how telehealth is driving and improving access to healthcare services in LMICs, most of which were selected from the Digital Health Atlas by the WHO,[30] the Global Goods Guidebook from Digital Square,[31] and experience of UNDP.

2. Telehealth addresses the challenges facing health systems in LMICs

People around the globe have increasing access to ICTs, driven largely by the widespread adoption of mobile phones and mobile connectivity globally. Almost half of the global population are connected to the mobile internet, and around three-quarters of mobile internet users live in LMICs. This rapidly increasing access to ICTs has expanded opportunities for the digitalisation of services and addressing some of the world's most pressing challenges to sustainable and equitable development.[32]

For healthcare digital technologies are disrupting the delivery of care and changing how health and healthcare are perceived. [33] The over reliance on ‘top-down’ models and facility-based services has rendered many health systems struggling to cope with evolving disease burdens and in meeting the needs of their populations, who are increasingly demanding better quality, accessible and affordable healthcare, as well as better, quicker and more reliable access to information.[34]

[30] WHO (n.d.). Digital Health Atlas. Available online at: https://www.digitalhealthatlas.org/en/-/edit-profile
[31] PATH, ‘Digital Square Global Goods Guidebook’ (Seattle: PATH, 2021).
[32] United Nations Development Programme, ‘Future Forward: UNDP Digital Strategy’.
[33] Marc Mitchell and Lena Kan, ‘Digital Technology and the Future of Health Systems’, *Health Systems & Reform* 5, no. 2 (3 April 2019): 113–20, https://doi.org/10.1080/23288604.2019.1583040.
[34] Ibid.

The enormous potential of telehealth in enhancing health system capacity in delivering essential services has been highlighted during the COVID-19 pandemic. By digitalising health services and functions, telehealth contributed to a reduction in COVID-19 transmissions by reducing the need for face-to-face interactions between patient and health provider, by enabling the tracking of symptoms and community outbreaks, and by generating data to support policymakers and programme managers in decision-making.[35]

While the sector is fragmented, examples of telehealth globally show how digital technologies are supporting health systems to offer, improve and expand the provision of essential care. This section describes the potential role of telehealth in supporting health systems to address some of the challenges to achieve equitable access for all. Each section presents different examples of successful telehealth in LMICs. A full description of these case studies and other additional examples can be found in Annex 2.

The potential of telehealth in supporting health systems

The attainment of a high-quality health intervention will be determined by the efficacy and efficiency of the delivery of said intervention. Many interventions are beset with inefficiencies, such as low demand for services, poor patient adherence to treatment, insufficient supplies or health staff, or geographical inaccessibility of services. By offering new possibilities to how high-quality care and health information can be accessed by everyone from everywhere, telehealth creates novel opportunities to resolve these challenges (see Figure 2). Adequate and well-designed digital interventions can help mitigate the system's inefficiencies and support the delivery of quality of care.

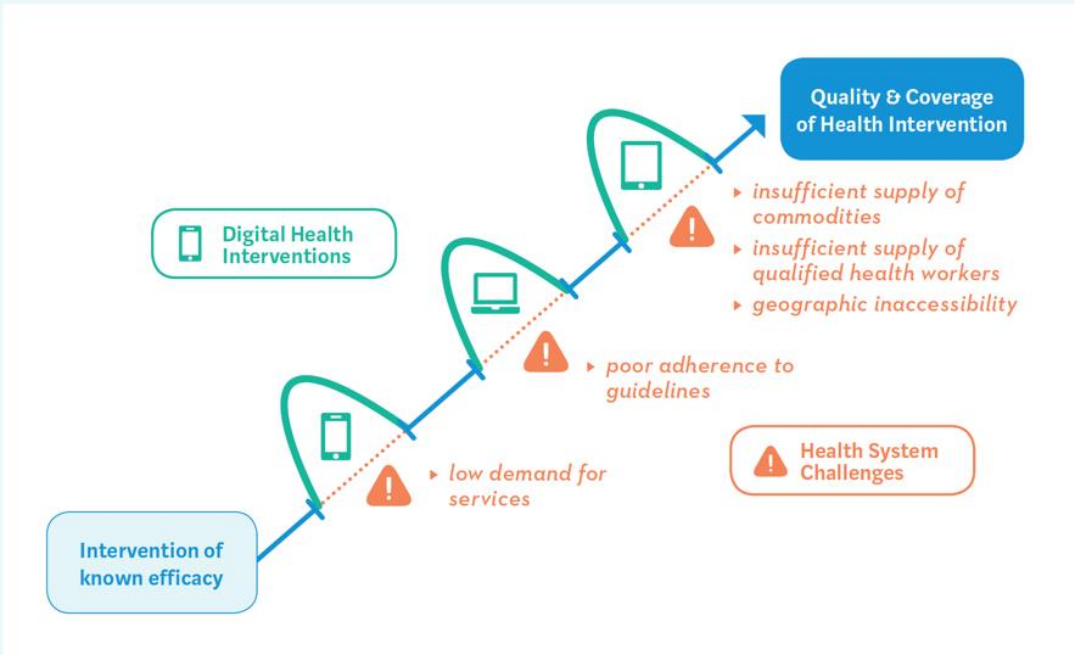

Figure 2. Digital health interventions can help overcome health system challenges[36]

[35] Blandford et al., 'Opportunities and Challenges for Telehealth within, and beyond, a Pandemic'.
[36] World Health Organization, 'WHO Guideline. Recommendations on Digital Intervention for Health Systems Strengthening.'

Digital technologies should not be considered as replacements for any of the elements of functioning health systems. In fact, telehealth and any other digital solution should be seen as complementary and an enhancer of health systems functions. Hence, recognising the value of telehealth requires an understanding of the challenges experienced by health systems to achieve equitable access to care for all.

Health systems include "all the people, resources, organizations, and actions that have as a primary goal to promote, maintain or restore the health of a population."[37] Universal Health Coverage (UHC) requires efficient, resilient, and high-quality health system that can deliver the needed services and that can respond to the changing needs of the population.[38] While every country has different ways of organising healthcare, the WHO defines the components or 'building blocks' of health systems as shown in Figure 3.[39]

Strengthening health systems and improving health outcomes require actions that go beyond simply increasing inputs into the system.[40] Most LMICs experience significant challenges in delivering good quality essential healthcare services, many of which can be addressed through telehealth. Telehealth can improve the availability, affordability, and accessibility of healthcare services; ensure quality and safe care; and improve the efficiency and responsiveness of healthcare services. By understanding these challenges better, digital solutions can be designed to address them more effectively, as illustrated below.

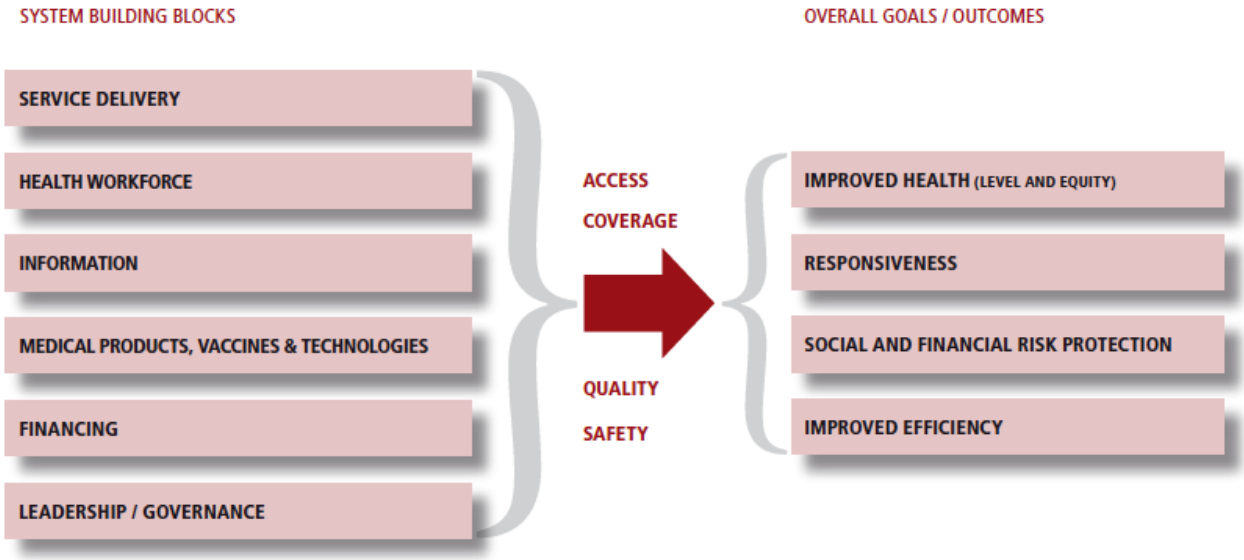

Figure 3. The building blocks of a health system according to the World Health Organization[41]

[37] World Health Organization, 'Everybody's Business—Strengthening Health Systems to Improve Health Outcomes : WHO's Framework for Action'.
[38] Margaret E. Kruk et al., 'High-Quality Health Systems in the Sustainable Development Goals Era: Time for a Revolution', *The Lancet Global Health* 6, no. 11 (1 November 2018): e1196–1252, https://doi.org/10.1016/S2214-109X(18)30386-3.
[39] World Health Organization, 'Everybody's Business—Strengthening Health Systems to Improve Health Outcomes : WHO's Framework for Action'.
[40] Grace Chee et al., 'Why Differentiating between Health System Support and Health System Strengthening Is Needed', *The International Journal of Health Planning and Management* 28, no. 1 (2013): 85–94, https://doi.org/10.1002/hpm.2122.
[41] World Health Organization, 'Everybody's Business—Strengthening Health Systems to Improve Health Outcomes : WHO's Framework for Action'.

Challenge 1: Healthcare services are unavailable, unaffordable or inaccessible for many people in LMICs.

Barriers to accessing essential health services in LMICs have led to poorer health outcomes and elevated levels of mortality and morbidity. Compared to high-income countries, LMICs tend to have lower density of health workers and hospital beds per population which limits access to services for many people, particularly those most vulnerable.[42] The limited hours of service, lack of trained health staff or absentee staff, and the lack of medicines and equipment contribute to the low availability of health services in LMICs.

In addition, out-of-pocket (OOP) payments for healthcare services can lead many people to catastrophic spending and poverty. [43] The cost of care is often unaffordable for households that are already vulnerable and living in poverty. In 2010, over 800 million people in the world incurred catastrophic health spending, which is 10-25% of household consumption.[44] As the burden of disease changes in LMICs, chronic conditions also require specialised, long-term interventions, exacerbating the risks of increasing household spending on health services.

Geographical access is a particular challenge for health systems in LMICs, making the delivery of healthcare interventions (i.e., services or health programmes) costly and demanding high operational resources to expand service coverage, particularly to ensure that an acceptable level of quality can be sustained in remote areas that lack access.[45] Other barriers to increasing health coverage include inadequate physical infrastructure, such as weak transportation systems, as well as conflict and insecurity, amongst other factors.[46] These are particularly difficult challenges for health systems in LMICs that are already under pressure and under-resourced.

Telehealth can help improve access and coverage to healthcare services

Telehealth has the potential to provide tools that enable remote healthcare delivery, particularly access to telemedicine solutions that can support the diagnosis, treatment, and management of diseases, including primary care and non-communicable diseases as well conditions requiring long-term interventions, such as mental health. By increasing the availability of services through digital technologies, as well as increasing the coverage of services overall, digital technologies can support the efforts to achieve UHC.

[42] David H. Peters et al., 'Poverty and Access to Health Care in Developing Countries', *Annals of the New York Academy of Sciences* 1136, no. 1 (25 July 2008): 161–71, https://doi.org/10.1196/annals.1425.011.
[43] World Health Organization and World Bank, 'Tracking Universal Health Coverage: First Global Monitoring Report.' (Geneva: World Health Organization, 2015).
[44] Adam Wagstaff et al., 'Progress on Catastrophic Health Spending in 133 Countries: A Retrospective Observational Study', *The Lancet. Global Health* 6, no. 2 (February 2018): e169–79, https://doi.org/10.1016/S2214-109X(17)30429-1.
[45] Olu et al., 'How Can Digital Health Technologies Contribute to Sustainable Attainment of Universal Health Coverage in Africa?'
[46] Ibid.

The lack of resources and flexibility to adapt to changes in global patterns of disease are significant barriers facing primary care services. There are many examples of how telehealth can help alleviate pressures overloading primary health systems, particularly when it comes to maternal and new-born care.[47] For instance, in Malawi, the *Digital Village Clinic* initiative uses a mobile-based solution to integrate health service packages for the provision of maternal and newborn care in rural villages (see *Box A2.4* in Annex 2).

During the COVID-19 pandemic, digital healthcare services also became a fundamental part of the global response. As the number of infections increased, healthcare facilities were put under pressure and their capacity limits were tested. Telehealth allowed healthcare providers to continue delivering services, while reaching out patients who were not previously connected, reducing the number of people requiring face-to-face services and providing tools for healthcare workers to continue monitoring patients remotely.[48] In LMICs, many telehealth solutions were streamlined and rapidly scaled up to ensure that many people could have access to health care services digitally. As an example, Safiri Smart in Kenya, a platform developed by Korea Telecom under their Global Epidemic Prevention Project, helped with disease surveillance and identification of community outbreaks (see *Box A2.1* and *Box A2.2* in Annex 2).

Telehealth can also improve the coverage of services for conditions requiring specialised diagnosis and long-term treatment, such as chronic conditions. Most of these diseases are preventable with early diagnosis, adequate treatment, and behaviour and lifestyle changes. With the burden of disease changes in LMICs and 80% of deaths attributable to chronic diseases occur in LMICs,[49] many people lack access to care due to poor infrastructure, socio-political disruptions, poverty rates, and limited access to physical healthcare facilities. Evidence suggests that telehealth can improve chronic disease outcomes in LMICs by reducing socio-economic barriers related to cost and access, improving service uptake and patient adherence to treatment, and facilitating the delivery of interventions for long-term management of conditions[50] An interesting successful example is given by the integration of Digital LifeCare as a part of India's IT system for population-based screening of non-communicable diseases (see *Box A2.5* in Annex 2).

Telehealth can close the gap in access to services that are underfunded or that have not been prioritised by health systems in LMICs. An example of this is access to mental health services in LMICs. While mental health is a leading contributor to the total burden of disease that disproportionately affects people in LMICs, 73-93% of people with depression and over 85% of those with anxiety do not have access to treatment.[51] Digital psychosocial interventions in LMICs have a strong positive effect on treatment outcomes, particularly for patients with depression, and these interventions can help to expand the reach of mental health services provided by local health systems.[52] However, evaluating digital solutions for mental health services in LMICs is challenging,

[47] Labrique et al., 'Best Practices in Scaling Digital Health in Low and Middle Income Countries'.
[48] Monaghesh and Hajizadeh, 'The Role of Telehealth during COVID-19 Outbreak'.
[49] Saleem Sayani et al., 'Addressing Cost and Time Barriers in Chronic Disease Management through Telemedicine: An Exploratory Research in Select Low- and Middle-Income Countries', *Therapeutic Advances in Chronic Disease* 10 (1 January 2019): 2040622319891587, https://doi.org/10.1177/2040622319891587.
[50] Andrea Beratarrechea et al., 'The Impact of Mobile Health Interventions on Chronic Disease Outcomes in Developing Countries: A Systematic Review', *Telemedicine and E-Health* 20, no. 1 (1 January 2014): 75–82, https://doi.org/10.1089/tmj.2012.0328.
[51] Zhongfang Fu et al., 'Effectiveness of Digital Psychological Interventions for Mental Health Problems in Low-Income and Middle-Income Countries: A Systematic Review and Meta-Analysis', *The Lancet Psychiatry* 7, no. 10 (October 2020): 851–64, https://doi.org/10.1016/S2215-0366(20)30256-X.
[52] Ibid.

as most of projects are feasibility studies of emerging or new technologies.[53] MindIT in Ghana provides an example of a mobile-based solution for screening of mental health conditions (see *Box A2.6* Annex 2).

Challenge 2: Safe and quality of care is inaccessible for many people in LMICs

Beyond ensuring access and increasing coverage of services, ensuring the quality of care is also critical for addressing challenges faced by many LMICs experiencing high disease burden and for reaching UHC. Inadequate quality of care, rather than insufficient access, is the largest barrier to reducing preventable deaths in LMICs.[54] Furthermore, poor quality of care impacts the safety of care, which can result in other adverse health outcomes, such as the loss of function, pain or unnecessary health-related suffering, and decreased trust and/or increased scepticism in the health system.[55]

Improving quality and safe care through telehealth

Apart from improving the quality of care for patients, telehealth is shown to have a positive effect on patient safety and health outcomes.[56] Subbaraman et al.[57] found that digital adherence technologies (DAT), such as smartphone applications, virtually-observed therapy (VOT), digital pillboxes and ingestible sensors have the potential to facilitate patient-centric approaches for monitoring and driving greater adherence to TB treatment. Annex 2 presents some successful examples in India and Moldova (*Box A2.7* and *Box A2.8*).

Telehealth also offers the opportunity to monitor, track and evaluate other types of events, such as adverse drug reactions or adverse events following immunization. Many LMICs have established national pharmacovigilance systems, to collect evidence of drug-related harm and preventability of consequent hospitalisation and death. Digital technologies, including telehealth, has been shown to enhance the efficiencies of pharmacovigilance systems by facilitating easier and timely reporting and monitoring of adverse events (see *Box A2.9* in Annex 2).

Challenge 3: Health systems face inefficiencies, are often poorly coordinated, and data required for decision making is lacking

[53] John A Naslund et al., 'Digital Technology for Treating and Preventing Mental Disorders in Low-Income and Middle-Income Countries: A Narrative Review of the Literature', *The Lancet Psychiatry* 4, no. 6 (June 2017): 486–500, https://doi.org/10.1016/S2215-0366(17)30096-2.
[54] Margaret E. Kruk et al., 'Mortality Due to Low-Quality Health Systems in the Universal Health Coverage Era: A Systematic Analysis of Amenable Deaths in 137 Countries', *The Lancet* 392, no. 10160 (17 November 2018): 2203–12, https://doi.org/10.1016/S0140-6736(18)31668-4.
[55] Kruk et al., 'High-Quality Health Systems in the Sustainable Development Goals Era'.
[56] Blandford et al., 'Opportunities and Challenges for Telehealth within, and beyond, a Pandemic'.
[57] Ramnath Subbaraman et al., 'Digital Adherence Technologies for the Management of Tuberculosis Therapy: Mapping the Landscape and Research Priorities', *BMJ Global Health* 3, no. 5 (1 October 2018): e001018, https://doi.org/10.1136/bmjgh-2018-001018.

Health systems aim to improve health outcomes and health equity, through making efficient use of available resources, being responsive and financially fair.[58] Strong leadership and governance are necessary to provide oversight and coordination of the entire health system, while ensuring the protection of the public interest. Effective stewardship of the health system cannot exist without information, data and research that are reliable and timely to support decision-makers at different levels of the system. [59]

Reliable data to measure, evaluate, and track health system performance and progress towards UHC is scarce.[60] Furthermore, data is lacking and difficult to collect, particularly because only a few treatment indicators have reliable denominators and sick patients often do not seek treatment due to their inability to afford them. Consequently, the lack of data limits opportunities to evaluate and improve the system and make decision-making more accountable and transparent.

Building efficient and responsive health system through telehealth

Health system resilience depends on the capacity of the system to responsiveness and adaptability of the system. While digital technologies can help improve the efficiency of the system, they can also strengthen parts of the system that are critical for its resilience. In many LMICs, examples of emerged of existing telehealth solutions that adapted to the changes in demand and support needed by health systems, and new innovative solutions also emerged. [see *Box A2.10* in Annex 2)

The COVID-19 pandemic highlighted the importance of a resilient health system. Primary healthcare providers had to quickly adapt, adopt and scale up telehealth services to provide ongoing services, while also identifying cases and referring people with COVID-19 symptoms.[61] Sehat Kahani in Pakistan is an example on how this was done successfully, by integrating existing digital health solutions into the systematic changes required for the provision of care (see *Box A2.3* in Annex 2).

Telehealth and other digital technologies enabled health care systems to deploy new resources and to build community-based approaches using resources and knowledge in the local context, critical to build resilience of the health system during the pandemic response and reach out vulnerable groups disproportionately affected by COVID-19. [62]

Generating data for improved decision-making and systems' efficiency

Policy- and decision-makers rely on timely and accurate data to make informed decisions about the health system. A critical advantage offered by digitisation is the ability to generate data in real-time, which can be evaluated and analysed to provide information for more effective and efficient decision-making. For instance, capturing and sharing data through telehealth helped surveillance of the spread of infections during the COVID-19 pandemic, providing information to support governments to respond to the crisis.[63]

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[58] World Health Organization, 'Everybody's Business—Strengthening Health Systems to Improve Health Outcomes : WHO's Framework for Action'.
[59] Ibid.
[60] World Health Organization and World Bank, 'Tracking Universal Health Coverage'.
[61] Haldane et al., 'Health Systems Resilience in Managing the COVID-19 Pandemic'.
[62] Ibid.
[63] Blandford et al., 'Opportunities and Challenges for Telehealth within, and beyond, a Pandemic'.

Additionally, digital data also allows the deployment of other frontier technologies for data analytics, such as artificial intelligence (AI) or machine learning, which could improve health system performance, while reducing costs. AI applications can, for instance, help health programmes reach, screen or monitor patients who are hard-to-reach; or, can help predict pathologies or vulnerabilities in the population (e.g., impact of climate change on health). For instance, MinoHealth in Ghana uses AI to automate diagnosis and prognosis of conditions such as TB, pneumonia and cancer (see *Box A2.11* in Annex 2). AI chatbots and virtual avatars can improve access to important health information and advice in multiple languages, particularly for community groups which are marginalized or stigmatised (e.g., people living with HIV, transgender people, people with disabilities). [64]

[64] Hassane Alami et al., 'Artificial Intelligence in Health Care: Laying the Foundation for Responsible, Sustainable, and Inclusive Innovation in Low- and Middle-Income Countries', *Globalization and Health* 16, no. 1 (December 2020): 52, https://doi.org/10.1186/s12992-020-00584-1.

3. The key drivers of successful telehealth in LMICs

The past decade has seen a proliferation of telehealth projects, many of which have provided conceptual evidence on how telehealth can improve health coverage and outcomes, by improving the effectiveness and efficiency of health systems. The examples in the previous section illustrate the impact of telehealth on improving health service access and coverage, quality and safety of care, and health systems responsiveness and resilience. It is important to understand the key policy and programmatic drivers for successful implementation and scale up of digital technologies for health.

An enabling ecosystem is critical. The right policies are needed to ensure good coordination, resource management and accountability. Strong political will and leadership are needed for the effective implementation of a national digital health strategy, and the enforcement of regulatory frameworks for data privacy and standards for interoperability. Moreover, during the development and rollout of telehealth, key programmatic considerations include ensuring that the digital solutions are appropriate for addressing the identified healthcare challenge; that these solutions are people-centred, and that the end-users have the necessary skills and knowledge to benefit from telehealth (i.e., digital skills and literacy, digital inclusions).

The enabling ecosystem for digital health and policy considerations

The enabling ecosystem for successful implementation of digital health is defined as "attitudes, policies and practices that support the effective and efficient functioning of organisations and [digital health] programmes".[65] It provides a foundation upon which digital health, including telehealth, can successfully operate. The key elements of this ecosystem are (see Figure 4):[66]

- The **leadership and governance** to coordinate digital health activities and provide accountability ;
- **Strategies and investments** that align stakeholders, identify priorities and mobilize resources for digital health;
- The development and review of national **policies and legislation** on digital health;
- A **physical and digital infrastructure** enabling the operation and functioning of digital health systems;
- Common **services and applications** used by users to collect health-related data;
- Developing and introducing **standards and guidelines** to enable interoperability and integration between different digital health solutions;
- **Educating and training the workforce** to adopt digital health.

[65] World Health Organization, 'WHO Guideline. Recommendations on Digital Intervention for Health Systems Strengthening.'
[66] Hima Batavia and Patricia Mechael, 'Assessing the Enabling Environment for Establishing a Contextualized National Digital Health Strategy' (United Nations Foundation, 2019).

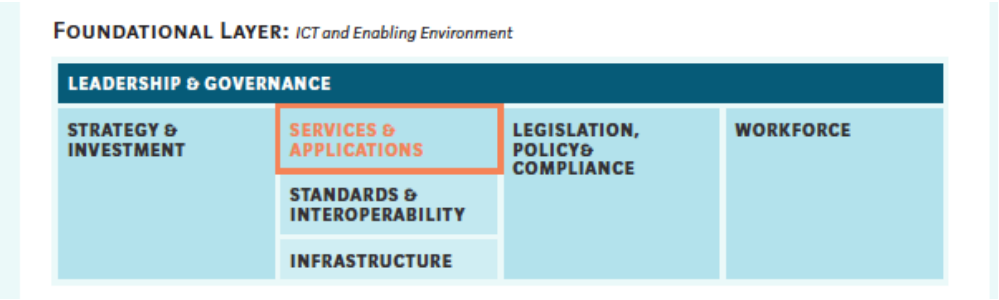

Figure 4. Foundational layer to successful digital health implementations[67]

Working in unison, the coordination of these components can drive the success of digital health implementation.[68] The absence of a robust enabling ecosystem risks the implementation of multiple systems that are unconnected, ineffective and unsustainable. Many LMICs lack adequate policies, regulations and programmes to fully benefit from digital health.

Understanding and assessing the ecosystem within a specific national context, as well as reviewing the needs and priorities of the health system, are important before implementing a digital health solution. While different tools exist for assessing the digital maturity of countries, the Global Digital Health Index provides an overview of the state of the preparedness and general degree of adoption of digital health in 22 countries[69] in different regions of the world, with varying demographic characteristics and economic development. [70]

Most countries have an average degree of digital health maturity (a score of 3 out of 5). On average, countries show a high maturity (4) for leadership and governance because of having digital health implemented as part of a national strategy (e.g., national health plan) or due to having a fully functional digital health structure led by the government that monitors the national progress on the digital health plan.[71]

However, most countries are challenged by a lack of financial investments in digital health, regulations for data security that are not enforced, missing certifications and regulations of digital health applications, lacking training for health professional on digital health, an underdeveloped national digital health architectural framework or protocols for exchanging health information, and a lack of digital health platforms to address national health priorities.[72]

Extrapolating from best practice examples that have been published, the rest of this paper will highlight the policy, programmatic and strategic drivers that are important for the successful implementation of digital health. While this section considers digital health broadly, the issues presented below are very much applicable to telehealth. While examples are only briefly presented in this section, Annex 3 provides a more comprehensive portrait of each of these cases.

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[67] World Health Organization, 'WHO Guideline. Recommendations on Digital Intervention for Health Systems Strengthening.'
[68] Ibid.
[69] Afghanistan, Bangladesh, Benin, Chile, Ethiopia, Indonesia, Jordan, Kuwait, Lao People's Democratic Republic, Malaysia, Mali, Mongolia, New Zealand, Nigeria, Pakistan, Peru, Philippines, Portugal, Sierra Leone, Sri Lanka, Thailand, and Uganda.
[70] Patricia Mechael and Joanne Ke Edelman, 'The State of Digital Health 2019' (Global Development Incubator, 2019).
[71] Ibid.
[72] Ibid.

Digital health leadership and governance

The success of digital health in LMICs will depend on enabling ecosystems that are aligned to the local context and needs and, as importantly, must be driven by national governments, with support from international organisations.[73] The importance of government, particularly decision-makers and government leaders working at the intersection of ICT and health, has been highlighted by the Broadband Commission for Sustainable Development as fundamental to efforts in consolidating the often-fragmented ecosystem of digital health.[74]

Governments can foster enabling environments by coordinating stakeholders and investments, promoting the harmonization of standards and strengthening regulatory and legal frameworks. Many countries have introduced national digital health strategies. The experience of Nigeria provides an interesting example on how clear governance, cooperation, and leadership from government ministers can successfully drive the development of a national digital health strategy (see *Box A3.1* in Annex 3).

For countries seeking to implement digital health strategies, there are three typical governance approaches: a) leadership by the Ministry of Health, who drives and mobilises the technical capacities, skills and resources from other ministries, agencies and governments; b) driven by the Ministry of Health, jointly with a government-wide agency that provides the ICT capabilities and infrastructure; and c) leadership by the Ministry of Health, but a third party agency drives the strategy and implement the solution with their own resources.

Current best practices help to draw key lessons for the development of national digital health strategies: [75]

- The institutionalisation of digital health in the national health system requires a strong leadership and commitment from governments;
- Committed financing mechanism for digital health is an important driver of success;
- Successful digital health initiatives require an integrated strategy (ICT and Health sectors working together) and governments should promote the appropriate use of digital technologies for health;
- Recognise the urgent need to address the major impediments faced by least developed countries to implement digital health;
- Efficient decision-making during the design and implementation of the strategy requires a clear government mechanism with defined roles and responsibilities in the process;
- Connectivity and interoperability are critical for functioning digital health platforms and can be driven by a national ICT framework that helps to align the health and ICT sectors by establishing common practices and policies as well as appropriate standards and regulations for digital health.

With the adoption of the digital health resolution of the WHO (WHA71.7) in 2018, the WHO has recently published their Global Digital Health Strategy 2020-2025 which aims to support and

[73] Holst et al., 'Sub-Saharan Africa—the New Breeding Ground for Global Digital Health'.
[74] Broadband Commission for Sustainable Development, 'Digital Health: A Call for Government Leadership and Cooperation between ICT and Health' (ITU & UNESCO, 2017).
[75] Ibid.

respond to the increasing needs from countries to develop adequate strategy for the implementation of digital health and achieve their national health priorities. [92] The strategy proposes objectives and a framework for action for Member States and the Secretariat to ensure digital health progress globally.

Policies and legislation considerations to scale up digital health in LMICs

The role of government is also important in driving policy and regulatory frameworks in four areas:[76] i) data protection and privacy, ii) medical device regulation, iii) reimbursement policies, and iv) interoperability. Specific to data privacy and protection, policies and regulation are critical for protecting privacy and health data confidentiality and promoting the secure exchange of data and information. [77]

With the considerable number of telehealth solutions currently implemented in LMICs, it is important to have good processes and policies for data generation and management—or data governance— to define data flows in the existing data systems (structure of inputs, user interfaces, and information flows); and how systems are coordinated and data is protected.[78] Data governance is also a mechanism that can ensure that underrepresented and underserved groups are also included in the health system. The Government of Tanzania's Data Use Partnership (DUP) is a good example of strong data governance and how data policies are supporting the health information needs of the health system while, at the same time, protecting individual privacy (see fuller description in *Box A3.3* in Annex 3).

Digital health implementations should recognise individuals as agents over their own data—for data collected from technologies and data exchanged between technologies—and full informed consent should be requested prior to collection, which should include safeguards on data integrity and security.[79] The lack of regulations and policies to protect data can deter further investments and limit the scale up of digital health innovation. Privacy and security concern can also be a source of mistrust from users and health care staff and impact the adoption and use of digital health.

Data sharing and analytics are fundamental for quality improvement, manage operations, evaluating outcomes of care, and the monitoring continuity of care for patients. [80] Data can also help create knowledge and research effectiveness of interventions. Digital health, however, does not need new approaches to data protection and privacy, but existing regulatory frameworks must not create barriers and should provide legal clarity for digital health use cases. As recommended by the Broadband Commission for Sustainable Development,[81] data privacy and protection should be technology-neutral and applicable to all players in the ecosystem and the value chain. Additionally, as more countries pass legislation on user data privacy and protection, data policies should facilitate

[76] World Health Organization, 'Global Strategy on Digital Health 2020-2025'.
[77] Broadband Commission for Sustainable Development, 'Digital Health: A Call for Government Leadership and Cooperation between ICT and Health'.
[78] Ashley Bennett and Hallie Goertz, 'Governing Data for Better Health', PATH, accessed 30 July 2021, https://www.path.org/articles/governing-data-better-health/.
[79] United Nations Development Programme, 'Guidance on the Rights-Based and Ethical Use of Digital Technologies in HIV and Health Programmes' (New York: United Nations Development Programme, 2021).
[80] World Health Organization, 'Global Strategy on Digital Health 2020-2025'.
[81] Broadband Commission for Sustainable Development, 'Digital Health: A Call for Government Leadership and Cooperation between ICT and Health'.

data sharing across borders. Governments can support industry best practices and frameworks on data sharing, and work to make these frameworks interoperable. [82]

Programmatic and strategic considerations for successful telehealth

Successful deployment and adoption of any innovative health intervention, including digital health, requires changes in behaviours and practices of both service providers and community members. Hence, solutions that are driven by the needs of health system and the population that it serves, and which are designed with the local context in mind, are more likely to be successful adopted than those which are driven by the technology. People designing and implementing digital health must be aware of these considerations that may affect the adoption and deployment of the technology, leading to failure.

Digital infrastructure and information systems

Strong digital infrastructure and information systems are important elements of an enabling environment for digital health. Weak digital health infrastructure could lead to an increase in risk of data breaches, exposing individuals' privacy and, potentially, increasing the vulnerability of some already vulnerable groups, and potential exacerbating inequalities and discrimination.[83] The basic components required for effective digital health implementation, including (Figure 4): validated content and information of a relevant health domain or practices; a discrete function to achieve the required health outcomes; and the digital technologies to deliver the digital health interventions (including hardware, software, and interfaces).

Figure 5. The ICT environment of digital health implementations[84]

A key technical consideration for scaling up digital health solutions is to simplify its function or application. Complex systems with multiple functions are often harder to implement and integrate, and often fail to scale.[85] This is in part because complex solutions may be more dependent on multiple external factors that are harder to control when designing and implementing digital health. Solutions with complex functions are also more likely to experience technical challenges and users may be more reluctant to accept and adopt the technology. Occasionally, the complexity of solutions may pose policy and budgetary challenges, deterring risk-averse decision-makers. [86]

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[82] Ibid.
[83] David Peiris et al., 'Use of MHealth Systems and Tools for Non-Communicable Diseases in Low- and Middle-Income Countries: A Systematic Review', *Journal of Cardiovascular Translational Research* 7, no. 8 (November 2014): 677–91, https://doi.org/10.1007/s12265-014-9581-5.
[84] World Health Organization, 'WHO Guideline. Recommendations on Digital Intervention for Health Systems Strengthening.'
[85] Labrique et al., 'Best Practices in Scaling Digital Health in Low and Middle Income Countries'.
[86] Ibid.

Digital health requires an information infrastructure ('infostructure') upon which solutions are delivered to support healthcare delivery; the infostructure includes software solutions, data definitions, and messaging standards for interoperability.[87] Digital health can be designed applying validated existing standards for product functionality, safety, compatibility and interoperability; for ICT in particular, there are common standards that exist and provide definition on data exchange formats, as well as communication protocols and standards for programming languages and the use of hardware.[88]

Standards and guidelines for interoperability and efficacy of digital health

In a sector as fragmented as telehealth, standards and guidelines for interoperability are vital for the successful adoption, scale up and integration of digital tools and platforms into the health system. Interoperability is the ability to connect different applications to access, exchange, integrate, and cooperatively use data even without direct systems integration.[89] The lack of interoperability may result from many factors, including the nature of the development of solutions that use proprietary components, a lack of awareness and experience of interoperability among technical and clinical staff, and the lack of expertise in implementing interoperability standards during the design and implementation of telehealth.[90] By supporting interoperability, the digital infrastructure will connect different components (internal and external applications, systems or software) and operate as a single streamlined, cohesive system.[91] Through interoperability, telehealth application users can also manage and use information, thus improving organisational performance and health outcomes.

Many countries lack interoperability standards for telehealth, and with a surge in digital solutions for health, an urgent need arose to move from individual solutions to an integrated approach to digital health.[92] Standards and guidelines that promote interoperability are usually part of a national digital health strategy. In the Philippines, the Nation e-Health Initiative was launched with the purpose of addressing health inequalities resulting from inadequate or delayed health data. Importantly, the strategy aimed to resolve concerns of poor data interoperability and health information exchange. In South Africa, the National Department of Health launched the National Health Normative Standards Framework for Interoperability in eHealth in 2014 due to the realisation by the Ministry of Health that the health information systems in the country relied largely on manual systems with a distinct lack of automation, coordination, and digital systems interoperability.[93] Annex 3 described these examples in more detail (see *Box A3.5* and *Box A3.6.*).

Improving data governance

The previous section discussed the policies and legal frameworks required for data governance. Data governance, however, is often poor in LMICs and has triggered concerns regarding data misuse,

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[87] Edward Kelley et al., 'Digital Health Platform Handbook: Building a Digital Information Infrastructure (Infostructure) for Health' (Geneva: World Health Organization, 2020).
[88] Ibid.
[89] World Health Organization, 'Global Strategy on Digital Health 2020-2025'.
[90] GSMA, 'Digital Health Interoperability' (London: GSMA, 2016).
[91] Kelley et al., 'Digital Health Platform Handbook: Building a Digital Information Infrastructure (Infostructure) for Health'.
[92] Mechael and Ke Edelman, 'The State of Digital Health 2019'.
[93] Funmi Adebesin et al., 'A Review of Interoperability Standards in E-Health and Imperatives for Their Adoption in Africa', *South African Computer Journal* 50 (26 July 2013), https://doi.org/10.18489/sacj.v50i1.176.

particularly among vulnerable populations. Adequate data governance can help minimise or eliminate some of those risks while increasing the potential benefits to the users and the health systems. There are some key technical considerations regarding data governance, including data access and security.

Once data has been collected, data access controls must be established which can be done in two ways. 94 One way is by using a clear and unbiased process, where people can apply to request access to data. Usually, a Data Access Committee is established to hold a record of the previously granted access to data and the dissemination of data. These processes need to operate within the laws of data protection, including how data is transferred and shared across organisations, or countries. The Data Access Committee should also establish if the data was generated ethically. Another way is by using structural and technological protocols (e.g. firewalls, encryption, etc.), to control access to data and databases.

Other technical considerations of data governance include implementing systems for data back-ups, disaster recovery plans, secure storage of copies of data, well-documented transfer protocols, password protection, separation of identifiable from sensitive data, and the use of secure digital platforms. [95]

Digital inclusion as a social determinant of health

Over 3 billion people, mostly in LMICs, live in areas without mobile internet coverage.[96] Many of these underserved populations belong to marginalised groups, discriminated against for their gender, disability, or low income. Even in places where connectivity is available, devices may not be affordable, and people may not have the digital skills required to benefit from mobile internet.

The successful deployment and ultimate adoption of digital health solutions will depend on how digitally connected people and their communities are. This includes ensuring that users have the right skills and knowledge to use the technology. Digital health initiatives are often limited in how they address the challenges to digital inclusion. The WHO's Global Strategy on Digital Health 2020-2025 suggests that to scale up digital health to strengthen health systems, governments should foster digital health literacy amongst the population but, importantly, also amongst healthcare staff by identifying core digital skills and competencies needed to be included in the education and training curricula.[97]

Digital inclusion, including internet connectivity and literacy, are considered social determinants of health. [98] Digital technology provides access not only to telehealth and telemedicine services, but also other services which have an impact on health, such as employment, financial inclusion, and other assistance programmes. Addressing this digital divide will be critical for achieving health equity in an increasingly digitised society.

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[94] Nicki Tiffin, Asha George, and Amnesty Elizabeth LeFevre, 'How to Use Relevant Data for Maximal Benefit with Minimal Risk: Digital Health Data Governance to Protect Vulnerable Populations in Low-Income and Middle-Income Countries', *BMJ Global Health* 4, no. 2 (April 2019): e001395, https://doi.org/10.1136/bmjgh-2019-001395.
[95] Ibid.
[96] Kalvin Bahia and Anne Delaporte, 'The State of Mobile Internet Connectivity 2020' (London: GSMA, 2020).
[97] World Health Organization, 'Global Strategy on Digital Health 2020-2025'.
[98] Sieck et al., 'Digital Inclusion as a Social Determinant of Health'.

Box 1. Gender considerations for the deployment of digital health
Gender is an important consideration for digital health. Digital health implementations should drive health equity in ways that do not further exacerbate gender inequalities. Women are at risk of being digitally excluded in many LMICs due to patriarchal views of gender. When planning and implementing digital health, measures should be taken to ensure that these inequalities are not aggravated and access for specific vulnerable groups, such as women, is guaranteed. [99] This means that addressing the barriers to digital inclusion and digital health needs to include a gender perspective. Approaches for designing and deploying digital health should be inclusive of women, providing a safe space to share their experiences, desires and aspirations for the technology. In doing so, digital health will propel inclusiveness and health equity for all.

Designing digital health programmes around people

Users are rarely involved in the design of digital health programmes, as they are often not involved in the financial decisions made for the procurement and deployment of digital health.[100] User-centred design digital health programmes have demonstrated to have better and more sustained levels of uptake and use in LMICs. Digital health should be design together with the people who will use, deploy and benefit from the technology.[101]

Using participatory design approaches can help designers and implementers to gain a more comprehensive understanding of the contextual needs, as well as the diverse requirements of the multiple stakeholders that will be part of the success of a digital health implementation. Furthermore, these stakeholders should also be involved in decision related to the implementation, monitoring and evaluation of digital health. Putting people at the core of the design of digital technologies is part of the Principles for Digital Development (see Box 2). Importantly, a consideration should be made to ensure that the views from underrepresented and marginalised groups are included to avoid their further exclusion from accessing digital health care services.

Box 2. Principles for Digital Development
With an increase in technology-enabled development programmes, donor and implementing organisation realise the fragmentation and lack of coordination of digital development programme leading to high failure rates. A community of development implementers and practitioners gather to collect insights and share knowledge to integrate best practices in technology-enabled programmes. Supported by organisations such as the Bill and Melinda Gates Foundation, the Swedish International Development Agency, UNICEF, UNDP, the World Bank, the WHO, and the US Agency for International Development, the following practices were unified in the Principles for Digital Development:[102]

- **Design for the user.** Through the use of co-design or user-centred design, digital initiatives can put those at the centre for whom the design is intended. Designing with the user rather just than for them can help build digital tools that are better suited to the context, culture, behaviours, desires, and aspirations of the targeted user groups and communities.

[99] World Health Organization, 'Global Strategy on Digital Health 2020-2025'.
[100] Labrique et al., 'Best Practices in Scaling Digital Health in Low and Middle Income Countries'.
[101] United Nations Development Programme, 'Guidance on the Rights-Based and Ethical Use of Digital Technologies in HIV and Health Programmes'.
[102] https://digitalprinciples.org/principles/

- **Understand the existing ecosystem.** Successful digital tools and initiatives are designed with the existing ecosystems in each community, region, or country in mind. These ecosystems will be defined by the cultural norms, political environment, institutions, economy, technology infrastructure and individual factors to access and use technology.
- **Design for scale.** Often, digital development initiatives face challenges to move beyond pilot stage, causing what is known as 'pilotitis' in the sector. Scaling initiatives means moving past the pilot and making decisions that will enable a greater adoption of the technology in a wider scale (i.e., rather than only by the pilot groups). In scaling up a solution, it can be adopted by new users, regions, and countries if a specific solution meets their needs and can create a social impact.
- **Build for sustainability. S**ustainability of digital initiatives is important to maximise long-term impact and ensure support and engagement with users and stakeholders. Sustainability of digital initiatives is usually achieved when these embedded in policies, organisational practices, or service and user workflows. In some case, institutionalisation will be key for the long-term adoption of an impact.
- **Be data driven.** An advantage of digitising services is the possibility to generate, monitor, and evaluate data that support decision-making. Digital development initiatives should thrive to gather quality of data and use it beyond outputs (e.g., publications, reports) to inform decision-making including project management, research, operations, surveillance, and informing other programmes.
- **Use open standards, open data, open source, and open innovation.** Collaboration is fundamental for digital development where resources for the development of tools, data, content, and innovations is limited. Collaboration across the different stages of a digital development initiative will not only reduce the possibility to duplicate work done by others but also allow organisations to access resources, knowledge, and capabilities from others.
- **Reuse and improve.** Too often, implementers and practitioners try 'reinventing the wheel' when searching for digital solutions to a development challenge. Many solutions have already been successfully piloted and scaled up in different development areas; identifying and considering how to improve or build on them can be more resource-efficient than to start anew.
- **Address privacy and security.** Data that has been collected, used, stored, and shared needs to be carefully managed to protect confidential information and personal information from those who may be at risk from unauthorised data access or manipulation by third parties. Organisations need to be transparent on any data being collected and on its intended use, as well as on what steps the involved entities are taking to reduce the amount of sensitive or identifiable data being collected.
- **Be collaborative.** Collaboration is crucial to increase the impact of digital technologies in development, as organisations can benefit from shared resources and expertise that will ultimately benefit the global community.

Putting the health system at the centre

Designing digital health responsibly requires that technologies are designed to support health systems. Where gaps or inefficiencies exist in the system that affect information flows and access, digital health interventions can help resolve them by providing the functionality that can make processes more efficient, useful and of better quality—this leads to better performing health systems.[103] Importantly, digital health implementations that are conscientious of the needs of the

[103] Kelley et al., 'Digital Health Platform Handbook: Building a Digital Information Infrastructure (Infostructure) for Health'.

health care system will not only be better integrated but plans for their sustainability can be drafted from their outset. Furthermore, new or designed digital health interventions may have common components with existing solutions that can be leveraged or shared for improved efficiency.[104]Finally, health systems with plans for the integration of digital technology can budget and more sustainable develop financing mechanisms.

Ethical considerations and trust

Other considerations include the ethical aspects of implementing digital health. Importantly, data should only be collected and used for a purpose that is legitimate and has been made explicit to those giving their data through informed consent. [105] Individuals should also be given the opportunity to withdraw and delete their data. If the purpose of the data changes, informed consent should be regained. As digital health is increasing access to underserved populations, it is likely that digital health implementations will collect data from vulnerable and marginalised group. Where vulnerable groups are identified, efforts should be made to protect their data and privacy. [106]

Building trust and confidence is at the core of the uptake of digital technologies by patients, healthcare workers and other stakeholders in the health system. The proper and consistent application of ethics, including data protection and privacy policies, will be essential to gain trust from users who will want to know that their data is protect but, also, would like to express choice and decide what data is collected, and how it is shared and used. [107] It is important that communities and the public are involved and informed when making decision about these important ethical considerations.[108]

[104] Ibid.
[105] Tiffin, George, and LeFevre, 'How to Use Relevant Data for Maximal Benefit with Minimal Risk'.
[106] Ibid.
[107] Broadband Commission for Sustainable Development, 'Digital Health: A Call for Government Leadership and Cooperation between ICT and Health'.
[108] Tiffin, George, and LeFevre, 'How to Use Relevant Data for Maximal Benefit with Minimal Risk'.

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World Economic Forum, 2021. https://www.weforum.org/agenda/2021/05/digital-health-telemedicine-telehealth-ai-digitalize-health-services/.

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Annex 1: Categorisation of telehealth

Digital technologies allows for the deployment of multiple types of solutions to digitalise healthcare. Labrique et al.[109] identified and categorised several mHealth and ICT applications around twelve categories presented in the Introduction to this paper. These categories are defined as follows:

1. **Client education and behaviour change communication.** The solutions offer channels for information and content delivery that can help an individual improve their knowledge or modify their behaviours and attitudes around a health subject. Health education or information is usually delivered by text (e.g., SMS), video, or audio materials.
2. **Sensor and point-of care diagnostics.** With an increasing number of connected technologies and sensors, remote monitoring of patients helps expand the reach of healthcare facilities to hard-to-access communities and even deliver care into the patients' homes. While many of these technologies are more common in high-income markets, the increasing availability of smartphones and the declining costs of sensors have increased opportunities to develop more affordable connected technologies.[110]
3. **Registration and tracking of vital events.** Information about vital events, such as births and deaths, are fundamental for keeping updated population registries and developing relevant national policies. In many countries, however, the paper-based registration systems are not reliable, and many people are not registered in official national records. Digital health solutions have been shown to improve the registration of births and ensure that patients continue to receive care.
4. **Data collection and reporting.** The move from paper-based to digital solutions can help optimise how data is collected. Information can be gathered at the point of the intervention and, through applications of data analytics such as machine learning, the information can be analysed, interpreted, and visualised in real-time. More accurate and reliable data can support better decision-making (e.g., clinical or operational).
5. **Electronic health records.** Through digital technologies, health staff can electronically register and track the health history of a given patient, including diagnoses, test results, and prescriptions. These can now be done in remote areas where the lack of health facilities prevented such monitoring in the past.
6. **Electronic decision support.** Electronic decision support tools also can help ensure that healthcare providers and staff adhere to protocols, reduce decision-making errors, and maintain accountability in clinical procedures. They can also help to deliver targeted interventions in resource-limited settings with at-risk populations.
7. **Provider-to provider communication.** Telehealth solutions provide opportunities to transform the ways in which different providers communicate with each other, removing hierarchies and improving the coordination of different platforms of care provision. These solutions can also improve knowledge exchange and expert assistance between different care providers.
8. **Provider work planning and scheduling.** Tools for planning and scheduling can help healthcare workers organise their work, prioritise tasks, and stay informed about required follow-ups or upcoming interventions. Particularly in LMICs where staff shortages are

[109] Labrique et al., 'MHealth Innovations as Health System Strengthening Tools'.
[110] Alex Boakye and Omilola Babatunde Olumide, 'The Role of Internet of Things to Support Health Services in Rural Communities. A Case Study of Ghana and Sierra Leone', *Transnational Corporations Review* 13, no. 1 (2 January 2021): 43–50, https://doi.org/10.1080/19186444.2020.1849937.

common in healthcare facilities, digital solutions can help systematise interventions and increase efficiency (e.g., scheduling household-based outreach visits).

9. **Provider training and education.** For many healthcare workers in LMICs, access to continuous education is unavailable or inaccessible. Telehealth solutions can provide education to healthcare staff, particularly in remote areas, allowing them to access updated educational content and practice their skills through interactive exercises. These solutions help clinical staff gain skills and monitoring their learning.
10. **Human resource management.** Most health systems in LMICs are understaffed (particularly for rural communities) and there is a high reliance on community healthcare workers. Digital solutions have been developed that help track and manage activities from community health workers and monitor performance. These human resource management systems can be applicable to many different activities in the health system and, ultimately, the data generated will help measure service accountability and the responsiveness of community health workers.
11. **Supply chain management.** Paper-based systems to monitor supplies and stocks are often hard to manage and difficult to keep up-to-date. Through telehealth, essential commodities can be remotely managed and monitored. Clinics and pharmacies in remote areas can send request to re-stock supplies on a daily basis, or as frequently as needed. These systems have also been designed to reduce the risk of purchasing counterfeit medicines.
12. **Financial transactions and incentives.** To decrease the financial barriers to accessing healthcare services, providers have implemented technologies for financial transactions (e.g., mobile money or digital payment platforms). Solutions exist for patients to use mobile money to pay for services, supplies, or drugs, or to incentivise the demand of services (e.g., using mobile-based cash vouchers).

Annex 2: Examples of telehealth solutions in LMICs

This section provides a comprehensive description of the different examples of successful telehealth solutions in LMICs. It includes a fuller description of the examples presented previously in the report.

Telehealth during the COVID-19 pandemic response

The COVID-19 pandemic put telehealth in the spotlight. Across the world, responses to the COVID-19 pandemic were varied; but most health systems could not maintain their 'business-as-usual' operations while attempting to cope with the surge of infections, need for critical care, and high mortality rates of severely ill patients. Of the 135 countries surveyed by the WHO,[111] 94% reported disruption to services and 40% reported disruptions to access and availability of primary care, rehabilitation, palliative care, and care for chronic conditions; around 20% of countries reported disruption to life-saving emergency, critical, and operative care interventions, while two thirds reported disruptions to elective surgeries. Nearly a third of countries reported disruptions to their supply chains.

The unprecedented disruption experienced by health systems globally led to a rapid adoption of digital technologies. Evidence of the role played by telehealth in supporting the pandemic response is only starting to emerge. Health systems implemented telehealth solutions to reduce interactions between healthcare staff and patients (e.g. using video calls, self-monitoring tools); social media platforms enabled mental health professionals to provide information and expand services during the pandemic; novel screening and triaging tools were designed and deployed including the use of teleradiology and teleconsultation; digital tools were also used to help systems cope with reduce or limited number of healthcare staff and limited hospital capacity.[112] The outcomes of all these implementations will need to be evaluated and reviewed to gather lessons from the COVID-19 pandemic. However, telehealth was at the spotlight of the pandemic response, and will lead to the greater digitalisation of healthcare services.

Telehealth for disease surveillance and providing information during the pandemic

Box A2.1 Low-tech to help COVID-19 surveillance in Ghana, Kenya and Lao PDR
In 2019, the Kenyan mobile network operator Safaricom, partnered with the Ministry of Health and Korea Telecom (KT) to launch 'Safiri Smart'. The platform was originally developed by KT as part of their Global Epidemic Prevention Project. Safiri Smart offers a free low-tech solution that uses short code or USSD to alert subscribers about disease outbreaks and epidemics. Subscribers need to opt-in to the services, and they can receive information about the disease, such as symptoms signs to observe, and preventative measures.[113] The technology also allows people to report their symptoms, allowing health officials to monitor potential focal points of disease outbreak.

[111] World Health Organization, 'Second Round of the National Pulse Survey on Continuity of Essential Health Services during the COVID-19 Pandemic' (Geneva: World Health Organization, 2021), https://www.who.int/publications-detail-redirect/WHO-2019-nCoV-EHS-continuity-survey-2021.1.
[112] Monaghesh and Hajizadeh, 'The Role of Telehealth during COVID-19 Outbreak'.
[113] Laura Ayienga, 'Technology: Safiri Smart Is An Epidemic Prevention Platform Developed By Safaricom In Partnership With MOH and Korea Telecom', *Potentash* (blog), 7 January 2020, https://www.potentash.com/2020/01/07/safiri-smart-epidemic-prevention-safaricom/.

In Kenya, the solutions were introduced prior to the COVID-19 outbreak to help the surveillance of disease spread of diseases such as yellow fever, cholera, Ebola. However, Safiri Smart provided an important tool for disease surveillance in Kenya during the COVID-19 pandemic.[114]
Prior to being deployed in Kenya, the programme had already been successfully introduced in Ghana and Laos to monitor epidemic outbreaks in these countries.[115] This solution from KT

With the support from the Bill and Melinda Gates Foundation, KT plans to further develop the technology further by introducing an artificial intelligence algorithm for the early identification of epidemics and predict the course of the epidemic spread.[116]

Box A2.2. Tackling misinformation during the COVID-19 pandemic
Parekelt.org developed a solution for tackling misinforleadershipmation about COVID-19 using Turn.io—a tool that uses WhatsApp for the dissemination of information. Known as COVID-19 HealthAlert, the service helps to share the latest news and information about COVID-19, latest situation reports and details about cases in real-time. The solution can help governments and health officials to protect the health of their population. HealthAlert was endorsed and disseminated by the World Health Organization, and adopted by many governments in LMICs.[117] For instance, the South African National Department of Health adopted the solution as HealthConnect to disseminate timely and accurate information about the COVID-19 pandemic, as well as provide responses to questions by users (through a chatbot), help assess risks and early detection of cases, and provide psychosocial support for frontline workers.[118] After the first seven weeks of its deployment, HealthConnect was being used by more than 6 million users, with an average of more than 700 thousand daily users.

Providing teleconsultations during the COVID-19 pandemic

Box A2.3 Telemedicine to increase access to specialised care in Pakistan
With a population of over 200 million, Pakistan has experienced the impact of the COVID-19 pandemic. A country with a segmented and under-resource health system, nearly 1 million people have tested positive for COVID-19 and around 23,000 had died by July 2021.[119]

Sehat Kahani, a digital health start up with a network of 32 e-Health clinics, staffed with a female doctor who provides consultations to people in remote communities with limited access to healthcare, where a female nurse meets them in person. The main focus on Sehat Kahani is to increase access to quality and affordable services through mobile solutions. Through an app, users can also access consultations from this network of doctors on demand, where they can select the medical speciality and a convenient time for their consultation.[120] In addition, Sehat Kahani also employs a network of female mobilisers to promote and provide outreach in the communities where they operate. In 2020, Sehat Kahani had over 250,000 active users on the app.

[114] 'Safaricom News, Safaricom Twaweza - Safaricom Newsroom', accessed 6 August 2021, https://newsroom.safaricom.co.ke/safeguard-your-health-as-you-travel/.
[115] 'KT Corp Unveils Global Epidemic Prevention Platform in Laos', accessed 6 August 2021, https://www.biospectrumasia.com/news/28/14428/kt-corp-unveils-global-epidemic-prevention-platform-in-laos.html.
[116] Lim Jeong-yeo, 'KT Gets Bill & Melinda Gates Foundation's W12b Funding for Epidemic Research', The Korea Herald, 17 May 2020, http://www.koreaherald.com/view.php?ud=20200517000118.
[117] 'Praekelt.Org', Praekelt.org, accessed 6 August 2021, https://www.praekelt.org.
[118] 'COVID-19 Connect South Africa', Praekelt.org, accessed 6 August 2021, https://www.praekelt.org/covid-19-response-in-sa.
[119] Government of Pakistan (2021). COVID-19 country statistics. Available at: https://covid.gov.pk/
[120] GSMA, 'Sehat Kahani: Improving Women's Healthcare Experience in Pakistan.' (London: GSMA, 2020).

To support the response to the COVID-19 pandemic, UNDP Pakistan partnered with Sehat Kahani to increase access to digital health services and, in collaboration with the Ministry of National Health Services, Regulation and Coordination, the solution was implemented in 60 intensive care units to provide care to patients with COVID-19.

Sehat Kahani had to bring quality medical expertise that could help cope with the new demand. Over 30 clinical specialists trained in pulmonology and critical care joined the app. Teleconsultations were made available free of charge to patient who could access specialised care remotely. Moreover, a helpline was launched where people could access reliable information about COVID-19, as well as be referred to a doctor if there were any suspected cases and provide follow up to people who tested positive and were isolating at home. Furthermore, the telemedicine solution implemented in intensive care units helped teams connect with critical care nurses and emergency care doctors to virtually monitor patients between different hospitals.[121]

Sehat Kahani rapidly adapted to the emerging demands requiring health systems to respond to the pandemic. Interestingly, the pandemic has changed the views in Pakistan on virtual clinical consultations and people are becoming more accepting of telemedicine,[122] which is promising for the future of digital health in Pakistan.

Telehealth for improved access, coverage and availability of services

Many telehealth solutions are increasing access to and coverage of essential services including maternal and newborn care, prevention and monitoring of chronic disease, amongst others. Some examples are presented below.

Box A2.4. The Digital Village Clinic in Malawi

The lack of resources and flexibility to adapt to changes in global patterns of disease are significant barriers facing primary care services. There are many examples of how digital technologies can help alleviate pressures overloading primary health systems, particularly when it comes to maternal and new-born care.[123] For instance, in Malawi, the Ministry of Health together with a digital health organisation called D-Tree, developed and implemented the *Digital Village Clinic*, a mobile-based community support solution that integrates health service packages offered by community health workers or health surveillance assistants (HSAs).

HSAs are fundamental for the provision of services in village clinics. They are trained to assess signs and symptoms of sick children and manage conditions according to the community case protocol.[124] The quality of care provided by HSAs is important to expand the reach of primary care and reduce the risk of child mortality. Before the introduction of digital technologies, HSAs used paper-based records of their work, which made it difficult to track and monitor the quality of care. This created inefficiencies in how HSAs were operating and prevented accurate data to evaluate care across the

[121] 'How Telemedicine Is Helping in the Fight against COVID-19 (and Why It Should Be Here to Stay) | UNDP in Pakistan', UNDP, accessed 15 July 2021, https://www.pk.undp.org/content/pakistan/en/home/blog/2020/how-telemedicine-is-helping-in-the-fight-against-covid-19--and-w.html.

[122] Anon. (2021). Sehat Kahani: Addressing the social phenomenon of doctor brides. Health Management [Interview]. 21(3). Available at: https://healthmanagement.org/c/healthmanagement/issuearticle/sehat-kahani-addressing-the-social-phenomenon-of-doctor-brides

[123] Labrique et al., 'Best Practices in Scaling Digital Health in Low and Middle Income Countries'.

[124] Adamson S. Muula et al., 'How Smartphones Could Help Improve Child Health in Malawi', The Conversation, accessed 14 July 2021, http://theconversation.com/how-smartphones-could-help-improve-child-health-in-malawi-146622.

continuum. [125] A solution was needed that could streamline workflows and integrate the work from HSAs into the structure of the health system (e.g., include supervisory roles, reporting and using resources efficiently).

To develop the solution, D-Tree consulted relevant stakeholders including the Malawi Ministry of Health, other government agencies, as well as partnering organisations such as Save the Children, JHPiego, and the Barr Foundation. The initial focus was on improving outcomes for maternal health and family planning, and 14 HSAs and 35 supervisors were initially trained. Using user-centred approaches, user feedback from the field was also collected during the initial process. Meanwhile, the Ministry of Health was responsible for reviewing protocol materials and HSA training materials, which were incorporated into the solution to ensure that a standardise approach was used for the provision of services and decision-support for HSAs. The solution was jointly developed by D-Tree alongside the Ministry of Health and tested with end-users to validate the solution and the content provided. The Digital Village Clinic has now been implemented in seven of the 29 districts across three regions in Malawi, and it is used in nearly 190 health facilities by 1,280 health workers and 100,000 patients.[126]

Box A2.5 Digital LifeCare: Digitalising care for patients with chronic diseases

Over 80% of deaths attributable to chronic diseases occur in LMICs.[127] Often, health systems in these countries are unable to reach populations in remote and rural areas, which tend to be affected by higher morbidity and mortality rates. The majority of these diseases are preventable with early diagnosis, adequate treatment, and behaviour and lifestyle changes. However, poor infrastructure, socio-political disruptions, poverty rates, and limited access to physical healthcare facilities prevent people from accessing adequate care. Evidence suggests that telehealth can improve chronic disease outcomes in LMICs by reducing socio-economic barriers related to cost and access, improving service uptake and patient adherence to treatment, and facilitating the delivery of interventions for long-term management of conditions.[128]

Digital LifeCare, developed by Dell Technologies Inc. in 2013, is a digital platform that combines cloud data, data analytics, and mobile applications to help healthcare workers screen, diagnose, and manage patients with non-communicable diseases. The solution is designed to be used by healthcare staff—including doctors, nurses, midwives, and community health workers—in rural and remote areas, as well as in urban centres.

Digital LifeCare supports healthcare staff by providing a continuum of care for people in different facilities by providing an overview of patient histories (i.e., electronic records) and treatment journeys. When a patient is screened for a chronic disease, a primary healthcare doctor provides a diagnosis and a comprehensive care plan. Ensuring patient adherence to the plan is essential for managing the condition. With the support of Digital LifeCare, community health workers can plan follow-up visits with the patient. Digital LifeCare provides end-to-end support in the care pathway for chronic diseases across different healthcare facilities, and, at the same time, the digitisation of

[125] Amanda Nazombe, 'Scaling the Digital Village Clinic in Malawi Using Our Six-Step Approach', dtree-new-website, 3 March 2018, https://www.d-tree.org/post/scaling-the-digital-village-clinic-in-malawi-using-our-six-step-approach.
[126] Digital Health Atlas (n.d.). The Malawi Digital Village Clinic. Available at: https://digitalhealthatlas.org/en/-/projects/26/published
[127] Sayani et al., 'Addressing Cost and Time Barriers in Chronic Disease Management through Telemedicine'.
[128] Beratarrechea et al., 'The Impact of Mobile Health Interventions on Chronic Disease Outcomes in Developing Countries'.

care allows the generation of data that can be aggregated to evaluate performance and provide insights for decision- and policy-makers on trends in the relevant geographies (local, district, or state level).

The solution was first developed for a single facility in Karnataka (India) and later, in 2018, the solution was co-developed in partnership with the Government of India as part of a programme to restructure the health system through Ayushman Bharat, a national health initiative that aimed to transition from a sectoral and segmented approach to health service delivery to comprehensive care.[129] In India, with non-communicable diseases accounting for nearly 60% of deaths, the initiative launched a programme that included population-based screening and management of chronic diseases, which included screening for people over 30 years old for hypertension, diabetes, oral cancer, and breast and cervical cancer for women.[130] For this purpose, Digital LifeCare was integrated as part of the Government's NCD IT system designed for population-based screening.

This collaboration included inputs from the Ministry of Health and Family Welfare, National Health Systems Resource Centre, and the Tata Trusts, Dell's implementation partner. It also gathered user feedback from field workers during the development of the solution. Through this collaboration, Dell's Digital LifeCare has been adopted in over 28 states and union territories across India, with more than 75,000 health workers trained on the platform and 100 million patients enrolled in the database. The solution is integrated with the health system and has enabled healthcare workers to adopt technology, even with minimal digital literacy and basic education. It has encouraged doctors and health workers to use telehealth and resulted in the successful implemented technological solutions in rural areas, benefiting millions of patients.[131]

Expanding access to underfunded or neglected health services

Telehealth can close the gap in access to services that are underfunded or that have not been prioritised by health systems in LMICs. An example of this is access to mental health services in LMICs. While mental health is a leading contributor to the total burden of disease that disproportionately affects people in LMICs, 73-93% of people with depression and over 85% of those with anxiety do not have access to treatment.[132] Digital psychosocial interventions in LMICs have a strong positive effect on treatment outcomes, particularly for patients with depression, and these interventions can help to expand the reach of mental health services provided by local health systems.[133] However, evaluating digital solutions for mental health services in LMICs is challenging, as most of projects are feasibility studies of emerging or new technologies.[134]

Box A2.6. Digital psychosocial interventions: how MindIT is supporting people with mental health conditions in Ghana

[129] Sunita Nadhamuni et al., 'Leveraging Technology to Enable Effective Preventive Screening of NCDs at Population Scale: Initial Observations', *Journal of the Indian Institute of Science* 100, no. 4 (October 2020): 691–700, https://doi.org/10.1007/s41745-020-00199-w.
[130] Ibid.
[131] Ibid.
[132] Fu et al., 'Effectiveness of Digital Psychological Interventions for Mental Health Problems in Low-Income and Middle-Income Countries'.
[133] Ibid.
[134] Naslund et al., 'Digital Technology for Treating and Preventing Mental Disorders in Low-Income and Middle-Income Countries'.

MindIT, founded in 2017, provides free mental health services through mobile technology for people in Ghana where an estimated 650,000 people live with a severe mental health disorder and over two million live with moderate to mild mental health condition. [135] There are less than 20 psychiatrists and around 1,000 registered mental health nurses in the country, and many people in Ghana are not aware of mental health conditions and do not know where to access affordable services.[136]

MindIT uses a toll-free "quick code" (USSD, or unstructured supplementary service data) that enables screening for symptoms that are suggestive of mental health conditions. Responses are sent to a government-funded call centre where trained personnel analyse the data and refer people to the nearest community psychiatric unit, where patients can access either free or subsidised services from the National Health Insurance Scheme in Ghana.[137] In 2021, the short code was incorporated into the Ghana Mental Health Services authority and is free of charge. In the last two years, more than 8,000 people have accessed the service and many of those received attention and treatment provided by clinical staff.

Telehealth for improving quality of care and patient safety

Telehealth solutions can help to address challenges faced in countries where there is a high burden of diseases that require long-term care. Telehealth can have a positive effect on patient safety and health outcomes, as well as improving the quality of care.[138] This includes, for instance, patients requiring specialised care and treatment that less-resourced health systems struggle to provide. An example is provided by treatment provided to TB patients.

Box A2.7. Event monitoring devices for medication support for patients with TB in India
99DOTS is an event monitoring device for medication support application, where the patient is required to call a toll-free number daily to message a unique code upon removing pills from a blister package.[139] Each blister package is wrapped around a paper envelope or sleeve, sealed shut by a care provider, on which a unique series of numbers are printed and can only be disclosed when the pills are expressed from the package. Using an ordinary phone, patients call these toll-free numbers daily in the sequence in which they were provided in the pack. From these calls, the patient's registered caller ID and the sequence of numbers are recorded, allowing to care providers to monitor the patient-specific dosing history, which can be verified and validated.[140] Healthcare workers can then follow up any missed doses more efficiently and deployment agencies and government can use the data to understand real-time patient adherence.

99DOTS started as a pilot project with 20 patients in 2013 and, in 2014, patients started to be enrolled after partnering with two non-profit organisations providing TB treatment. Over 250,000

[135] 'MindIT Mental Health Service Story - Ghana', Harvard Global Health Institute, 25 March 2020, https://globalhealth.harvard.edu/mindit-mental-health-service-story-ghana/.
[136] Ibid.
[137] Mind IT (n.d.). Available online at: https://minditgh.com/#impact
[138] Blandford et al., 'Opportunities and Challenges for Telehealth within, and beyond, a Pandemic'.
[139] World Health Organization, 'Handbook for the Use of Digital Technologies to Support Tuberculosis Medication Adherence' (Geneva: World Health Organization, 2017).
[140] Ibid.

cases were enrolled across 14 project sites by 2019.[141] The rapid scale up of 99DOTS can be attributed to, firstly, changes in the National TB programme in India that required daily dose medication, demanding more resource for adherence monitoring; and, secondly, the 99DOTS received funding from the Grand Challenges TB Control and as part of the programme 99DOTS were connected with government partners interested in piloting the solution.[142]

While 99DOTS offers clear benefits compared to in-person DOT, the acceptability and use of the amongst healthcare providers was in general high, as the 99DTOS was perceived as a useful tool that helped improved work efficiency and quality of care, but acceptability was variable amongst patients. [143] High patient acceptability was determined by a perceptions that patient-provider relationship improved; appreciation of the SMS text alerts as reminders for taking their medication; increased family involvement in the patient's treatment; experienced fewer daily life interruptions due to treatment; and perception that health providers use adherence data in the right way.[144] Factors for low patient acceptability include the perception that technology negatively affects the patient-provider relationship; stigma and lack of social support to the patient; poor training and understanding of 99DOTS; perceptions of inadequate outreach by healthcare providers; and, several technological barriers such as the lack of access to a mobile phone, poor connectivity, low literacy and digital skills.[145] These barriers can be addressed through a better rollout that provides counselling and training to patients and healthcare providers, and addressing barriers for those who lack reliable access to a mobile phone or lack the skills to use one.

Box A2.8. Piloting virtually-observed therapy in Moldova to improve adherence to TB treatment
Another example of DAT includes the use of video through virtually-observed therapy (VOT), where patients record a video of themselves taking their pills at a convenient time, instead of travelling to the facility to receive in-person DOT.[146] In Moldova, one of the countries with high burden of TB, the Ministry of Health, the UNDP, Act for in Involvement, the Centre for Health Policies and Studies (PAS Centre), and the Behavioural Insights Team developed a solution to evaluate adherence to treatment using VOT.[147]

The VOT solution was introduced in clinics in Chisinau, Moldova's capital, and was evaluated using a randomised-control trial with 178 patients. The project team measured patient adherence to treatment during a four-month period of time, comparing a group of patients receiving DOT (control group) and another group receiving VOT. Every day, patients in the VOT group were paired with the same observer each time. Patient sent daily videos with their phone when taking their pills, and the observer sent videos back to acknowledge receipt and encouragement on a weekly basis. This strengthen the patient-provider relationship, which has been shown to be correlated to higher rates of

[141] Andrew Cross et al., '99DOTS: A Low-Cost Approach to Monitoring and Improving Medication Adherence', in *Proceedings of the Tenth International Conference on Information and Communication Technologies and Development* (ICTD '19: Tenth International Conference on Information and Communication Technologies and Development, Ahmedabad India: ACM, 2019), 1–12, https://doi.org/10.1145/3287098.3287102.
[142] Ibid.
[143] Beena E Thomas et al., 'Explaining Differences in the Acceptability of 99DOTS, a Cell Phone–Based Strategy for Monitoring Adherence to Tuberculosis Medications: Qualitative Study of Patients and Health Care Providers', *JMIR MHealth and UHealth* 8, no. 7 (31 July 2020): e16634, https://doi.org/10.2196/16634.
[144] Ibid.
[145] Ibid.
[146] World Health Organization, 'Handbook for the Use of Digital Technologies to Support Tuberculosis Medication Adherence'.
[147] Luke Ravenscroft et al., 'Video-Observed Therapy and Medication Adherence for Tuberculosis Patients: Randomised Controlled Trial in Moldova', *The European Respiratory Journal* 56, no. 2 (August 2020): 2000493, https://doi.org/10.1183/13993003.00493-2020.

treatment adherence.[148] The study showed that VOT duplicated the adherence to treatment, from 44% for the DOT group to 84% for the VOT.

While the solution is still in the pilot stage, the Ministry of Health is planning to roll out VOT nationwide as part of the National TB Programme, together with local and international partnering organisations.[149] The results of the research indicate that, while resistance to change exists in institutions, policy experimentation can contribute to the much-needed change in the system that can help eradicate TB.

Digital solutions for pharmacovigilance

Digital technology can help countries implement pharmacovigilance systems, particularly in those areas where the deployment of resources is harder or costly. As many LMICs have established national pharmacovigilance systems, technologies are needed to help collected evidence of drug-related adverse events, including death.

Box A2.9. Building pharmacovigilance capacity in Ghana through telehealth
In Ghana, for instance, the Food and Drugs Authority rolled out an application to help improve the safety of health products in the country called Med Safety App. Launched in 2019, the app allows users to report side effects of medicines, vaccines and other medical products. The aim of the app is to gather data to ensure products in the market are safe and effective, improve patient safety, and generate a database with information on product safety. By the end of 2019, over 1,500 people had downloaded the app and 67 reports had been generated through the app. The project is part of the Access and Delivery Partnership (ADP) project by UNDP. The deployment of the app is still at an early development stage, but it is an example on digital solutions can help LMICs to monitor adverse effects to drugs and other medical products, and ensure greater patient safety.

Telehealth for improving efficiency, responsiveness, and resilience of health systems

Telehealth solution can help health systems to be efficient and responsive. By digitalising processes, data and insights can be generated that can help in the decision-making process—while also making the process more transparent and accountable—across the different levels of the health system. Through digital technologies, health systems can improve their adaptive capability and become more resilient.

Box A2.10. Digitization of the national immunization programmes in India and Indonesia
The governments in india and Indonesia have both introduced cloud-based digital systems to promote efficient and equitable distribution of vaccines. The Electronic Vaccine Intelligence Network (eVIN) in India, and the Sistem Monitoring Imunisasi Dan Logistik Secara Elektronik (SMILE) in Indonesia, were developed and rolled out with support from UNDP and Gavi, the Vaccine Alliance.

Both these digital systems provide customized end-to-end tracking of vaccine stock inventory, from the central store to the 'last mile' at the primary health centre level. This includes live monitoring of

[148] 'Can Behaviour Insights Help Tackle One of the World's Top Killers? Improving Tuberculosis Care in Moldova | UNDP in Moldova', UNDP, accessed 15 July 2021, https://www.md.undp.org/content/moldova/en/home/blog/2019/can-bi-help-tackle-one-of-the-world-s-top-killers-.html.
[149] Ibid.

stock distribution, consumption and storage temperature at each service delivery point. An online dashboard provides real-time visibility and data analytics of the entire vaccine supply chain, which is valuable in enabling oversight and accountability, and inform decision-making to optimize vaccine distribution and management.

Since the introduction of these systems, the incidence of vaccine stockouts has reduced by 80% and 55% in India and Indonesia, respectively. Significant cost savings have also been achieved through reductions in avoidable vaccine wastage. The transition from a paper-based to digital management system has also significantly improved accountability, transparency and integrity of the vaccine distribution process, improving the productivity of health workers and providing them with a higher degree of control over stock availability.

Both eVIN and SMILE are in the process of being scaled up for the routine immunization programme in both countries, and have been central to national efforts in the rapid deployment of the COVID-19 vaccines in these countries.

Box A2.11. Facilitating clinical decision making through artificial intelligence in Ghana
MinoHealth is a data science start-up based in Ghana which developed a solution that uses artificial intelligence (AI) to automate the diagnosis and prognosis of conditions such as pneumonia, TB, hernias, and breast cancer by using medical images, and deep learning.150 The system uses a medical image as an input and, using AI, can determine whether there is a risk to develop a condition, or if it is present or can progress further. The data is also analysed to generate visualisations of health statistics, aggregated from multiple health facilities and presented in a centralised portal to inform policy and decision-making at the regional or national level.

[150] 'MinoHealth AI Labs', accessed 30 July 2021, https://www.minohealth.org/.

Annex 3: Examples of policies enabling successful digital health in LMICs

This section provides a comprehensive description of policies driving the success of digital health in LMICs. These policies have been referred to in the previous sections of the report and are described in detail in this section.

Box A3.1. Aligning the health and ICT sectors in Nigeria through the national digital health strategy
In 2012, the Nigerian Federal Ministry of Health identified the need to harmonize the ICT and Health sector (FMoH). Through the ICT for Saving One Million Lives initiative (ICT4SOML), the FMoH and the Federal Ministry of Communication Technology (FMCT) where supported by the United Nations Foundation to conduct a baseline assessment of the digital health needs, build a coordinating body to manage digital health efforts, develop a strategic framework for digital health, and identify gaps and areas of improvement, particularly in terms of capacity, interoperability, and standards.[151] This led to the collaboration between the FMoH and FMCT to jointly develop the National Health Information and Communication Technology strategy.

The collaboration between different agency led to the development and implementation of a national strategy that aligned with the priorities of the health sector and other relevant goals of the country, as well as building the capacity required, sharing knowledge, and ensuring the alignment of digital health investments to the country's priorities. [152] Furthermore, each ministry assigned a point of country that reports to the Department of Health Planning, Research and Statistics of the FMoH and to the Director of FMCT eGovernment department. A member of the ICT4SOML helped each ministry to be aligned, facilitated collaborations needed for finalising the strategy, strengthen the capabilities of other government representatives, and provided technical assistance in health or ICT-related issues. While the development of the initiative was externally funded by the Norwegian Government, the National digital health strategy includes a provision to set up a trust fund dedicated to ICT for health, to poor resources from the government and partner organisations to coordinate and oversee the management and investment of funds.[153]

The catalyst and driver for the development of a national digital health strategy varies by country. For countries seeking to implement digital health strategies, there three main governance mechanisms typical used by countries: a) leadership by the Ministry of Health, who drives and mobilises the technical capacities, skills and resources from other ministries, agencies and governments; b) driven by the Ministry of Health jointly with a government-wide agency that provides the ICT capabilities and infrastructure; and c) leadership by the Ministry of Health but a third party agency drives the strategy and solution implementation with their own resources.

Box A3.2. Malaysia's leadership in developing a national strategy for digital health
Malaysia is a country with a relatively high maturity in digital health, due to the development of their digital health strategies over the past 15 years.[154] The government has aligned the digital health strategy to Malaysia's plans for social and economic transformation, following a more integrated

[151] Broadband Commission for Sustainable Development, 'Digital Health: A Call for Government Leadership and Cooperation between ICT and Health'.
[152] Ibid.
[153] Ibid.
[154] Mechael and Ke Edelman, 'The State of Digital Health 2019'.

approach to health and wellbeing, particularly as the country faces challenges of an aging population. Importantly, the Malaysian Administrative Modernization and Management Planning Unit (MAMPU) was created because of the country's vision to drive social transformation through ICTs. The agency aid ministries on the implementation of ICT -driven initiatives, to ensure that these are aligned to broader national standards, policies, and objectives from the ICT sector.[155]

Malaysia is characterised by having strong leadership and governance for telehealth and provides an example of a government-wide digital agency mechanism (formed by members from the ICT and health sectors) can be an important driver of the strong governance required for the development and implementation of a national digital health strategy.[156] This steering committee reports to MAMPU on technology implementation and coordinates the different divisions from the Ministry of Health responsible of digital health. The Ministry of Health leads, support strategy and programme implementation. The National Informatic Centre from the Planning. Division develops health information and data, standards and hosts the Malaysia health Data Warehouse (a centre for health data analytics, evidence-based decision making and research). Furthermore, the ministry oversees the development and implementation of telehealth solutions introduced in the health system, the protocols of health information exchange, and provides technical capacity to support and oversee internal information systems.

Malaysia's governance in digital health has led to the country's adoption and implementation of multiple digital health initiatives as well as embracing innovations and emerging technologies in digital health.[157]

Box A3.3. Developing a framework for Digital health data governance in Tanzania
The Tanzania Data Use Partnership (DUP) is a collaboration between PATH and the Government of Tanzania that provides an example of strong data governance and how data policies are supporting the health information needs of the health system while, at the same time, protecting individual privacy. 158 The DUP aims to strengthen the infrastructure for digital health and build capacity so people at every level of the health care system can use digital health data to make better informed decisions. Launched 2019, the Digital Health Strategy (2019-2024) includes a data governance framework that defines data flows between different levels of the health system and sets the standards and guidelines on data access and use.

Furthermore, the DUP has incorporated data security and privacy into all the components of the framework and is also developing skills and capabilities amongst the healthcare workforce to ensure that workers can benefit from using digital platforms and health data. The DUP has developed digital and data use toolkits and eLearning platforms to reach health workers that are most remote. This partnership demonstrates the government's commitment to scale and build the sustainability of digital health integrated into the health system.

Box A3.5. Harmonising health information systems in the Philippines
In the Philippines, government has embarked on several e-government projects since 2000. Driven by the launch of a national health insurance and a plan to achieve UHC, in 2010 the Department of

[155] Broadband Commission for Sustainable Development, 'Digital Health: A Call for Government Leadership and Cooperation between ICT and Health'.
[156] Ibid.
[157] Mechael and Ke Edelman, 'The State of Digital Health 2019'.
[158] Bennett and Goertz, 'Governing Data for Better Health'.

Health launched the National e-Health Initiative, guided by the e-Government Master Plan and government-wide Medium-term Information Technology Harmonization Initiative.[159] The purpose of the National eHealth Initiative was to address health inequities, particularly those that resulted from inadequate or delayed information due to the use of stand-alone health information systems using different types of data, poor recording and exchange of health data' and concerns of data accuracy and reliability.

However, in 2011, a consultation with Asian government digital leaders and USAID concluded that digital health systems in the Philippines lacked interoperability, including the digital health system managed by the Department of Health.[160] To address this issue, in 2014 the government launched the eHealth Strategic Framework and Plan. This led to the development of the Philippines Health Information Exchange, a platform for the exchange of information between different organisations in the public health sector. Aiming to integrate health data, the Philippines Health Information Exchange promotes adoption and implementation of interoperability standards as well as provides a platform to communicate and coordinate health data amongst health entities.[161]

Box A3.6. South Africa's strategy to driving greater interoperability of digital health
In 2014, the South Africa National Department of Health conducted a research on the digital health investments and solutions implemented in the country. The research concluded that the health information systems relied heavily on manual inputs without any automation and where digital systems were used, these were fragmented, lacked coordination and interoperability between multiple IT systems. As a result, the National Health Normative Standards Framework for Interoperability was launched to support the development of interoperable systems and adoption of data standards.

This framework has resulted in the successful implementation of telehealth solutions. An example of this is MomConnect, a national register of pregnant women, designed following the technical architecture defined by the National Health Normative Standards Framework.[162] The technical partners that developed MomConnect followed a roadmap based on the framework to design an inclusive solution that is interoperable with other existing health information systems and scalable to national level. [163] MomConnect is an example of how a national framework to drive interoperability of telehealth solutions can help scale up and wider adoption of telehealth, strengthening health systems and increasing coverage of healthcare services.

[159] UN APCICT, 'E-Government and Interoperability Initiatives in the Philippines: New Directions, Challenges and Opportunities' (UN ESCAP, 2019).
[160] Broadband Commission for Sustainable Development, 'Digital Health: A Call for Government Leadership and Cooperation between ICT and Health'.
[161] UN APCICT, 'E-Government and Interoperability Initiatives in the Philippines: New Directions, Challenges and Opportunities'.
[162] J. Peter et al, 'Taking Digital Health Innovation to Scale in South Africa: Ten Lessons from MomConnect | EndNote Click', accessed 6 August 2021, https://click.endnote.com/viewer?doi=10.1136%2Fbmjgh-2017-000592&token=Wzk1NzIwMSwiMTAuMTEzNi9ibWpnaC0yMDE3LTAwMDU5MiJd.HJfhMn5Q087N41LD2LuTD0tOujE.
[163] Ibid.